DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Seminoe Road Gas Development Project
Carbon County, Wyoming

U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office
Rawlins Field Office

NOVEMBER 2005

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

1793 (930)

NOV 1 8 2005

Dear Reader:

Attached for your review is the Draft Environmental Impact Statement (DEIS) for the Seminoe Road Gas Development Project (Project). This document describes the environmental effects of the proposed Project, a coalbed natural gas development operation planned for an area twenty miles northeast of Rawlins, in Carbon County, Wyoming. Dudley and Associates, LLC (referred to hereinafter as the "Proponent"), has proposed this project.

This DEIS is not a decision document. Following public review, we will consider comments in the preparation of a Final EIS and subsequent Record of Decision. Copies of the DEIS and other relevant documents regarding the proposed project are available for review at the State Office in Cheyenne, Wyoming, as well as the office in Rawlins, Wyoming. Additionally, this draft will be posted on the Bureau of Land Management Wyoming homepage at www.wy.blm.gov/rfo/.

Comments on the DEIS are being accepted for 60 days following the publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register*. In your comments, please include your name, organization, address, specific facts, and supporting reasons for the BLM to consider. Please address written comments to David Simons, Project Lead, at:

Bureau of Land Management
Rawlins Field Office
P.O. Box 2407
Rawlins, WY 82301-2407

Comments may be sent by facsimile to (307) 328-4224, or electronically to Seminoe_Road_EIS_WYMail@blm.gov. Please put "Seminoe Road DEIS" in the subject line.

Please note that public comments submitted for this DEIS, including names, email, and street addresses of the respondents, will be available for public review and disclosure at the address shown above during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to withhold your name and/or email or street address from public review or from disclosure under the Freedom of Information Act, you must state this plainly at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

We plan to host a public meeting during the 60-day review period. We will announce the date, time, and location of that meeting at least 15 calendar days prior to the actual meeting date. Announcements will be made through the local media and by posting it on the BLM website located at www.wy.blm.gov/rfo/.

Additional information on the Project DEIS can be obtained by contacting David Simons, Project Lead, at the Field Office shown above, by telephone at (307) 328-4328, by facsimile at (307) 328-4224, or by electronic mail to Seminoe_Road_EIS_WYMail@blm.gov.

Sincerely,

Alan L Kesterke

for Robert A. Bennett
State Director

FACT SHEET

Project Title:	Seminoe Road Gas Development Project
Document:	Draft Environmental Impact Statement
Issue Date:	November 2005
Project Location:	Carbon County, Wyoming
Proponent:	Dudley & Associates, LLC 1776 Lincoln Street, Room 904 Denver, Colorado 80203
Preparing Agency:	U.S. Department of the Interior Bureau of Land Management Rawlins Field Office 1300 North 3rd Street Rawlins, Wyoming 82301-2407
Responsible Official:	Bob Bennett, BLM Wyoming State Director
Contact Person:	David Simons, BLM EIS Coordinator

Abstract: The Seminoe Road Project draft EIS describes the physical, biological, social and economic resources that would be potentially affected by the development of the Seminoe Road Project. The BLM is the lead agency in the preparation of this EIS and must decide which alternatives to select for the project. This project is a proposed natural gas development and operation planned for an area 20 miles northeast of Rawlins, Wyoming. The Seminoe Road Project would involve the drilling and developing of up to 1,240 wells, on up to 785 well pad sites spaced at one well pad site every 160 acres. Associated facilities would include roads, gas and water collection pipelines, compressor stations, water disposal systems, and an electric power supply system. The project area encompasses 137,000 acres. Total disturbance for drill pads, access roads and associated facilities would be an estimated 6,174 acres (4.5% of the project area). Construction and drilling activities are planned to occur over a 10-year period from the start of the project. Approximately 60% of the initial site disturbance would be reclaimed after construction; therefore, an estimated 2,349 acres (1.7% of the project area) would remain disturbed for long-term operations; this area would be reclaimed at the conclusion of the estimated 30-year project life.

Comment Period: The comment period on this draft EIS will be 60 days from the date the Environmental Protection Agency publishes the Notice of Availability in the *Federal Register*. **Comments to the Seminoe Road EIS Project draft EIS should be sent to the BLM Rawlins Field Office, P.O. Box 2407, Rawlins, Wyoming 82301-2407, faxed to (307) 328-4224 or e-mailed to rawlins_wymail@blm.gov, Attention David Simons.**

Important Notice:
Reviewers must provide the BLM with their comments during the review period of the draft EIS. This will enable the BLM to analyze and respond to the comments at one time and to use information acquired in the preparation of a final EIS. Comments on the draft EIS should be specific and should address the adequacy of the statement, as well as the merits of the alternatives discussed (40 CFR 1503.3).

EXECUTIVE SUMMARY

Executive Summary

I. INTRODUCTION

The Bureau of Land Management (BLM) is analyzing a proposed coalbed natural gas development and operation known as the Seminoe Road Gas Development (Seminoe Road) Project. Dudley and Associates, LLC is the project proponent.

This Seminoe Road Project is located in an area approximately 20 miles northeast of Rawlins, in Carbon County, Wyoming. The project contemplates the drilling and development of up to 1,240 wells, on up to 785 well pad sites, which would be spaced at one well pad site every 160 acres. Associated facilities would include access roads, gas and water collection pipelines, compressor stations, water disposal systems, and an electric power supply system.

In September 2002, the BLM determined that the requirements of the National Environmental Policy Act (NEPA) would be best served by preparing an environmental impact statement (EIS) for the project.

This EIS encompasses a 137,000-acre analysis area, which involves a checkerboard pattern of mostly federal (greater than 49%) and private (greater than 49%) surface, with some state lands (less than 1%). The purpose of examining this large area is to provide BLM resource managers with a broad overview of the full development potential for coalbed natural gas resources in this part of Wyoming and to obtain a general understanding of the effects and impacts that might occur with such a development. The BLM decided that a comprehensive analysis of the entire potential development serves the interests of the BLM, the Proponent and the general public versus piecemeal analysis of commercial development “add-ons” to the Proponent’s existing Pilot Project.

In practical terms, both the BLM and Proponent recognize that prudent management dictates that a project of this size would be best engineered, analyzed, and developed in a series of phases. As a result, the Proponent plans for approximately ten distinct development phases across the EIS analysis area. Each phase would be individually and independently reviewed by the BLM with subsequent site-specific environmental reviews that conform with NEPA regulations and guidelines. Experience and knowledge gained from each phase would be applied to better plan and implement each subsequent phase.

Each phase would involve the drilling of an average of 124 wells, with associated road construction and installation (burial) of water, gas and electrical distribution lines. The Proponent would submit plans to the BLM for each phase, and the BLM would conduct appropriate NEPA analysis for each phase before making a final decision. This EIS would serve as an “over-arching” tool to assist the BLM in making better decisions regarding individual projects phases.

The BLM (Rawlins Field Office) is the lead agency in the preparation of this EIS. As required by NEPA, the BLM announced their intent to prepare an EIS for the Seminoe Road Project in the *Federal Register* on March 13, 2003. A 60-day EIS scoping process was initiated to solicit comments from the general public, businesses, special interest groups, Native American tribes, and government agencies regarding the project. Public scoping meetings were held on May 7, 2003, at the Town Hall in Hanna, Wyoming, and on May 8, 2003, at the BLM Rawlins Field Office in Rawlins, Wyoming. Eighteen letters were received during the EIS scoping process, which ended on May 14, 2003.

A. Background

During the summer of 2001, the Proponent completed construction of the Seminoe Road Coalbed Methane Pilot Project (Pilot Project) to determine the commercial feasibility of producing gas from coal formations in this area. Sixteen pilot production wells and one pressure observation well were installed. Many of these wells have begun to produce small amounts of gas; however, the Pilot Project production results are still being analyzed.

The BLM previously prepared an environmental assessment (EA) for the Pilot Project (WY-030-EA00-288). In addition, the BLM prepared a separate EA (WY-030-EA2-229) for the installation of a compressor facility and a 20-mile long, high-pressure pipeline from the Pilot Project to a commercial interconnect near Walcott, Wyoming. The BLM approved their construction in 2002; installation of the compressor and high-pressure pipeline is pending further Pilot Project results.

B. Purpose and Need

With the preparation of this EIS, the BLM is responding to the proposed project plans submitted by the Proponent for full field development. The Proponent’s purpose for the Seminoe Road Project is the economical recovery and sale of natural gas resources to US markets. As America's need for energy continues, natural gas has emerged as an important industrial and domestic fuel source. The development of domestic gas reserves reduces the country's dependence on foreign sources of energy and maintains a supply of fuel for domestic consumption, industrial production, power generation and national security. Natural gas development has also historically been, and continues to be, an important and integral part of the state and local economies in Wyoming.

C. Phased Approach

This EIS analyzes full field development to be implemented in phases. The Proponent plans for a minimum of ten distinct development phases across the EIS analysis area, and each phase would be individually and independently reviewed by the BLM, with subsequent site-specific environmental reviews that conform to NEPA regulations and guidelines. Experience and knowledge gained from each phase would be applied to better plan and implement the next subsequent phase.

Each phase would involve the drilling of an average of 124 wells, with associated road construction and installation (burial) of water, gas, and electrical distribution lines. The Proponent would submit plans to the BLM for each phase, and the BLM would conduct appropriate environmental analyses for each phase before making a final decision.

D. Issues and Concerns

The 2003 scoping process helped the BLM focus on key issues and concerns important to the public and various governmental agencies in preparation of a full field EIS. The issues and concerns addressed in the Seminoe Road EIS are as follows:

- **Air Quality**: Identify and mitigate project-related air quality impacts.
- **Cultural Resources**: Identify cultural resources, minimize disturbance impact to these resources, and conduct Native American consultation.
- **Hydrology (Surface and Ground Water)**: Identify and mitigate surface and ground water impacts to ensure watersheds are protected and maintained.
- **Land Use**: Minimize land disturbances and consider issues arising from area surface and mineral ownership differences.
- **Noise**: Identify and mitigate noise impacts.

- **Weeds**: Prevent the introduction and spread of weeds in the project area.
- **Health and Safety**: Protect public and worker health and safety.
- **Recreation**: Mitigate impacts on recreational activities.
- **Roads/Transportation**: Address construction and operational traffic impacts.
- **Socioeconomics**: Address the social and economic impacts on local residents.
- **Soils**: Identify and minimize project-related soil impacts.
- **Vegetation**: Address project-related impacts to vegetation and wetlands.
- **Visual Resources**: Mitigate project-related impacts on protected view sheds.
- **Wildlife**: Mitigate impacts on wildlife and wildlife habitat.

E. Decisions to be Made

Following the close of the 60-day draft EIS review and comment period, the BLM will consider comments submitted by the public, interested organizations and government agencies, and the BLM will respond to substantive comments in a final EIS. In accordance with 40 CFR 1503.4, the BLM may decide to modify alternatives, develop new alternatives, modify the draft EIS analysis, make revisions in the final EIS, and/or explain why comments do or do not warrant further response.

After the release of the final EIS, the BLM will issue a Record of Decision (ROD) regarding its respective decision on the proposed action or selected alternative. In the ROD, the BLM responsible official may decide to adopt the no action alternative, adopt the proposed action (with or without additional mitigation monitoring measures), adopt an alternative with features of several of the alternatives, or adopt one of the action alternatives with additional mitigation and monitoring measures.

II. ALTERNATIVES INCLUDING PROPOSED ACTION

The discussion of alternatives is the foundation of the EIS process. Alternatives are developed and analyzed for an EIS to respond to the purpose for and need of the proposed action, to address social and environmental issues, to respond to public and agency input, and to satisfy NEPA regulations.

The BLM explored and evaluated numerous ideas and options during the selection and development of action alternatives for this draft EIS. In total, four alternatives, which include the no action and proposed action alternatives, are evaluated.

A. Alternative A – No Action

NEPA regulations [40 CFR 1502.14(d)] require that EIS alternative analysis include the alternative of no action. However, in reality, BLM authority to implement a no-action alternative that totally denies an oil and gas project is limited because issued oil and gas leases already grant the lessee the "*exclusive right and privilege to drill for, mine, extract, remove and dispose of oil and gas deposits*." In checkerboard ownership, where the surface and mineral rights of every other section have private (non-federal government) control, a project proponent could pursue development and drilling on those private lands, if BLM delayed or denies approval of drilling on federal sections.

For purposes of this EIS, the no action alternative assumes that the proposal as submitted by the Proponent is denied. Previously authorized operations including those approved by the Seminoe Pilot Project EA would be developed, and gas would be transported in the manner described in the EA and Decision Record prepared for the distribution pipeline.

B. Alternative B – Proposed Action

Alternative B presents the actions proposed by the Proponent for the development, operation and reclamation of this gas extraction project.

The Proponent proposes to drill up to 1,240 natural gas wells on up to 785 well pad locations, which would be spaced at approximately one well pad site every 160 acres. The life of the project is anticipated to be 30 years. Following BLM's satisfaction of its NEPA requirement and other regulatory approval, the Proponent desires to initiate field development in late 2005 or early 2006. Disturbance projections for the project are set forth in **Table ES-1, Preliminary Estimate of Surface Area Disturbance**.

Table ES-1, Preliminary Estimate of Surface Area Disturbance

Facility	Initial Disturbance Area[2] (acres)	Operational Disturbance Area[3] (acres)
Drill Pads [4]	1,727	785
Access Roads[5]	2,854	1,427
Utilities[6]	1,427	0
Water Discharge Facilities[7]	79	79
Erosion Management Facilities[8]	57	28
Compressor Facilities[9]	30	30
Total Disturbed Area	6,174	2,349
Percentage Disturbance of Total Project Area[10]	4.5%	1.7%

Notes:

1. This table presents the total area estimated to be disturbed within the Seminoe Road Project during the projected 30-year life of the project.
2. The initial disturbance represents the area disturbed as a result of drill pad construction, access roads, gas, water and utility rights-of-way, compressor stations, and treated water-handling systems.
3. Part of the area initially disturbed by drilling operations would be reclaimed (~55%) shortly after each well is completed and equipped. The area not reclaimed would be used for ongoing operations. Once the gas resource is depleted, facilities would be removed and the balance of the drill pad would then be reclaimed.
4. An estimated 785 drill pads would be created in the project area. The area needed for drilling operations would average about 2.2 acres for each well pad location. Subsequent reclamation would reduce the drill pad size to approximately 1 acre, the area needed for production operations.
5. Each drill pad would require an estimated average 0.6 miles of access road for which an estimated width of 50 feet will be physically affected by the construction process. Fifty percent of the area initially disturbed by road construction (25') would be reclaimed following construction activities. Access roads would remain in service for the life of the project.
6. "Utilities" include gas and water collection pipelines, power lines and their ancillary facilities, and communications lines. Utilities corridors are ordinarily laid out parallel to and installed simultaneously with the access roads, initially utilizing an average width of 25 feet and an estimated average 0.6 miles length for each drill pad. Once utilities are installed and buried, the disturbed areas would be fully reclaimed.
7. The measured surface disturbance at the Pilot Project for DS-1, DS-2 and DS-3 water treatment facilities is 1.26 acres serving sixteen wells. Experience indicates that the construction, installation, and operation of water discharge facilities would entail an average disturbance of 0.1 acre allocated to each drill pad. These facilities would remain in service for the life of the project.
8. The Proponent did not include erosion control and management for ephemeral drainages below produced water discharge points as part of its proposed action. Given potential erosion concerns in the ephemeral drainages down-drainage of where produced water would be released, the BLM is considering possible mitigation that would include erosion control management facilities and structures, such as Gabions, concrete weirs, sheet piling, grade control, or other similar structures, as necessary to minimize erosion in ephemeral drainages resulting from produced water. To inform agency decision makers and the public, the BLM has made an estimate of the possible acreage that might be disturbed as a result of the installation of such erosion control management structures. See **Appendix O, Erosion Management for Ephemeral Drainages**.
9. It is also presumed that three compressor stations would be required to adequately serve the project, each requiring an estimated 10 acres, for a total projected disturbance of 30 acres.
10. This percentage is based on an estimated 137,000 acres within the EIS analysis area.

Natural gas would be produced in separate well bores from two distinct Cretaceous coal formations (the Mesaverde and Medicine Bow/Fox Hills formations); these targeted zones are separated by several thousand feet of low permeability sand and shale. Productive windows of gas extraction range from depths of 500 to 14,000 feet for the Mesaverde coals, with projected production depths of 500 to 10,000 feet for the overlying Medicine Bow/Fox Hills coals. The apparent duplication of producing horizons is due to the locally steep dip of the Cretaceous formations, which plunge east into the Hanna Basin at 10 to 15 degrees within the EIS analysis area.

Natural gas would be produced in separate well bores from two distinct Cretaceous coal formations (the Mesaverde and Medicine Bow/Fox Hills formations); these targeted zones are separated by several thousand feet of low permeability sand and shale. Productive windows of gas extraction range from depths of 500 to 14,000 feet for the Mesaverde coals, with projected production depths of 500 to 10,000 feet for the overlying Medicine Bow/Fox Hills coals. The apparent duplication of producing horizons is due to the locally steep dip of the Cretaceous formations, which plunge east into the Hanna Basin at 10 to 15 degrees within the EIS analysis area.

Produced natural gas from wells would be transported to one of three centralized compressor stations via an underground pipeline gathering system. From the compressors, natural gas would be transported in a buried, high-pressure gathering pipeline to a commercial interconnect near Walcott, Wyoming. Water gathering lines would be installed in the same trench as the gas gathering pipelines; water would be delivered to appropriate treatment and discharge systems.

An estimated 29 to 44 gallons of water per minute (gpm) would be pumped from each well via a submersible pump. This expected water production range would remain constant for each well for at least a year, and thereafter is expected to decline at 10 to 15% annually. This produced water would be discharged to intermittent and ephemeral drainages and playa areas at various locations within the EIS analysis area.

The plan proposes that the Seminoe Road Project would be completely electrified; however, the Proponent may temporarily use propane, natural gas-fired or diesel engines or generators at individual well sites. Electric distribution lines would be buried in trenches, alongside access roads, separate from the infield gas and water lines. Electricity for the Seminoe Road Project would likely come from the existing Western Area Power Authority (WAPA) 115kV transmission line that crosses the EIS analysis area. An approximate 8,000 foot-long overhead transmission line extension would be constructed from the WAPA line to a substation, from which electric distribution lines would feed the compressors and well pad sites.

During the 10 years of expected construction and well development, an estimated workforce of 80 to 110 people would be employed. A range of approximately 40 to 60 employees and contractors would be needed for normal day-to-day operations. Decommissioning and final reclamation activities at the end the project life would require approximately 30 to 50 people.

Both interim and final reclamation would be implemented for the project. The purpose of reclamation is to return disturbed areas to stabilized and productive conditions that ensure long-term protection of land and water resources. The post-project land uses would be managed for grazing, wildlife habitat and dispersed recreation.

C. Alternative C – Direct Discharge

Alternative C would be similar to Alternative B with two exceptions. First, unlike Alternative B, where produced water is discharged to intermittent/ephemeral drainages and playa areas, produced water from the water collection and treatment facilities would be routed to and discharged directly into the North Platte River or Seminoe Reservoir. Second, as a comparison to the electrified scenario presented for Alternative B, natural gas powered compressors and down-hole well pumps would be utilized for Alternative C.

Although there are a number of possible design and engineering options for routing produced water for direct discharge into Seminoe Reservoir or the North Platte River, including buried pipelines, surface pipelines, open ditches or canals, Alternative C contemplates using buried pipelines that would parallel drainages.

Because produced water has a relatively warm temperature (90 to 95°F), ponds would be used to "cool" produced water to a temperature consistent with the receiving water. These ponds would have capacity of storing several days of produced water, and each pond would be designed and constructed with a principal and emergency spillway. The principal spillway would allow for discharge of produced water into the buried pipeline that would conduct water for direct discharge into Seminoe Reservoir or the North Platte River.

An estimated 16 ponds would be required. Assuming 2 to 3 acres of disturbance for pond construction and water impoundment, approximately 32 to 48 acres would be affected with the installation of these ponds. An estimated 17 miles of buried water pipeline would also be installed and buried in a trench at depths of 4 to 6 feet. Assuming a 50-foot wide disturbance corridor for this pipeline installation, an estimated additional 103 acres would be disturbed for pipeline installation. The BLM expects that this disturbance would be reclaimed within a year of installation.

D. Alternative D – Underground Injection

Under Alternative D, produced water would be injected into the Dad Sandstone, a 30 to 40 feet thick sandstone layer found within the 1,000-foot thick Lewis Shale Formation that separates the

Medicine Bow/Fox Hills and Mesaverde coals. Within the EIS project area, a series of water injection facilities would be installed at strategic locations and produced water would be piped there.

Injection facilities would require electric-powered water-injection pumping equipment and associated infrastructure (water holding tanks, water storage ponds, enclosed structures for pumps and operational controls, pumps, and storage room for piping, valves and other spare parts. Similar to Alternative C, several days of reserve water capacity (tanks or water holding ponds) would be necessary adjacent to water injection facilities to allow time for routine or emergency maintenance on water injection facilities.

Two or more injection wells would be needed at each point of injection to allow for efficient and continuous injection. Experience at the existing coalbed natural gas activities at the Atlantic Rim Project, located southwest of Rawlins, Wyoming, indicates that one injection well is needed for every 8 to 12 gas wells. At this ratio, the Seminoe Road Project would require approximately 100 to 150 water injection wells, distributed throughout the EIS analysis area.

The other aspects of Alternative D would remain the same as for Alternative B.

III. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED EVALUATION

A number of alternatives were considered but eliminated from detailed study in the EIS. Based on technical environmental, legal and regulatory constraints, the alternatives considered but eliminated include:

- Mandated directional or horizontal drilling;
- Tighter well pad spacing;
- On-site centralized power;
- Individual well site power generation;
- Alternative energy sources, such as wind or solar power;
- Overhead electric distribution lines;

- Alternative water handling systems, including irrigation, evaporation, piping to local municipalities and/or industries, and misting towers;
- Alternative water treatment methods, including ion exchange, reverse osmosis, nanofiltration, and electrodialysis; and,
- Sole use of existing roads.

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Chapter 1 – Purpose of and Need for Action

1.1 Introduction

Dudley & Associates, LLC (referred to as the Proponent) proposes to develop and operate a coalbed natural gas project in the northwest part of the Hanna Basin in Carbon County, Wyoming, approximately 20 miles northeast of Rawlins. See **Figure 1, General Location Map**.

The proposed operation is identified as the Seminoe Road Gas Development (Seminoe Road) Project. This Project considers up to 1,240 wells, drilled on up to 785 well pad sites, spaced at approximately one well pad site for every 160 acres (4 wells per square mile). Associated facilities would include access roads, gas and water collection pipelines, compressor stations, water disposal systems and an electric power supply system. See **Appendix A, Proponent's Project Description**.

The project area totals approximately 137,000 acres and involves a checkerboard pattern of mostly federal (greater than 49%) and private (greater than 49%) surface, with some state lands (less than 1%). See **Figure 2, Surface Ownership Map**. The Proponent owns or controls mineral (oil and gas) interests comprising approximately 80% of the project area. The Bureau of Land Management (BLM) manages the federal mineral estate underlying the public lands administered by the BL Rawlins Field Office. See **Figure 3, Mineral (Oil & Gas) Lease Map**.

1.2 Background

During the summer of 2001, the Proponent completed construction of the Seminoe Road Coalbed Methane Pilot Project (Pilot Project) to determine the commercial feasibility of producing gas from coal formations. Sixteen pilot production wells and one pressure observation well were installed. Many of these wells have begun to produce small amounts of gas. Although the Pilot Project production results are still being analyzed, the Proponent has decided to plan for further natural gas development within their lease holdings in the area.

The BLM previously prepared an environmental analysis (EA) for the Pilot Project (WY-030-EA00-288). In addition, the installation of a compressor facility and a 20 mile-long high-pressure pipeline from the Pilot Project to a commercial interconnect near Walcott, Wyoming are discussed in the Seminoe Road Natural Gas Gathering Pipeline/Access Road and Compressor Station/Storage

Yard/Access Road (Pipeline) Project EA (WY-030-EA2-229). The BLM approved their construction in 2002; installation is pending further Pilot Project results.

In September 2002, the Proponent notified the BLM Rawlins Field Office of its desire to continue to drill and develop natural gas wells in the lands surrounding the Pilot Project. With the Proponent's notification, the BLM determined that the requirements of the National Environmental Policy Act (NEPA) would be best served by preparing an environmental impact statement (EIS) for the proposed full-scale project. The BLM is serving as the lead agency for preparation of the EIS, which is designed to inform the public of the potential environmental consequences of the project, present a range of reasonable alternatives, and assist in determining mitigation measures to be employed for protection of non-gas resources.

1.3 Purpose and Need

The Proponent's purpose for the Seminoe Road Project is the economical recovery and sale of natural gas resources to U.S. markets. This project is consistent with the National Energy Policy.

America's need for energy continues to grow, and natural gas has emerged as an important industrial and domestic fuel source. The development of domestic gas reserves reduces the country's dependence on foreign sources of energy and maintains a supply of fuel for domestic consumption, industrial production, power generation, and national security. Natural gas development has also historically been, and continues to be, an important and integral part of the state and local economies in Wyoming.

The BLM, as agent for the U.S. Secretary of the Interior, has responsibility for managing federally owned gas resources. For more than 100 years, it has been federal policy to make lands available for mineral exploration and development. Privately owned gas resources are likely to continue to be developed, regardless of gas development on federal lands.

1.4 EIS Scoping Process

The BLM announced their intent to prepare the Seminoe Road Project EIS in the *Federal Register* on March 13, 2003.

The BLM conducted two public meetings during a 60-day comment period to solicit comments on the Seminoe Road Project. These meetings were held on May 7, 2003, at the Town Hall in Hanna, Wyoming, and on May 8, 2003 at the BLM Rawlins Field Office in Rawlins, Wyoming. Eighteen letters were received during the scoping process.

Scoping documents, containing more detail about the scoping process, are on file at the BLM Rawlins Field Office in Rawlins, Wyoming. Additional information about the EIS process employed for the Seminoe Road Project is set forth in **Appendix B, The NEPA Process**.

1.5 Issues and Concerns

The issues and concerns for the Seminoe Road Project, follow. Key issues, as designated by the BLM interdisciplinary (ID) team, are denoted with an asterisk (*).

1.5.1 Air Quality*

Identify and mitigate project-related air quality impacts. Areas of consideration are fugitive dust and gaseous emissions affecting air quality; activities that affect state and federal public health and welfare standards; and those activities affecting visibility protection standards in highly valued areas (e.g. National Parks and Wilderness Areas).

1.5.2 Cultural Resources

Identify cultural resources, minimize disturbance impacts to these resources, and, as appropriate, conduct Native American consultation. Areas of consideration are the effects to historic properties listed or eligible for listing on the National Register of Historic Places.

1.5.3 Hydrology (Surface and Ground Water)*

Identify and mitigate surface and ground water impacts to ensure surrounding watersheds are protected and maintained. Areas of consideration are the potential erosion in ephemeral drainages resulting from produced water surface discharge, potential alteration to existing hydrologic systems, specifically project drainages and area aquifers; potential changes in downstream water flow rates; and potential alterations to North Platte River and Seminoe Reservoir water chemistry.

1.5.4 Land Use*

Minimize land disturbances and consider issues arising from area surface and mineral ownership differences. Areas of consideration are the acreage to be disturbed by the Seminoe

Road project, including the amount of disturbance to BLM, state and private land; effects on area livestock grazing; and possible future land use changes.

1.5.5 Noise

Identify and mitigate noise impacts. Areas of consideration are construction traffic and project development noise levels; compressor and generator operation noise levels; effects of project-related noise on Seminoe Reservoir recreational activities and area wildlife.

1.5.6 Weeds

Minimize the introduction and spread of weeds in the project area. Areas of consideration are the introduction and/or spread of weeds where project activities disturb the land; and the implementation of reclamation, use of innovative weed control methods (goats, mechanical, etc.) and careful herbicide use to avoid water quality, wildlife and vegetation impacts to plants not targeted for control.

1.5.7 Public and Worker Health and Safety

Protect worker health and safety. Areas of consideration are health and safety risks from project activities and accidents necessitating emergency responses.

1.5.8 Recreation

Mitigate impacts on recreational activities. Areas of consideration are project-related disruptions to recreational activities including hunting, fishing and boating, the potential for increased access to the Seminoe Reservoir and North Platte River, and potential impacts to outfitted (commercial guided) hunting on the checkerboard surface ownership within the EIS analysis area where legal public access is limited.

1.5.9 Roads/Transportation

Address project construction and operations traffic impacts. Areas of consideration are the amount of project-related road use and traffic; project-related traffic and maintenance demands on Carbon County Road 351; new roads necessary for serving well pads and compressor sites; possible access impacts to Western Area Power Authority's (WAPA) electric transmission line that traverses the project area; and project-related traffic accident increases.

1.5.10 Socioeconomics

Address the social and economic impacts on Carbon County residents. Areas of consideration are project-related income generation and nearby community impacts, including those on housing, utilities, employment, public services, tax and governmental revenues, and present lifestyles and quality of life.

1.5.11 Soils

Identify and minimize project-related impacts. Areas of consideration are project-related soil erosion increases and sedimentation, particularly from produced water and at construction activities; potential soil chemistry changes or soil quality degradation from produced water; and alterations in the ability of soil to support revegetation.

1.5.12 Vegetation

Address project-related impacts to vegetation and wetlands. Areas of consideration are the potential impacts to the vegetation communities within the EIS analysis area, including impacts on threatened, endangered or sensitive plants; avoidance, where possible, of impacts to vegetation within wetlands and riparian areas; and impacts to drainage vegetation affected by discharge of produced water.

1.5.13 Visual Resources

Mitigate project-related impacts on protected viewsheds. Areas of consideration are potential impacts of project facilities and activities on viewsheds within and adjacent to the EIS analysis area, including Seminoe State Park, Carbon County Road 351 (a National Back Country Byway from Sinclair to Alcova), Coal Creek fishing access, and from the Bennett Mountain Wilderness Study Area; and mitigation necessary to meet BLM Visual Resource Management (VRM) Class II requirements.

1.5.14 Wildlife*

Mitigate impacts on wildlife and wildlife habitat. Areas of consideration are potential impacts to certain wildlife and their habitats within and surrounding the EIS analysis area, including impacts on BLM species of concern and threatened, endangered, or candidate species identified by the U.S. Fish and Wildlife Service (USFWS).

1.6 Critical Elements Not Considered in Detail

Table 1-1, Critical Elements Not Considered in Detail, presents those resources or elements of the environment that are not expected to be encountered or affected by the build-out of the Seminoe Road Project. Critical elements of the human environment are those subject to requirements specified in statute, regulation or executive order.

Table 1-1, Critical Elements Not Considered in Detail[1]

Resource	Rationale
Areas of Critical Environmental Concerns[2]	No areas of critical environmental concerns are found in the EIS analysis and surrounding areas so there would be no impacts by the proposed action or other action alternatives.
Environmental Justice	No minority or economically disadvantaged communities or populations are present that could be affected by the alternatives.
Wilderness and Wilderness Study Areas	None of the areas within and adjacent to the EIS analysis area are wilderness areas or identified by the BLM as Wilderness Study Areas.
Prime or Unique Farmlands	None present.
Wild and Scenic Rivers	None present.
Fuels and Fire Management	Negligible. As appropriate, the BLM would impose standard practices to control the potential for wildfires.
Mineral Resources	Project wells would be completed across coal seams. Other than natural gas, no mineral resources would be extracted.
Paleontology	Underlying bedrock may contain paleontological resources. If discovered during excavation for pipelines and electric utilities, work would be stopped at the location of the discovery, and the BLM would be notified. Appropriate protection and/or mitigation would be implemented.
Wild Horses and Burros	None present.

Notes:
1. Elements considered and documented as a negative declaration according to BLMH-1790-1, Appendix 5, 1988.
2. Areas of critical environmental concern is defined in Section 103(a) of the Federal Land Policy and Management Act of 1976 (43 CFR 1610).

1.7 Decisions to be Made

The BLM is responsible for completing this draft EIS and has followed specific established procedures that began with scoping and data collection and continued with analysis of data and evaluation of alternatives. See **Appendix B, The NEPA Process**. Following the close of the draft EIS review and comment period, the BLM will consider comments submitted by the public, interested organizations, and government agencies and will respond to those comments in a final EIS. In accordance with 40 CFR 1503.4, the BLM may decide to:

- Modify alternatives;
- Develop new alternatives;
- Modify the analysis;
- Make revisions in the final EIS; or,
- Explain why comments do or do not warrant further agency response.

After the release of the final EIS, the BLM will issue a Record of Decision (ROD) regarding its respective decision on the proposed action or selected alternative. In the ROD, the BLM responsible official may decide to:

- Adopt the No Action Alternative;
- Adopt the Proposed Action (with or without additional mitigation and monitoring measures);
- Adopt an alternative with features of several of the alternatives; or,
- Adopt one of the action alternatives with additional mitigation and monitoring measures.

1.8 Agency Responsibilities and Jurisdictions

The proposed Seminoe Road Project gas wells would be developed in accordance with the Mineral Leasing Act of 1920 (Title 30; USC 181-287), Onshore Oil and Gas Leasing Act, and 43 CFR 3101.1-2. These statutes grant the Proponent the rights to develop their federal leases. However, compliance with various federal, state and local statutes (including NEPA), permits, easements and rights-of-way (ROW) is required for any action alternative, including the proposed action if selected. See **Appendix D, Agency Jurisdictions (Permits and Approvals)**.

Consistent with lease terms and conditions, the BLM will only approve development proposals that minimize adverse impacts to resources.

1.9 Conformance With BLM Land Use Plans

The Seminoe Road Project as proposed is in conformance with the Great Divide Resource Management Plan (RMP) (1990). The BLM-administered land in this area is generally open space used for oil and gas exploration and production, mineral exploration and mining, livestock grazing, wildlife habitat, and recreation.

The BLM is revising the Great Divide RMP, known also as the Rawlins RMP that provides guidance for managing an estimated 3.5 million acres of BLM-administered public land surface and 4.5 million acres of federal mineral estate in Albany, Carbon, Laramie and portions of Sweetwater counties in southern Wyoming. A draft of the Rawlins RMP revision and draft EIS were released in December 2004. A final EIS is not expected to be released until mid to late 2006 or later.

Until the Rawlins RMP is completed and its associated ROD is issued , the BLM will manage proposed activities, including the Seminoe Road Project, in conformance with the Great Divide RMP. See **Appendix C, Great Divide Resource Management Plan Analysis.**

1.10 Additional NEPA Analysis

As explained in **Appendix A, Proponent's Project Description**, the Proponent plans for approximately of ten distinct development phases across the entire 137,000-acre EIS analysis area. Prior to the implementation of any new phase or activities proposed by he Proponent on BLM administered lands, the BLM must process an application for permit to drill (APD), and ROW or other similar authorization in accordance with its policy of including additional NEPA analysis. These site-specific plans would include location surveys showing the specific area to be disturbed for access roads, well pads, utility (gas, water and electric) lines, and compressor facilities. Each submittal must comply with the general terms and conditions outlined in the ROD that will be issued as part of this EIS process, as well as the approved BLM RMP. Also see Section 2.4.1, Planning and Pre-Construction Activities and **Appendix D, Agency Jurisdictions (Permits and Approvals).**

1.11 Regional Activity

A number of activities occur in the region within and surrounding the proposed Seminoe Road Project. These activities include mining, oil and gas development, oil refining, gas and oil pipelines, electric power generation, railroad and highway ROWs, ranching and recreation. A discussion of these activities is set forth in **Appendix E, Regional Activity**.

Chapter 2 - Alternatives Including the Proposed Action

2.1 Introduction

The BLM explored and evaluated various ideas and options during the selection and development of alternatives for this draft EIS. The alternatives considered in detail in this chapter are a no action alternative, the proposed action, and two other action alternatives. A discussion of reclamation and environmental management, mitigation and monitoring measures is included. The environmental consequences associated with each of the alternatives are analyzed in Chapter 4, Environmental Consequences.

To assist in the development of alternatives for this draft EIS, representatives from the BLM, cooperating agencies and interested government agencies met numerous times in 2002 through 2005, and visited the project area on many occasions to become familiar with the Pilot Project operations, existing conditions, and surrounding areas.

2.2 No Action Alternative (Alternative A)

NEPA regulations require that EIS alternative analyses in the EIS *“include the alternative of no action”* (40 CFR 1502.14(d)). For this analysis, “no action” means that the BLM would reject the Proponent’s proposal and the proposed activity would not take place.

2.3 Formulation of Action Alternatives

The BLM ID team met on August 4, October 9 and December 9, 2003, to consider possible EIS alternatives that might have lesser environmental impacts than the proposed action. The key issue that drove alternative development was the Proponent’s proposal to dispose of produced water by discharging it directly into ephemeral draws as was proposed with the Seminoe Pilot Project. Field observations made in 2004 and 2005 found that produced water that was being directly discharged into ephemeral drainages was causing soil erosion and had possibly accelerated natural “headcutting” or erosion of the soil or stream channel that recedes towards the point of discharge. A number of options were identified. Alternatives were eliminated from consideration if they clearly could not meet the purpose and need for the project, did not address the identified issues, were impractical or unreasonable, did not respond to public and agency concerns, or did not satisfy NEPA regulations.

Those action alternatives screened from detailed evaluation, as well as a synopsis of the reasons for their dismissal, are delineated in Section 2.10, Alternatives Considered but Eliminated From Detailed Evaluation.

In addition to the no action alternative (Alternative A), the BLM has chosen to analyze three "action" alternatives in detail in this draft EIS:

- Proposed Action (Alternative B);
- Direct Discharge of Produced Water Into Seminoe Reservoir (Alternative C); and
- Underground Injection of Produced Water (Alternative D).

2.4 Alternative B – Proposed Action

Alternative B presents the actions proposed by the Proponent for the development, operation and reclamation of the gas extraction project. The detailed description of the Seminoe Road Project is set forth in **Appendix A, Proponent's Project Description**.

The Proponent proposes to drill up to 1,240 natural gas wells on up to 785 well pad locations, which are spaced at one well pad site every 160 acres. Development would also require construction of access roads, gas and water collection lines, electric utility lines, water treatment and discharge facilities, and compressor stations. **Figure 4, General Layout Map**, illustrates the tentative locations of well pad sites and access roads to be installed over the development phase of the project.

The Proponent plans to initiate field development in early 2006 following satisfaction of NEPA and other federal, state and local regulatory approvals. The life of the project is anticipated to be 30 years; this timeframe would include development, operations, and final decommissioning and reclamation work. Disturbance projections for the project are set forth in **Table 2-1, Preliminary Estimate of Surface Area Disturbance.**

Gas from two distinct coal formations (the Mesaverde and Medicine Bow/Fox Hills formations) would be produced in separate well bores, which would share a common well pad. Sharing well pads would minimize disturbed land surface in the development of the two formations and require less construction activity.

Table 2-1, Preliminary Estimate of Surface Area Disturbance

Facility	Initial Disturbance Area[2] (acres)	Operational Disturbance Area[3] (acres)
Drill Pads [4]	1,727	785
Access Roads[5]	2,854	1,427
Utilities[6]	1,427	0
Water Discharge Facilities[7]	79	79
Erosion Management Facilities[8]	57	28
Compressor Facilities[9]	30	30
Total Disturbed Area	6,174	2,349
Percentage Disturbance of Total Project Area[10]	4.5%	1.7%

Notes:

1. This table presents the total area estimated to be disturbed within the Seminoe Road Project during the projected 30-year life of the project.
2. The initial disturbance represents the area disturbed as a result of drill pad construction, access roads, gas, water and utility rights-of-way, compressor stations, and treated water-handling systems.
3. Part of the area initially disturbed by drilling operations would be reclaimed (~55%) shortly after each well is completed and equipped. The area not reclaimed would be used for ongoing operations. Once the gas resource is depleted, facilities would be removed and the balance of the drill pad would then be reclaimed.
4. An estimated 785 drill pads would be created in the project area. area needed for drilling operations would average about 2.2 acres for each well pad location. Subsequent reclamation would reduce the drill pad size to approximately 1 acre, the area needed for production operations.
5. Each drill pad would require an estimated average 0.6 miles of access road for which an estimated width of 50 feet will be physically affected by the construction process. Fifty percent of the area initially disturbed by road construction (25') would be reclaimed following construction activities. Access roads would remain in service for the life of the project.
6. "Utilities" include gas and water collection pipelines, power lines and their ancillary facilities, and communications lines. Utilities corridors are ordinarily laid out parallel to and installed simultaneously with the access roads, initially utilizing an average width of 25 feet and an estimated average 0.6 miles length for each drill pad. Once utilities are installed and buried, the disturbed areas would be fully reclaimed.
7. The measured surface disturbance at the Pilot Project for DS-1, DS-2 and DS-3 water treatment facilities is 1.26 acres serving sixteen wells. Experience indicates that the construction, installation, and operation of water discharge facilities would entail an average disturbance of 0.1 acre allocated to each drill pad. These facilities would remain in service for the life of the project.
8. The Proponent did not include erosion control and management for ephemeral drainages below produced water discharge points as part of its proposed action. Given potential erosion concerns in the ephemeral drainages down-drainage of where produced water would be released, the BLM is considering possible mitigation that would include erosion control management facilities and structures, such as Gabions, concrete weirs, sheet piling, grade control, or other similar structures, as necessary to minimize erosion in ephemeral drainages resulting from produced water. To inform agency decision makers and the public, the BLM has made an estimate of the possible acreage that might be disturbed as a result of the installation of such erosion control management structures. See **Appendix O, Erosion Management for Ephemeral Drainages**. Actual engineering design and siting of possible erosion control management structures would be completed as necessary for each phase of the proposed project build-out.
9. It is also presumed that three compressor stations would be required to adequately serve the project, each requiring an estimated 10 acres, for a total projected disturbance of 30 acres.
10. This percentage is based on an estimated 137,000 acres within the EIS analysis area.

Field development and drilling would occur in a phased sequence as illustrated on **Figure 5, Projected Build-out Scenario (Mesaverde Formation)**, and on **Figure 6, Projected Build-out Scenario (Medicine Bow and Fox Hills Formations)**. The actual timing of field development and operations could be affected by the availability of drilling contractors and other third-party services, oil and gas lease acquisition, regulatory requirements and stipulations, contractual obligations, weather, and commodity prices.

2.4.1 Planning and Pre-Construction Activities

The Proponent plans for approximately ten distinct development phases across the entire 137,000-acre EIS analysis area. See **Figure 5, Projected Build-out Scenario (Mesaverde Formation), and Figure 6, Projected Build-out Scenario (Medicine Bow and Fox Hills Formations).**

Each phase would be individually assessed and approved by the BLM with site-specific NEPA analysis and environmental reviews. Experience and knowledge gained from each phase would be applied to better planning and implementation of each subsequent phase.

Prior to the start of a new phase of construction and drilling, the Proponent would submit a site-specific APD plan of development and ROW applications to the BLM that would include a description of the activities to be conducted and/or completed in the forthcoming phase. These applications would conform to BLM regulations and include site-specific plans for the drilling, testing, completing and equipping process including but not limited to location surveys showing the exact area for access roads, well pads, and ancillary facilities (gas/water/electric lines; compressor stations, water treatment and discharge facilities, etc.).

To support BLM's efforts to review the applications, the Proponent would stake proposed development sites in the field. The BLM would inspect these staked sites to ensure consistency with the application and that environmental resources are evaluated such that proposed operations comply with the governing RMP and any EIS decisions made for the Seminoe Road Project. The BLM would undertake subsequent NEPA analysis tied to this EIS, as necessary. See Section 1.10, Additional NEPA Analysis.

As appropriate, the applications for construction and development activities would be revised per negotiations with the BLM. The BLM may approve or deny site-specific proposals, and any conditions of approval would be attached to and become part of each permit. Upon receipt of final BLM site-specific NEPA review and approval, the Proponent could commence with the specific approved activities, as long as other applicable federal, state and local permits are obtained.

2.4.2 Roads

Up to approximately 470 miles of roads would be necessary to access Seminoe Road Project well pad sites and ancillary support facilities at the time of full project build-out. Of this total, approximately 200 miles of existing roads would be upgraded to access those sites, and an estimated 270 miles of new roads would be constructed. Rock aggregate, such as sand and gravel, would be used to surface roads to benefit year-round use, which would allow the transport of heavy loads, minimize dust generation and reduce road maintenance.

BLM road standards are set forth in BLM Manual 9113; these standards would be applied to new and upgraded roads on both BLM and fee (private) lands, although the Proponent would consider the private landowner needs for roads on private lands. See Section 2.8.7, Road Construction/ Transportation. Depending primarily on traffic and volume, the BLM standards provide for three different functional classifications:

> **Collector roads** provide primary access to large blocks of land and connect with or are extensions of a public road system. They generally receive the highest volume of traffic of the roads in the BLM road system.
>
> **Local roads** normally serve a smaller area than collector roads and connect either to collector roads or public road systems. Local roads receive lower volumes, carry fewer traffic types, and generally serve fewer users than collector roads. These local roads can be single lane roads with turnouts.
>
> **Resource roads** normally are single lane spur roads that provide point (well pad) access and connect to local or collector roads. They carry very low volume and accommodate only one or two types of use.

Roads within the EIS analysis area would be single lane (14-foot gravel surface) all-weather local and resource roads, with turnouts as necessary on the local roads. They would be used by the Proponent employees and contractors, BLM and other governmental personnel, and local ranch operational and management personnel. There should be no or minimal public use on these roads.

Projected locations of access roads within the EIS analysis area are shown on **Figure 4, General Layout Map**. A typical road cross-section with parallel, buried gas/water gathering and electric lines is illustrated as **Figure 7, Typical Access Road**.

Access roads would be reclaimed as soon as they are no longer needed. However, to satisfy possible requests by the BLM or the fee surface owner, an access road may be stabilized and allowed to revert to a two-track trail upon completion of the proposed project. Reclamation would be completed by the Proponent as set forth in **Appendix F, Reclamation Plan**.

2.4.3 Well Pads

The area physically affected by a typical well pad for drilling operations would be approximately 2.2 acres. Each well pad must be a level area for placement of the drilling rig and its support equipment, along with space for an earthen reserve pit to contain drilling fluids and for topsoil material storage. The projected locations of well pads are shown on **Figure 4, General Layout Map**. There would be a minimum setback of 500 feet between the well pad and the high water mark of Seminoe Reservoir and the North Platte River. A typical drill pad layout is shown on **Figure 8, Typical Well Pad Layout During Drilling Activities**.

After drilling is completed and production equipment is installed, the Proponent would implement interim reclamation measures for each well pad site, thereby reducing the disturbed area from 2.2 acres to 1 acre, which is the size needed for production operations. See **Appendix F, Reclamation Plan.**

Well pad sites would be recontoured to approximate the original topography to blend with surrounding terrain. Produced water, gas lines and electric distribution lines would be buried and installed at the wellhead. The well pump, separator building, and other production facilities are shown on **Figure 9, Typical Producing Well Layout**.

2.4.4 Drilling and Production Operations

Following access road and well pad construction, the components of a rotary drilling rig would be transported to the well pad and erected on site. Drilling would be conducted to the desired target zone, and appropriate casing would be installed and cemented in place as required by the Wyoming Oil and Gas Conservation Commission (WOGCC). Cuttings and drilling fluids would be contained in the reserve pit. See **Figure 8, Typical Well Pad Layout During Drilling Activities**.

After development drilling, each well would be production tested. The rig used to drill the well would be replaced with a smaller surface rig, which would be used to ensure proper perforation of the target coals. Well pumping units and other production facilities would be installed to facilitate the pumping activities. Produced water and gas would be separated at each wellhead in a small separator building. Following production testing and facility installation, interim reclamation activities would be conducted to reduce the well pad site to approximately 1 acre in size. See **Figure 9, Typical Producing Well Layout**.

2.4.5 Gas and Water Gathering Systems

Produced natural gas from wells would be transported to one of three centralized compressor stations (see **Figure 4, General Layout Map**) via an underground pipeline gathering system. These infield gas-gathering pipelines would normally be located adjacent to and parallel to water lines and access roads to minimize disturbance. Infield gas pipelines generally would be 3 to 6 inches in diameter, and buried to depths of 4 to 6 feet, which would be below expected frost zones, and located adjacent to roads.

Water-gathering lines would be installed within the same trench as the gas-gathering pipelines. Water would be piped via 3 to 6 inch diameter pipelines, buried at depths of 4 to 6 feet, which would be below expected frost zones, and delivered to appropriate treatment and discharge systems. See Section 2.4.8, Produced Water Management. Produced water pipelines would typically be located adjacent to roads.

The Proponent also plans to bury electric distribution lines adjacent to access roads as set forth in Section 2.4.10, Power.

2.4.6 Compressor Stations

The Seminoe Road Project would eventually require three compressor stations; their general locations are shown on **Figure 4, General Layout Map**, and these sites would be accessed by local or resource roads. The three compressor stations would be installed as the gas field is developed. Each station would require approximately 10 acres, and a planned layout for a compressor station is shown on **Figure 10, Compressor Station Layout**. Plans for building and operating the compressor station in Section 10, T23N, R85W, were discussed in detail in the Pipeline Project EA (WY-030-EA2-229); and the BLM has approved this compressor for construction and operation. The remaining two compressor sites are likely to be located in Section 34, T23N, R85W and Section 23, T22N, R85W, respectively. See **Figure 4, General Layout Map**. The exact locations of the two compressor sites could be shifted to mitigate impacts to any sensitive wildlife issues, such as sage grouse leks, or to minimize visual impacts.

Equipment associated with each compressor station would likely include two 1,000 horsepower compressors and a single dehydration unit. This equipment would be housed in a metal, sound reducing building, painted with a BLM approved color, and have a stack anticipated to be no higher than 25 feet. A work building would also be located at each compressor station location. The compressor station storage yard would contain a small maintenance building, pipe racks for casing, tubing and rods, and fuel storage, as well as additional storage space for pumping units, motor separators, miscellaneous valves, fittings, poly pipe, and other equipment.

A pig launching facility for pipeline maintenance would likely be sited within each compressor station storage area. “Pigs” remove condensate liquids from the pipeline by “pigging” the line regularly. This activity maintains line efficiency and controls corrosion.

2.4.7 Gas Gathering Pipeline and Terminal Facilities

A high-pressure gas gathering pipeline would connect the three compressor stations with an interconnect near Walcott, Wyoming. Plans for building and operating the high-pressure gas gathering pipeline and terminal interconnect facilities were discussed in detail in the Pipeline Project EA (WY-030-EA2-229) and previously approved for construction and operation by the BLM.

The approved pipeline alignment and Walcott interconnect facilities are shown on **Figure 4, General Layout Map**. A pig catcher, separator, dehydrator and associated tanks would be constructed at the southern terminus of the high-pressure, gas-gathering pipeline where it joins the commercial transmission/sales pipeline. Please refer to the related discussion in the Pipeline Project EA (WY-030-EA2-229) for further information; this document is on file at the BLM Rawlins Field Office.

2.4.8 Produced Water Management

The coals of the western Hanna Basin are water bearing, and the desorption (release) of natural gas occurs when the formation’s hydrostatic pressure is reduced by pumping water out of the coal formation through a well bore. As hydrostatic pressure drops, the physical bond between the coal and the natural gas molecules breaks, the gas diffuses through the coal into the natural fractures, and flows with the water stream towards the zone of lower pressure at the well bore. Therefore, to create favorable conditions for the release of natural gas from the coal seams, water must be produced prior to and during natural extraction, and water management would be a key component of the Seminoe Road Project.

If the proposed action is selected, an estimated 29 to 44 gallons of water per minute (gpm) (0.06-0.10 cubic feet per second [cfs] or 1,000 to 1,500 barrels per day) would be pumped (via submersible pump) from each well. This expected production range would remain constant for each well for at least a year and thereafter is expected to decline at 10 to 15% annually. Actual discharge from each borehole might be less, depending on geologic conditions, pumping rates, or interference from adjacent wells. Produced water would be discharged to ephemeral drainages at various locations in the EIS analysis area. See **Figure 12, Produced Water Discharge Points - Alternative B**.

Daily water production during the build-out would be expected to increase for the first 4 to 5 years of operations, then stabilize at a level of approximately 5,250 gallons of water per minute (12 cfs or 180,000 barrels per day). After 9 to 10 years, water production would decline for the remainder of the project life because no additional wells are planned.

A detailed Water Management Plan for the Pilot Project, dated April 2001, is on file with the BLM Rawlins Field Office. A schematic of a typical water treatment facility (as is being used for the Pilot Project) is illustrated on **Figure 11, Water Treatment Facilities Layout**. Water produced from the Pilot Project wells is regulated under a National Pollutant Discharge Elimination System (NPDES) permit (NPDES Permit WYW004-1807) issued from the Wyoming Department of Environmental Quality (DEQ). The proposed method for managing produced water as the project expands is expected to be similar to that currently employed by the Pilot Project, and this assumes that the Wyoming DEQ would continue to require treatment for iron and manganese at future discharge points. Under future modifications to the NPDES permit, the Wyoming DEQ could change discharge standards, which, in turn, could cause the Proponent to alter or refashion water treatment facilities and methods.

The Proponent currently discharges produced water into Pool Table Draw and uses three approved discharge points, pursuant to the aforementioned Pilot Project NPDES permit. At the appropriate time during the Seminoe Road Project, the Proponent would seek to modify its NPDES permit to allow for up to fifteen additional discharge points. The tentative location of these discharge points is shown on **Figure 12, Produced Water Discharge Points – Alternative B**.

With three exceptions, water released at project discharge points would flow down various drainages, which are tributaries of the Seminoe Reservoir or North Platte River.

The exceptions to release of produced water discharge into drainages would be in the project area south of the Seminoe Reservoir, where discharge water would be routed into three closed basin playas. From the playas, the water would evaporate and/or infiltrate.

2.4.9 Beneficial Use of Produced Water

Water produced at the Seminoe Road Project would have a number of beneficial uses, including the production of natural gas. The following beneficial uses are proposed by the Proponent:

(1) Project construction, development and operational activities would use water for drilling operations, road dust control, and on-site facilities. Water could also be available for fire suppression purposes, whether such a fire would be a structure or rangeland fire. In addition, it is expected that Carbon County and other government agencies would request and use water for road maintenance activities.

(2) The Proponent has and would continue to work with the BLM and private landowners to place stock watering tanks and/or construct stock ponds throughout the EIS analysis area where practical and reasonable. Although most of the EIS analysis area is managed for winter livestock grazing, these tanks and ponds, supplied with produced water, could assist the private landowners and the grazing permitees with more efficient rangeland and grazing management practices.

(3) The Wyoming Water Development Commission (WWDC) and the Wyoming State Engineer's Office, in partnership with the U.S. Bureau of Reclamation initiated development of a water conservation program from Wyoming in 1998. The purpose of this effort is to develop options for conserving water that targets best water conservation practices. One of the major obstacles facing these agencies in the North Platte River Basin is the development of a program that would help conserve and recover federally listed threatened and endangered species and critical habitat along the river that depend on flows in the North Platte River system in the state of Nebraska. Recognizing these concerns, the WWDC is proposing that Seminoe Road Project

produced water not otherwise used for the beneficial uses discussed above could aid in this effort of downstream conservation.

2.4.10 Power

The Seminoe Road Project would eventually be completely electrified. However, during the first two years of development, the Proponent would temporarily need to use propane, natural gas fired or diesel engines or generators at the well sites. These two years are the anticipated timeframe for substation construction and installation of buried electric distribution lines. These electric distribution lines, occurring between the substation and well sites, would be buried in trenches alongside the roads, however, separated from the infield gas lines. In addition, throughout the construction and drilling portion of the project, there would probably be a need for some propane and natural gas fired or diesel engines or generators at certain “out-lying” well sites; these would be replaced with electrification as electric lines are installed (buried) to these “out-lying” sites. Appropriate Wyoming DEQ air quality permits would be acquired for all combustion equipment.

Electricity for the Seminoe Road Project would likely come from the existing WAPA 115 kV transmission line located within the EIS analysis area, on the west side of County Road 351. A high voltage substation would be constructed to accept power from the transmission line. This substation would be located at the compressor station site in Section 10, T23N, R85W. See **Figure 4, General Layout Map**. An approximate 8,000-foot long overhead transmission line extension would be constructed from the existing line to the substation. This extension line would be built using standard industry procedures to prevent raptor electrocution.

Substations would also be installed at the other two proposed compressor sites. The electric distribution lines that feed the other two substations, as well as the electric distribution lines to well pad sites, would be buried along access roads in most cases.

Once power supplies are established, the Proponent would maintain up to five portable propane or natural gas fired engines and/or generators on site to serve well pad and compressor operations during emergency situations where electric power is disrupted.

2.4.11 Work Force

The construction and well development phases of the Seminoe Road Project would require a workforce of 70 to 90 people. These phases would occur during the first ten years of build-out. The Proponent estimates that approximately 50% of this workforce would be hired locally, within Carbon County.

As the project operation phase begins, the Proponent would require a fulltime workforce. This workforce would handle day-to-day operations, including routine maintenance. The Proponent estimates that a peak operating and maintenance force of approximately 40 to 60 employees and contractors would be employed. This workforce would be needed throughout the projected 30-year life of the project. The Proponent estimates that approximately 80% of this workforce would be hired locally within Carbon County.

Decommissioning and final reclamation activities at the end of project life would require approximately 30 to 50 people. The Proponent would manage this work using subcontractors that specialize in reclamation activities. The Proponent estimates that approximately 95% of this workforce would be hired locally within Carbon County.

2.5 Direct Discharge of Produced Water Into Seminoe Reservoir and North Platte River (Alternative C)

Alternative C would be similar to Alternative B with two exceptions. First, unlike Alternative B where produced water is discharged to ephemeral drainages, produced water from the water collection and treatment facilities would be routed for direct discharge into Seminoe Reservoir or the North Platte River. Second, in comparison with the electrified scenario presented for Alternative B, gas powered down-hole well pumps and compressors would be utilized for Alternative C.

There are a number of possible design and engineering options for routing produced water for direct discharge into Seminoe Reservoir or the North Platte River, including buried pipelines, surface-laid pipelines, open ditches or canals; it is expected that the selected option would parallel the drainages as shown in **Figure 14, Direct Discharge Into Seminoe Reservoir – Alternative C**.

An estimated 17 miles of water pipelines would be installed from the collection and treatment facilities to the discharge locations into Seminoe Reservoir or the North Platte River. See **Figure 14, Direct Discharge into Seminoe Reservoir – Alternative C**. These pipelines would be sized to accommodate produced water volumes and would probably range from 12 to 18 inches in diameter. There would be only limited disturbance if such pipelines are placed on the surface. However, if such pipelines are buried below expected frost zones, at depths of 4 to 6 feet, with an estimated 50-foot wide disturbance corridor for this pipeline installation, an estimated 103 acres would be disturbed. A buried pipeline would also probably be constructed outside the floodplain of the drainages to avoid erosion impacts from flash floods to the disturbed pipeline ROW.

Canals or ditches could be used to convey produced water, but they would be less efficient than pipelines as some water would be lost to infiltration and evaporation (similar to Alternative B). Canals or ditches, like buried pipelines, would probably be constructed outside the floodplain of the drainages, less they become susceptible to erosion impacts from flash floods. In addition, canals and ditches must be installed at a relatively constant shallow grade (probably at around 0.5%) and/or lined with rock rip-rap to avoid channel erosion. They would be constructed to essentially parallel natural contours, and this would cause them to be configured in a serpentine fashion. This alignment could also create more disturbance than a buried pipeline ROW. In addition, aqueduct-like structures would be needed where the canal or ditch crossed over drainage channels.

The produced water is relatively warm temperature (90 to 95° F). Given the coldwater fishery of the North Platte River and Seminoe Reservoir, produced water likely would have to be "cooled" to a temperature consistent with the receiving water. Although there are numerous possible engineering design options for cooling produced water, this alternative considers the use of in-drainage ponds (similar to "stock ponds"). See **Figure 15, Design Concepts for Direct Discharge – Alternative C**. Such storage time would allow for produced water to cool to ambient temperatures and also allow for possible maintenance time on pond outlet structures, pipelines, or the pipeline outlet structures, if necessary.

In-drainage ponds would be designed and constructed with both a principal and an emergency spillway. The principal spillway would allow for discharge of produced water, while the emergency spillway would only be necessary in the event of major runoff events. See **Figure 15, Design Concepts for Direct Discharge – Alternative C**.

Based on the design option set forth for this alternative on **Figure 14, Direct Discharge into Seminoe Reservoir – Alternative C**, it is estimated that 16 ponds would be required. Assuming 2 to 3 acres for each pond, approximately 32 to 48 acres would be affected with the installation of these ponds.

The water pipelines would terminate at the high water mark of Seminoe Reservoir or the North Platte River. Outlet structures would be designed and installed with energy dissipaters. See **Figure 15, Design Concepts for Direct Discharge – Alternative C**.

No permanent all-weather roads would be established parallel to the pipeline. No maintenance should be needed for water pipelines; but, if problems develop, crews could access the pipeline along the pipeline ROW make necessary repairs.

At the end of the project, the in-drainage ponds could remain as long-term stock ponds to satisfy possible requests by the BLM of the fee surface owner. However, if there is no long-term need for such ponds, they would be removed and the areas reclaimed.

2.6 Underground Injection of Produced Water (Alternative D)

Underground injection of produced water is an alternative to surface discharge, and this process is typically used when the produced water quality is of very poor quality, when there are regulatory restrictions on surface discharge, and where the local geology is conducive to such a disposal method.

Underground injection of produced water beneath the Mesaverde coals, the deepest target of the Seminoe Road Project, was considered but not evaluated in detail given, impermeable geologic formations, coupled with the expected complexity and costs of delivery. The rock strata directly beneath the Mesaverde coals are deep and are thought to exist under intense hydrostatic (water) pressure, which would make the injection of anticipated volumes of produced water infeasible.

The review of geologic logs from the Pilot Project drilling revealed a 30 to 40 foot thick sandstone layer, identified as the “Dad Sandstone,” found within the 1,000 foot thick Lewis Shale Formation that separates the Medicine Bow/Fox Hills and Mesaverde coals (HydroGeo 2003a). Little is known about the Dad Sandstone; however, based on existing information and geologic inference, this Dad Sandstone is projected to be continuous across the EIS analysis area at a depth of a few hundred feet to over 10,000 feet, and have similar geologic characteristics as sandstones found in the Fox Hills formation.

Under Alternative D, produced water would be injected into the Dad Sandstone, and a series of water injection facilities would be installed at strategic locations within the EIS analysis area. See **Figure 16, Underground Injection of Produced Water – Alternative D**.

Preliminary modeling based on general geologic interpretations indicates the Dad Sandstone may be able to accommodate the injection of water (HydroGeo 2004); however, additional evaluation would be necessary with future drilling into the Dad Sandstone and when the associated data (obtained from drilling) are analyzed. For purposes of this EIS, it is assumed that water injection facilities would be located at the same locations proposed for water treatment facilities under Alternative B, but specific future study of the Dad Sandstone might reveal that additional facilities and infrastructure would be required to inject and distribute produced water homogeneously throughout the formation.

Injection facilities would require electric-powered water-injection pumping equipment and associated infrastructure (water holding tanks, water storage ponds, enclosed structures for the pumps and operational controls, compressors, and storage room for pipes, values and other spare parts). Similar to Alternative C, surge water capacity (tanks or water holding ponds) would be necessary adjacent to water injection facilities. Water storage would allow for routine or emergency maintenance on water injection facilities. Without such storage, well field production pumping could be stopped or curtailed.

It may be necessary to have two or more injection wells at each point of injection to allow for efficient and continuous injection. Experience at the existing coalbed natural gas activities at the Atlantic Rim Project (southwest of Rawlins) indicates that one injection well would be needed for every eight to twelve coalbed wells. At this ratio, the Seminoe Road Project would require approximately 100 to 150 water injection wells; however, the Seminoe Road and Atlantic Rim projects have different geologies, so the actual number of possible water injection wells for the Seminoe Road Project would be determined only when additional data and analyses are completed on the Dad Sandstone. It is projected that these Seminoe Road Project injection wells would be distributed throughout the EIS analysis area and could be located on existing well pads.

The other aspects of Alternative D would remain the same as for Alternative B.

2.7 Reclamation Measures

BLM reclamation policies focus on returning disturbed areas to productive uses consistent with land management policies. The purpose of reclamation is to return disturbed areas on both private and public land to stabilized and productive conditions that ensure long-term protection of land and water resources.

The Proponent discusses reclamation for the Seminoe Road Project in **Appendix A, Proponent's Project Description**. The BLM has developed its requirements for reclamation at the Seminoe Road Project. See **Appendix F, Reclamation Plan**.

The reclamation objectives for the Seminoe Road Project would be as follows:

- Reclaim wildlife habitat;
- Reclaim livestock grazing land;
- Protect water quality;
- Protect public, livestock and wildlife by proper well abandonment;
- Minimize overall disturbance levels by implementing interim reclamation;
- Minimize the establishment and spread of weeds;
- Reclaim areas to pre-project viewshed quality; and,
- Ensure reclamation is consistent with BLM Great Divide RMP.

The post-project land uses on federal lands would be managed for multiple uses, including grazing, wildlife habitat, and dispersed recreation, consistent with the provisions of the RMP.

2.8 Management, Mitigation and Monitoring Measures

The Proponent proposes numerous management, mitigation and monitoring measures to minimize environmental impacts and to ensure productive multiple uses both during and following final project closure and decommissioning. Some of these measures are standard practices or the result of BLM or other government agencies regulations and policies.

The Proponent would incorporate environmental management and mitigation measures into day-to-day operations and use monitoring to establish whether anticipated impacts are realized. These measures would be employed with certain refinements evolving from the alternative that the BLM selects at the end of this EIS process. In addition, depending on the decision(s) for this EIS, BLM may identify additional site-specific management and mitigation measures during the APD application processes; this would occur in subsequent site-specific NEPA analysis tiered to the ROD for this EIS. The Proponent would also be subject to additional operating requirements, including permit limits and conditions, emanating from a variety of other applicable regulations administered and enforced by other local, state and federal government agencies.

2.8.1 Planning and Design

(1) Prior to construction, the Proponent would submit to the BLM an APD for each well pad, pipeline segment, and access road, or groupings of such project features, and the BLM would conduct site-specific NEPA analysis tiered to the ROD. See Section 2.4.1, Planning and Pre-Construction Activities. Well pad locations and the routing of associated access roads/pipelines/electric utilities on both public and private lands would be selected and designed to minimize disturbance to areas of important wildlife habitat, scenic quality, and/or recreational value.

(2) Following APD submittal, representatives from the Proponent and the BLM would conduct an on-site inspection of proposed disturbance sites (e.g., well pads, roads, pipelines, electric utility lines, etc.) to finalize site-specific environmental management and mitigation measures.

(3) BLM would consult with the Wyoming Game and Fish Department (WGFD), the USFWS, the State Historic Preservation Office (SHPO), and other governmental agencies, as appropriate or when required.

2.8.2 Sewage, Trash and Other Waste Material

(1) Portable self-contained chemical toilets would be provided for human waste disposal. Upon completion of drilling activities, or as required, toilet holding tanks would be pumped and their contents disposed of at an approved sewage facility in accordance with applicable rules and regulations regarding sewage treatment and disposal.

(2) Garbage and non-flammable waste materials would be collected in self-contained portable dumpsters or trash cages and hauled off site to an approved sanitary landfill.

(3) No trash would be placed in the reserve pit at the well pad locations, nor would any open burning of garbage and refuse be allowed on the project area.

(4) Debris and other waste material not contained in the trash cage or dumpsters would be cleaned up, removed from the well sites, and disposed of at state-approved sanitary landfill.

(5) No potentially harmful materials or substances would be left on the project site.

2.8.3 Cultural and Historic Resources

(1) Cultural surveys would be conducted prior to disturbance according to procedures outlined in **Appendix M, Cultural Resource Management Plan** affected by construction and operations.

(2) The Proponent and its contractors would inform their employees about relevant federal regulations protecting cultural resources.

(3) Any objects of historic or cultural interest discovered during construction and operation would be brought to the attention of the responsible BLM official. The Proponent would halt construction activities in potentially affected areas in the event that previously undetected cultural resource properties are discovered during construction. The BLM would consult with the SHPO as necessary. Proper mitigation measures would be developed, and construction in the affected area would not resume until authorized.

2.8.4 Paleontological Resources

(1) Any objects of paleontological interest discovered as a result of construction would be brought to the attention of the BLM. Construction activities in the affected area would cease until appropriate clearances are issued by the BLM.

2.8.5 Vegetation

(1) Removal or disturbance of vegetation would be kept to a minimum by using previously disturbed areas wherever possible (including existing ROWs) and by limiting the area used by equipment/material storage yards and staging areas.

(2) Disturbed areas would be stabilized and seeded in accordance with BLM approved reclamation plan. See **Appendix F, Reclamation Plan.**

2.8.6 Weeds

(1) The Proponent would control weeds along road ROWs, at well sites, and within any other areas disturbed by the project or areas infested as a result of weeds in project disturbed areas.

(2) Prompt interim reclamation would be implemented, and native seed mixtures would be used for reclamation. See **Appendix F, Reclamation Plan**.

(3) Hand pulling/digging, biological control (e.g. goats), mechanical methods, and/or application of approved herbicides would be used for control of weeds, as appropriate.

(4) Only BLM-approved herbicides would be used, and the Proponent must receive BLM approval before using such herbicides.

2.8.7 Road Construction/Transportation

(1) Roads would be constructed specifically to support field development and operations, while following BLM guidance and considering private landowner needs.

(2) Access road location and design would be considered and approved by BLM before any ground disturbing activities occur.

(3) Roads would be designed to minimize surface disturbance and surfaced with gravel to provide year-round use necessary for project operations. Telemetry and other technology would be employed to minimize traffic during periods of wildlife sensitivity. Existing roads would be used and upgraded where possible to access the planned drill pad sites or help minimize surface disturbance.

(4) Small and short road loops would be discouraged to minimize surface disturbance and vehicle traffic.

(5) Standard BLM design and construction procedures as outlined in the BLM Manual, Section 9113 (Roads), and in the “Gold Book” *Oil and Gas Surface Operating*

Standards for Oil and Gas Exploration and Development, 3rd Ed. for oil and gas access roads would be employed for road development on both public and private land, unless other effective and safe design options that cause less surface disturbance are approved by BLM. The Proponent and its contractors would comply with existing federal, state and county requirements and restrictions with regard to transportation.

(6) Available soil material (up to 12 inches) would be removed from road corridors prior to construction activities. This material would be stockpiled for later redistribution on back slope areas of the borrow ditch. Borrow ditches would be seeded in the first season after initial disturbance.

(7) Roads would be constructed with effective drainage and erosion control structures, such as relief culverts, drainage culverts, wing ditches, etc.

(8) Roads would be built, surfaced, and maintained to be safe. A regular maintenance program would include activities such as blading, ditching, re-surfacing, and culvert and cattle guard maintenance/replacement, as needed.

(9) Special road designs would be completed when roads are sited in areas of rough terrain or high erosion potential, and these roads would be monitored for erosion during and after construction.

(10) During drilling and operation, traffic would be restricted to state and county roads, such as Carbon County Road 351, and to roads developed for the project. Given checkerboard ownership, there would be no new public access to the project area, such as to the Seminoe Reservoir and the North Platte River. Access from Carbon County Road 351 would be limited to private surface, where gates would be used to control public access to the project area.

(11) The Proponent would set and self-enforce speed limits (25 mph) commensurate with road type, traffic volume, vehicle types, wildlife stipulations and site-specific conditions, as necessary, to ensure safe and efficient traffic flows. As necessary, signs would be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information.

(12) Off-road travel by Proponent and contractor vehicles would be prohibited except in emergency situations.

(13) New or improved roads through crucial wildlife habitats would be gated and locked, with appropriate cautionary signage, as directed by the BLM to prevent unnecessary access and wildlife disturbances.

(14) Following permanent project closure, the Proponent would close and reclaim roads as set forth in **Appendix F, Reclamation Plan**.

(15) The Proponent and its contractors would comply with requirements of the Wyoming Department of Transportation and Carbon County for any oversize or over weight loads. Special arrangements would be made with the Wyoming Department of Transportation and/or Carbon County to transport any oversized loads to the project area.

2.8.8 Chemicals and Hazardous Materials

(1) The Proponent and its contractors would manage chemicals and hazardous materials in a manner that complies with applicable federal, state, and local regulations. A list of hazardous materials that may be present on site is set forth in **Appendix G, Hazardous Materials Management Plan**.

(2) Releases of hazardous materials would be reported to the BLM and would be handled under the Rawlins Field Office "HazMat Release Contingency Plan."

(3) The Proponent and its contractors would transport, locate, handle, store and use regulated hazardous materials in an appropriate manner that protects workers and the public, and prevents accidental releases to the environment.

(4) The Proponent would develop and use, as necessary, a Spill Prevention Control and Countermeasure (SPCC) Plan for the operation as required by the Federal Oil Spill Prevention regulation (40 CFR 112) as administered by the Environmental Protection Agency (EPA). In the SPCC Plan, the Proponent would identify a spill response program that includes overall management objectives, instrumentation and equipment needs, response actions, monitoring and reporting requirements, and general safety

considerations for employees, contractors, and the general public. Copies of the SPCC plan would be given to appropriate Proponent's personnel, contractors, and field personnel. This plan would also be kept on file at the Proponent's Denver, Colorado office. In addition, the Proponent would develop a Hazard Communication Program and Emergency Response Plan and would coordinate with the BLM in the development of this plan. See **Appendix G, Hazardous Materials Management Plan**.

2.8.9 Air Quality

(1) The Proponent would meet all applicable state and federal air quality requirements. This would mean compliance with applicable Wyoming ambient air quality requirements. (WAAQS), National Ambient Air Quality Standards (NAAQS), permit requirements (including pre-construction, testing, and operating permits), and other applicable regulations, as required by the Wyoming DEQ, Air Quality Division.

2.8.10 Topography and Physiography

(1) Areas with high erosion potential and/or rugged topography, such as steep slopes, would be avoided where possible. See **Figure 17, Steep Slopes**, for slopes greater than 25% within the EIS analysis area.

(2) Upon completion of construction and/or production activities, the Proponent would restore the topography to blend with surrounding terrain at well site locations, facilities, corridors, pipelines, and other facility sites.

2.8.11 Soils and Erosion Control

(1) Available topsoil material would be removed during the construction operations to achieve reclamation plan objectives. Soil stockpiles would be constructed with the lowest profile feasible to reduce the potential for wind erosion, to minimize visual impacts, and to diminish the loss of mycorrihizal fungi in the topsoil. Where possible, given safety and area considerations, topsoil stockpiles would be oriented to further reduce wind erodibility. In addition, soil stockpiles would avoid steep slopes (>25%) and would be seeded or otherwise protected to prevent erosion within a year following their placement.

(2) Considering natural gas production requirements, the location of proposed facilities would be sited to avoid or minimize, to the degree possible, disturbance to sensitive soils. While it is not possible to avoid sensitive soils entirely given their occurrence over the EIS analysis area, a minimization approach would serve to decrease the potential for erosion and increase the potential for successful and timely reclamation. Minor siting modifications in sensitive soil areas, targeting lesser slope angles or higher-quality soils, would result in lesser and more manageable impacts to the soil resource.

(3) Off-road vehicle travel by Proponent and contractor vehicles would be prohibited except in emergency situations.

(4) The Proponent would minimize project related travel during periods when soils are saturated and excess road rutting (e.g., greater than 4 inches) may occur. To reduce erosion and soil loss, the Proponent would use, as appropriate, water bars, silt fencing, diversion ditches, revegetation or other erosion control techniques.

(5) The area of disturbance would be kept to the minimum needed for drilling activities and subsequent production activities while still providing for safety. Interim reclamation practices would be conducted throughout the life of the project. See **Appendix F, Reclamation Plan**.

(6) Cut and fill slopes for well pads and access roads would be designed to prevent soil erosion. Disturbed slopes would be reseeded, mulched, or otherwise stabilized to minimize erosion within a year following completion of construction.

(7) Topsoil material would be replaced over disturbed surfaces prior to both interim and permanent revegetation. Compacted disturbed areas would be “ripped” to alleviate compaction prior to topsoil replacement. Mulching would be used after topsoil replacement as set forth in **Appendix F, Reclamation Plan**.

2.8.12 Water Resources

(1) The Proponent would adhere to the limits and conditions contained in the NPDES permit issued by the Wyoming DEQ.

(2) The Proponent would avoid well pad, road and compressor site disturbances within 500 feet of a perennial stream and within 100 feet of intermittent and ephemeral drainages. Road crossings of ephemeral, intermittent and perennial streams would be made perpendicular to flow direction.

(3) Well pad disturbances within 500 feet of wetland and riparian areas should be avoided. Where wetland and riparian areas are disturbed by linear features such as roads and pipelines, the following measures would be employed:

- Construction across riparian areas would occur during dry conditions (i.e., late summer, fall, or dry winters);
- BLM-approved plant species would be used to revegetate any disturbed riparian areas; and,
- Reclamation would be completed on affected areas in the first appropriate season of the first year after completion of construction activities.

(4) Discharge of water would comply with the applicable rules and regulations of the BLM, WOGCC, and Wyoming DEQ. See **Appendix D, Agency Jurisdictions (Permits and Approvals).**

(5) WOGCC casing and cementing criteria for wellbore plugging would be implemented in accordance with standard oil field practices to protect subsurface water bearing zones. See **Figure 18, Conceptual Schematic of Plugged and Abandoned Wellbore.**

(6) Reclamation of reserve pits containing drilling fluids and muds would be completed within one year following completion of drilling, unless additional time is allowed by BLM. See **Appendix F, Reclamation Plan**.

2.8.13 Wetlands, Special Aquatic Sites, and Waters of the U.S.

(1) Wetlands and Other Waters of the U.S. are regulated under Section 404 of the Clean Water Act. See Section 3.0, Army Corps of Engineers, in **Appendix D, Agency Jurisdictions (Permits, and Approvals)**. The Proponent would avoid these sensitive areas, wherever practical.

(2) The Proponent would conduct inventories for jurisdictional wetlands and waters of the U.S. ahead of construction and drilling activity. See Section 2.4.1, Planning and Pre-Construction Activities.

(3) Before any wetlands or other special aquatic sites, riparian areas, streams, and Wyoming DEQ Section 401 ephemeral/intermittent stream channels are disturbed, the Proponent would obtain the necessary Section 404 permits and authorizations.

2.8.14 Noise and Odor

(1) The Proponent would muffle and maintain motorized equipment according to manufacturer's specifications.

(2) In construction and operation areas (such as a drill site or compressor station) where noise levels exceed limits specified by the U.S. Occupational Safety and Health Administration (OSHA), employees and contractors would use proper personnel protective equipment.

2.8.15 Wildlife and Fisheries

(1) Reserve pits or other project-related impoundments potentially hazardous to wildlife would be fenced. As necessary, if there is a water quality problem, reserve pits or other project-related impoundments would be netted to prohibit wildlife access and to ensure protection of migratory birds and other wildlife.

(2) The Proponent would notify employees and contractors of applicable wildlife laws and the penalties associated with unlawful take and harassment of wildlife.

(3) During the raptor-nesting period, no disturbance would occur during nesting season within designated seasonal buffer zones of an identified raptor nest (depending on raptor species and line of sight) until the nest is surveyed by a qualified biologist to determine nest activity status or unless an exception is granted by BLM. See **Table 2-2, Raptor Nest Protection Dates**. If an active raptor nest is identified, the Proponent would restrict construction within the designated buffer zone during the critical nesting season for that species.

Table 2-2, Raptor Nest Protection Dates

Raptor	Seasonal Buffer
Golden eagle; barn owl; red-tailed hawk; great-horned owl; other raptors	February 1 – July 15
Osprey; merlin; sharpshinned hawk; kestrel; prairie falcon; northern harrier; Swainson's hawk; Cooper's hawk	April 1 – July 31
Short-eared owl; long-eared owl; ferruginous hawk; screech owl	March 1 – July 31
Burrowing owl	April 15 – September 15
Goshawk	April 1 – August 31

Notes:
1. Seasonal buffers are for ¾-mile radius for all active raptor nests except for active nests of bald eagles, golden eagles, and ferruginous hawks where a 1- mile radius is recommended.
2. These seasonal buffers have been established as a result of BLM coordination and interaction between the WGFD and the USFWS.

(4) Known occupied sage grouse leks would be avoided, and road and well pad construction activities within adjacent (2-mile radius from lek) public land areas would be avoided during the breeding and nesting season (March 1 – June 30). No construction or drilling activities would occur within a 0.25-mile (1,320 foot) perimeter of known occupied sage grouse lek sites. Playa lakes would not be inundated by project-produced water within a 0.25-mile (1,320 foot) perimeter of known occupied sage grouse lek sites. The Proponent would conform and comply with current BLM sage grouse policy for avoidance, in coordination and cooperation with sage grouse policies of Wyoming Game and Fish Department.

(5) The Proponent would avoid construction activities in crucial big game (mule deer and antelope) habitat between November 15 and April 30, unless the Proponent requests and the BLM grants a site-specific exception for a portion of this time frame.

2.8.16 Threatened, Endangered, Proposed, Candidate and Sensitive Species

(1) The Proponent would conduct site-specific analysis for each individual APD for compliance with the Endangered Species Act. Given the changing nature of USFWS species listings, accepted mitigations and timing stipulations, each APD would be assessed and must comply with the standards in existence at the time the APD is filed.

(2) Similarly, the Proponent would implement any BLM requirements concerning BLM sensitive species.

2.8.17 Livestock/Grazing Management

(1) The Proponent would coordinate project activities with ranching operations and BLM rangeland management specialist(s) to minimize conflicts with livestock movement or other ranch operations. The Proponent would maintain fences, cattle guards, and other existing livestock related structures. In areas of high livestock use, the Proponent would fence reclaimed areas, as necessary, to ensure successful revegetation.

2.8.18 Socioeconomics

(1) The Proponent would implement hiring practices that encourage the use of local contractors and workers, and would only go outside the region to hire if an adequate local pool of candidates cannot be generated.

2.8.19 Land Use

(1) The Proponent would minimize disturbance by maintaining as compact an operation as possible. See Section 2.8.5, Vegetation; Section 2.8.7 Road Construction and Transportation; and **Appendix F, Reclamation Plan**.

(2) Roads, power lines, and pipelines would be located adjacent to existing compatible linear facilities where practical.

2.8.20 Recreation

(1) Generally, access to public land is open. Under conditions of checkerboard land ownership, public access is typically constrained by the private landowners. The Proponent would work with BLM, state and private landowners to ensure public access is consistent with BLM policies.

2.8.21 Visual Resources

(1) Seminoe Road Project surface facilities would be designed to reduce direct visual impacts to visitors using the North Platte River, Seminoe Reservoir, and County Road 351, which the BLM has designated as a Back Country Byway. The Proponent would conform to standards for applicable BLM VRM requirements.

(2) The Proponent would minimize road access into the EIS analysis area from Carbon County Road 351. Access points would likely be located on private land and gated to control public access.

(3) External lighting would be kept to the minimum required for safety and security purposes.

(4) Facilities would be painted a flat, to blend with the surrounding landscape. Exceptions would be allowed for facilities requiring safety coloration by OSHA requirements.

(5) Reclamation seed mixes would be selected so that revegetated areas would blend into surrounding undisturbed vegetation. See **Appendix F, Reclamation Plan**.

2.8.22 Health and Safety

(1) The Proponent considers worker safety as the highest priority of Seminoe Road Project construction and operation.

(2) Well and pipeline installations would meet reliability and safety standards set by federal, state and local government agencies. Adherence to such standards would minimize or prevent hazards to the Proponent's employees, contractors, and the public and ensure a high level of system reliability.

(3) The Proponent would set and self-enforce speed limits (25 mph) commensurate with road type, traffic volume, wildlife stipulations, and site-specific conditions. Special care would be needed by Proponent employees and contractors near where project roads intersect Country Road 351 to avoid conflicts or accidents with recreational drivers on this county road.

2.9 Environmental Monitoring Measures

The Proponent would implement and maintain environmental monitoring programs that meet the requirements of the BLM and other agencies as part of the project. Monitoring would determine the effects of the development and operations, as well as the effectiveness of the environmental management and mitigation measures. Monitoring would also provide valuable input to government agencies regarding project performance. The information acquired by monitoring would be used as the basis for additional mitigation measures, if necessary, and be considered by BLM when reviewing site-specific NEPA documents.

The Proponent, the BLM and other agencies would develop specific monitoring plans prior to project approval or permit issuance, and these plans would become part of the operational plan. General monitoring measures are discussed in the following sections.

2.9.1 Air Quality

Given the results of the detailed air quality modeling work (see Section 4.1, Air Quality, and **Appendix H, Air Quality Information**), no site-specific air quality monitoring is planned for the Seminoe Road Project. The Wyoming DEQ would require the Proponent to obtain air quality permits to construct and operate the project. See **Appendix D, Agency Jurisdictions (Permits and Approvals)**. The BLM is currently assessing the possibility of statewide air quality monitoring, but any plans for such monitoring have yet to be finalized.

2.9.2 Water Resources Monitoring

The Proponent would establish or maintain water monitoring throughout project life to assess:

- Compliance with state and federal permits;
- Operational performance;
- Changes in water quality;
- Permanent closure and final reclamation success; and,
- Magnitude and extent of unanticipated releases of regulated substances.

The Wyoming DEQ would regulate the discharge of produced water under the provisions of a NPDES permit (see **Appendix D, Agency Jurisdictions (Permits and Approvals)**. The discharge of produced water from the Pilot Project is currently regulated under NPDES Permit WYW004-1807. For produced water discharge contemplated under Alternatives B and C, the NPDES monitoring program likely would include water quality and flows at the discharge points, as is the case for the current NPDES permit for the Pilot Project. Some examples of key parameters include pH, conductivity (measure of salinity), sodium, calcium, magnesium, and iron. For the underground injection program set forth in Alternative D, the WOGCC would monitor this process under the provisions of an underground injection permit.

For an approved action alternative, the Proponent would update the project's water management plan. This plan includes the location of monitoring stations (surface water points, springs and seeps), the frequency of monitoring, the parameters for field and laboratory analysis, and quality assurance and quality control plans.

2.9.3 Wildlife Monitoring

The proposed wildlife monitoring procedures for the Seminoe Road Project are set forth in **Appendix K, Wildlife Monitoring and Protection Plan.**

2.9.4 Reclamation Monitoring

The Proponent would monitor for reclamation success according the plans that are approved by the BLM. See **Appendix F, Reclamation Plan**. Areas to be monitored would include soil placement, revegetation success, presence of soil erosion, etc. Inspections would be conducted by the BLM to verify reclamation success criteria.

2.9.5 Weed Monitoring

Because weeds occur and can invade into disturbed and newly reclaimed areas, the Proponent would monitor disturbed and reclamation sites for weeds and would implement weed control measures to control weeds during operations and until reclamation success criteria have been successfully met. See **Appendix F, Reclamation Plan**.

2.9.6 Reporting to Regulatory Authorities

The Proponent would comply with the reporting requirements of the federal, state and local government authorities. Such reporting would occur on forms provided or in a report format approved by those agencies. Likewise, the timing of reporting would correspond to the stipulations set forth in various permit and plan approvals.

2.10 Alternatives Considered but Eliminated From Detailed Evaluation

Many of the considered alternatives were eliminated from detailed study in this EIS based on technical, environmental, legal and regulatory constraints. Following are summaries of those alternatives, along with the reasons for eliminating them from detailed consideration.

2.10.1 Mandated Directional or Horizontal Drilling

Directional and horizontal drilling are two related yet distinct drilling techniques, and they are the source of great interest for many people from both inside and outside the drilling industry. Directional drilling is used to guide a well to a predefined target. Horizontal drilling is a process of guiding a well to a predefined rock strata (like a coal seam), then realigning the well to track within or parallel to the strata.

The BLM and the Proponent recognize that directional and horizontal drilling techniques are tools to be used when unacceptable surface effects would occur, and they have the option to utilize these techniques as necessary based on site-specific issues and conditions. However, mandating directional or horizontal drilling for every well is not a practical alternative for the Seminoe Road Project based in part on the nature and arrangement of the coal formations. Instead, the BLM and the Proponent can manage environmental impacts with careful planning, using site data to realign roads and shift well pad sites, and implementing environmental management and mitigation measures and proper interim and final reclamation techniques.

2.10.2 Tighter Well Pad Spacing

As set forth in Section 2.4, Alternative B – Proposed Action, the Proponent plans to space well pads every 160 acres. This spacing is determined by the results from the Pilot Project, which analyzed many factors including geology, permeability of the target coal seams, and economics. One of the important goals of the Proponent is to maximize the natural gas production while minimizing surface disturbance and capital and operating expenses.

The WOGCC regulates well spacing for oil and gas projects. See **Appendix D, Agency Jurisdictions (Permits and Approvals)**. This agency strives to ensure maximum recovery of oil and gas reserves. That is one of the reasons that coalbed natural gas wells are generally spaced evenly within land sections; such spacing allows for uniform recovery of the gas resource. If wells are spread too far apart, portions of the gas can be left un-recovered.

Many coalbed natural gas projects have tighter spacing than one well pad per 160 acres proposed for the Seminoe Project. For example, the Powder River Basin in northeastern Wyoming has well spacings of 80, 40 and even 20 acres. The tighter well spacing in this region is dictated by the coal seam permeability and the general geology, where the coal seams are thicker and shallower, with relatively flat dips, as compared to the target coals of the Seminoe Project.

The impacts of tighter well spacing were not analyzed for the Seminoe Road Project. This alternative was considered but not analyzed given the current reasonable expectation from Pilot Project results that the gas resources would be recovered by the wells at a spacing of one per 160 acres. If it is determined in the future that tighter spacing would be necessary, environmental and NEPA analysis would be required to assess additional impacts.

2.10.3 On-site Centralized Power

Large on-site generators could be installed to provide permanent electric power to drive the on-site compressors, as well as power the pumps at each well site. Similar to electric power distribution in Alternative B, Proposed Action (see Section 2.4.9, Power), electric power would be distributed to individual well pad sites from the centralized compressor areas via buried electric utility lines.

The turbine generators would be run on either diesel or methane/propane. Initially, diesel fuel would probably be transported to the Seminoe Road Project to operate the on-site generators. However, once gas is produced at the site, the turbine generators would then be reconfigured to operate on natural gas.

The use of large on-site generators for permanent project-wide electric power would require additional operational and maintenance staff. Their use could also result in elevated noise levels (both from operation of generators and increased traffic from fuel transport and extra staff), increased air emissions (again from operator of generators [gaseous] and traffic [gaseous and particulates]), increased visual impacts to Back Country Byway travelers, and extra traffic on Carbon County Road 351 (fuel shipments and employees). Additional traffic would increase the potential for wildlife collisions and possible accidents involving fuel spills. For these reasons, the use of on-site generators for permanent project-wide electric power was eliminated from detailed consideration in the EIS. The assessment of any environmental conflicts from the use of WAPA electricity was considered to be outside the scope of this EIS.

2.10.4 Individual Well Site Power Generation

Pumps at the Seminoe Road Pilot Project are currently powered by individual, propane-fueled motors. This system provided the start-up power needed for the Pilot Project and required no installation of electric utility lines. So far, this system has sufficed for Pilot Project operations. Under this scenario, propane fuel must be regularly transported to each well site, and the individual well site motors require prudent and routine monitoring and maintenance activities.

If this system were employed for the build-out, it would require over 1,200 individual motors/ generators to be located on the project site. Each motor would create gaseous emissions, as well as require regular maintenance and fueling. Although produced natural gas could be used to run these motors, initial start-up would require fuel to be delivered from a remote source. At the scale proposed for development, and given the increased impacts expected under such a proposal, electrification resolves most, if not all, resource conflicts in this context and makes further consideration of permanent, individual well site power generation needless.

Given the logistics, operating and maintenance requirements, and possible air quality effects, this alternative was eliminated from detailed consideration in the EIS. However, it should be noted that the proposed action does allow for some small number of on-site power generation. See Section 2.4.9, Power.

2.10.5 Alternative Energy Sources

In lieu of fossil fuel electric energy, such as that generated by the Jim Bridger coal-fired power plant near Rock Springs, Wyoming, or hydro-electric energy such as produced at the Seminoe and Kortes hydroelectric power stations on the North Platte River, wind and solar power sources were considered for the Seminoe Road Project, but their use was eliminated from detailed evaluation in this EIS. Use of these sources would still require a stable full-time back-up energy source, such as electrification. Addition of these energy generation systems, while providing extra energy to the grid, would not resolve environmental effects; rather, they would increase effects to the environment, primarily due to surface disturbance.

Both wind and solar power require many acres of land and are visually obstructive. Wind turbo blades are noisy, and they can kill birds and disturb livestock. Wind towers, like power line structures, can also affect ground-nesting birds such as sage grouse. In addition, both wind and solar power can only provide intermittent supplies, which would be unacceptable to the Seminoe

Road Project where constant power would be required to supply compressors and well site pumps.

2.10.6 Overhead Electric Distribution Lines

Electric distribution lines generally transmit electric loads of 13 kV or less; these would be the type of lines needed to supply power to the individual well pads, the compressor facilities and miscellaneous operational and maintenance facilities.

Electric distribution lines should be distinguished from electric transmission lines, which carry higher voltage (>13 kV). As an example, the existing WAPA 115 kV line would be considered a "transmission" line, as would the proposed line transmitting electricity from the WAPA line to the proposed Seminoe Road Project substation.

Electric transmission lines are rarely buried given the problems of electrically insulating each phase and dissipating the heat generated by the conductors. Underground transmission lines require three-phase conductors to be encased separately in sealed piping systems with constantly circulating oil or nitrogen for cooling. These pipes must be placed in thermal backfill to transfer heat. Underground transmission lines are difficult to maintain, and, if problems occur, power outages of several days or even weeks might be needed to locate and repair the system.

Overhead electric distribution lines could be installed to transmit electric power from either a substation or an on-site generator to each individual well pad. Overhead lines would require wooden or metal power pole structures. Although overhead electric distribution lines and associated structures can be easily constructed, they are visually obstructive and can create problems for wildlife, particularly electrocution of raptors and reduction or elimination of breeding activities for sage grouse. The electric distribution lines could be constructed with a raptor proof insulation, to prevent electrocution of raptors; however, the power structures (poles) would provide convenient perches for raptors. Not only the presence of raptors on the poles but also merely the presence of aboveground structures could affect ground-nesting birds such as sage grouse.

Given visual effects and possible impacts to wildlife, along with the Proponent's preference for burying electric distribution lines, the construction of overhead electric distribution lines was considered but eliminated from detailed evaluation in the EIS.

2.10.7 Alternative Water Handling Systems

Handling and disposal of natural gas produced water are major and essential aspects of the Seminoe Road Project. As part of BLM deliberations, the relative merits of the following water handling alternatives were discussed:

- Surface discharge to drainages (Alternative B - Proposed Action);
- Surface discharge directly to Seminoe Reservoir and North Platte River (Alternative C);
- Underground injection (Alternative D);
- Irrigation;
- Evaporation;
- Piping to local municipalities and/or industries; and,
- Misting towers.

Alternatives considered in detail in the EIS are surface discharge to drainages (Alternative B), surface discharge directly to Seminoe Reservoir and North Platte River (Alternative C), and underground water injection (Alternative D).

The remaining water handling systems were considered but eliminated from detailed evaluation within the EIS. The reasons for this elimination are described in the following sections.

2.10.7.1 Irrigation

No irrigation has ever occurred in the EIS analysis area, and irrigation will not be carried forward for detailed evaluation in this EIS. Irrigation would result in changes to the native environment, modifying or eliminating vegetation communities currently present, and is not consistent with land management planning in the RMP or the purpose and need for the Seminoe Road Project. Irrigation would also be considered outside the scope of this EIS as no specific proposal for irrigation has been submitted from private landowners or mineral lessees. If such a proposal should come forward in the future, a separate environmental and NEPA analysis would be required to address the specific proposal and to assess impacts.

Although irrigation may be technically feasible with natural gas produced water, the Wyoming BLM presently does not allow irrigation on public lands. In addition, none of the private landowners within the EIS analysis area want to invest in the type of irrigation system and associated management infrastructure required to ensure productive long-term irrigation. Furthermore, the area's soil chemistry is not conducive to irrigation. Soil amendments requiring significant and costly land management techniques and resources would be needed to ensure long-term soil productivity. In addition, natural gas produced water chemistry must also be regularly analyzed and a water-conditioning facility would probably be required to regulate sodium adsorption ratio (SAR) levels in the irrigation water.

2.10.7.2 Evaporation and/or Percolation Ponds

Evaporating natural gas produced water as the sole means of water handling at the Seminoe Road Project was considered but eliminated from detailed evaluation.

Evaporation ponds would require an extensive expanse of area and cause large scale effects to vegetation, which would be inconsistent with land management planning in the RMP. Shallow ponds (5 to 10 feet deep), encompassing an estimated area of 3,000 to 4,000 acres, would be needed to provide sufficient surface area to evaporate the large quantity of natural gas project produced water. In addition, the ponds may need to cover even larger areas to have ample volume to account for limited evaporation during freezing conditions. Further, the ponds would probably require an elaborate and expensive spray system to further assist the evaporation process. Water quality in the constructed evaporation and/or percolation ponds could deteriorate over time due to evapo-concentration of salts. Use of large-scale evaporation and/or percolation ponds would cause more effects (land disturbance, construction noise and air quality impacts, elevated traffic, reduction in grazing area for livestock and habitat for wildlife, visual impacts, etc.) than the analyzed alternatives and does not address unresolved resource conflicts from other alternatives.

However, although evaporation as sole means of natural gas produced water is not practical, nor feasible, there is the possibility of using the natural playas south of the Seminoe Reservoir for some limited evaporation. The Proponent is requesting the use of the natural playas to store and evaporate produced water. This system would be combined with a discharge program as outlined in Section 2.4, Proposed Action (Alternative B).

2.10.7.3 Piping Water to Municipalities and/or Industries

Because the produced water at the Seminoe Road Project is expected to meet drinking water standards, the Proponent approached several municipalities in close proximity to the project area and the Sinclair Oil Refinery about using water from the project, but the Proponent found no interest at this time. It was thought that the towns of Sinclair, Rawlins and/or Hanna might put this water to beneficial use to supplement their present water supply.

Under this alternative, a pipeline infrastructure would need to be developed to supply water to these municipalities and the refinery, and modifications would be necessary to the existing water treatment facilities. The availability of water for municipality or industrial purposes would be tied to the Seminoe Road Project, which in turn would be subject to technical, regulatory, and economical conditions that could cause fluctuation in water availability. Because of this, and the availability of other water sources, the use of produced water from the Seminoe Road Project gives uncertainty to municipalities and industry; therefore, little interest was shown by these entities at the time they were approached by the Proponent.

Given the need for an expensive pipeline infrastructure, existing water plant modifications, the uncertainty of supply, and the lack of interest, this alternative was eliminated from further consideration.

2.10.7.4 Misting Towers

Produced water could be evaporated at the wellhead using misting towers. Misting towers are essentially vertical pipes, up to 30 feet in height, with a spray head at the top. At the spray head, nozzles produce a fine water mist, which would be adjusted to evaporate the water before it reaches the ground.

Each individual well would require an infrastructure of these towers, spaced far enough apart so that the water would not saturate the soil; however, salt would probably still be deposited on the soil and could create salt loading problems that could change vegetation species composition. Misting towers work best on hot and dry days, and lose effectiveness at night and during winter conditions. As a result, misting towers can only be used in combination with another water handling technique.

Misting towers require many acres of land, can be visually obstructive, may create surface crusting and sealing of soil beneath the towers, given elevated salinity in produced water require a backup system of water handling, and often operate with less than total efficiency and effectiveness. For these reasons, their use has been eliminated from detailed consideration in this EIS.

2.10.8 Alternative Water Treatment Methods

Discharge of coalbed natural gas produced water in Wyoming is regulated by the Wyoming DEQ, Water Quality Division, under provisions of an NPDES permit. Although the produced water at the Seminoe Road Pilot Project meets NPDES discharge standards and requires little, if any, treatment, the Proponent has installed and has the ability to use an aeration and filtration system, when necessary at two of it's current NPDES discharge points. See Section 2.4.8, Produced Water Management, and **Appendix A, Proponent's Project Description**.

Existing water quality data for the Seminoe Road Project indicate that parameters of interest are primarily dissolved iron and manganese. Any qualitative comparison of available water treatment processes for produced water must be based on the specific characteristics of the water to be treated and the effluent criteria to be achieved. Removal effectiveness, energy and chemical requirements, by-products treatment and residual disposal requirements, operational simplicity, and system reliability must be assessed as part of any water treatment system screening criteria. Water treatment processes not evaluated in detail and eliminated from consideration are shown on **Table 2-2, Alternative Water Treatment Methods**. In addition, a number of proprietary or experimental processes have been reported for water treatment but are likewise not addressed in the EIS.

Given expected water quality, none of the processes included in **Table 2-3, Alternate Water Treatment Methods**, are currently expected to be needed for water treatment at the Seminoe Road Project. Water treatment, when and if used, must ensure compliance with NPDES permit requirements.

2.10.9 Sole Use of Existing Roads

Although approximately 300 miles of existing roads currently exist within the EIS analysis area, nearly 100 miles of these roads are not in the proper position to access the proposed well pad sites or of high enough quality to carry project related traffic. To achieve the desired 160-acre spacing for development, an estimated 250 miles of new roads must be constructed. In addition, most of the existing roads that can be used (~200 miles) in the

Table 2-3, Alternate Water Treatment Methods

Process	General Effectiveness	Comparative Cost (capital + operating & maintenance)	Advantages	Disadvantages
Ion Exchange	Excellent	Moderate - High	Selective metal treatment possible	Regenerate disposal, possible reactive material
Reverse Osmosis	Excellent	Moderate - High	Effectively removes most metals	Brine disposal, low membrane life
Nanofiltration	Good	Moderate - High	Easier to operate than reverse osmosis	Brine disposal, low membrane life
Electrodialysis	Excellent	Moderate - High	Membrane life improvement over reverse osmosis and nanofiltration	Brine disposal, possible reactive material
Granular Activated Carbon	Good	Moderate - High	Low technology, lower removal effectiveness	Limited effectiveness; need to replace carbon on frequent basis
Evaporation / Distillation / Crystallization	Excellent	High - Very High	Very effective, zero discharge	Difficult operation, very costly, not proven on larger scale, brine disposal
Electrolytic	Varies	Very High	Stabilizes available metals	Limited effectiveness, metal specific, high energy cost

EIS analysis area are two-track roads that do not provide all-weather access. Therefore, even though the existing footprint of these roads is used, they would be upgraded to an all-weather condition so that personnel and equipment could access well pad sites on a year-round basis.

Given the impracticality of using only existing roads, and using those roads in their present state, this alternative was eliminated from further consideration.

2.11 Comparison of Alternatives

Environmental impacts of each alternative are addressed in Chapter 4, Environmental Analysis. **Table 2-4, Summary of Impacts by Alternative for Each Issue**, compares alternatives to the issues identified in Chapter 1, Purpose of and Need for Action.

Table 2-4, Summary of Impacts by Alternative for Each Issue[1]

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Air Quality				
Fugitive dust emissions PM_{10} $PM_{2.5}$	Pilot Project permitted with Wyoming DEQ Air Quality Division; impacts much less than Alternative B.	515 tons/year 120 tons/year	Same as Alternative B	Same as Alternative B
Gaseous emissions $NO_{(x)}$ SO_2 VOC	Pilot Project permitted by Wyoming DEQ Air Quality Division; impacts much less than Alternative B	320 tons/year 42 tons/year 30 tons/year	1,420 tons/year 42 tons/year 1,130 tons/year	Same as Alternative B
Visibility effects to Class I air sheds (Wilderness Areas) by Seminoe Road Project	None expected	Unlikely; below 0.5 deciview (dv) level	Similar to Alternative B	Same as Alternative B
Cumulative visibility impacts from all regional sources including both Atlantic Rim and Seminoe Road Projects	None expected	1 to 4 days per year visibility impacts greater than 1.0 dv threshold for Bridger & Popo Agie Wilderness Areas in western Wyoming.	Similar to Alternative B	Same as Alternative B
Cultural Resources				
Impacts to cultural and historic sites	None impacted: Pilot Project cleared by BLM and SHPO	16% of EIS analysis area has been previously surveyed with results showing approximately 1 site per 80 acres. Based on this ratio, it could be projected that 1,700 sites could be identified in entire EIS analysis area, but with less than 5% direct disturbance, avoidance of sites highly likely.	Same as Alternative B	Same as Alternative B
Hydrology (Surface and Ground Water)				
Alterations to downstream flow rates	Produced water from Pilot Project being discharged directly into Pool Table Draw and tributaries.	A maximum discharge rate of 35.5 acre-feet of water per day (1,430 gpm) would be added to the hydrologic system. This represents approximately 5% of the average January low flow and 0.4% of the average June high flow of the North Platte River into the Seminoe Reservoir. Discharging produced	Same as Alternative B with no infiltration losses in ephemeral drainages as produced water discharged through pipelines directly into Seminoe Reservoir. Beneficial use of produced water for downstream use.	None of the produced water would be added to downstream flow rates; produced water would be injected into underground formation (Dad Sandstone). No beneficial use of produced water for downstream use.

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
		water into EIS analysis area drainages would result in an infiltration loss of an estimated 2.9 gallons of water per foot of drainage length per day of flow. Beneficial use of produced water for downstream use.		
Erosion of ephemeral channels	Head cutting has occurred in Pool Table Draw both above and below the high water mark of Seminoe Reservoir. Mitigation measures are underway above the high water mark of Seminoe Reservoir. Peak runoff in drainages increased slightly due to project-related surface disturbances in the watersheds.	Discharge of produced water to ephemeral drainages would cause further erosion in drainage channels. Peak runoff in drainages increased slightly due to project-related surface disturbances in the watersheds.	No additional erosion as produced water piped to Seminoe Reservoir or North Platte River. Peak runoff in drainages increased slightly due to project-related surface disturbances in the watersheds.	No additional erosion as produced water injected into underground formation (Dad Sandstone). Peak runoff in drainages increased slightly due to project-related surface disturbances in the watersheds.
Impacts to water chemistry in Seminoe Reservoir from produced water	No water chemistry changes have been noted for Seminoe Reservoir as a result of Pilot Project.	Sodium levels could increase from 42 mg/l to 48 mg/l in Seminoe Reservoir during low flow month of January and if drought conditions recur. During high flows, natural dilution and mixing effects would essentially eliminate any adverse effects.	Similar but the potential to be slightly higher than Alternative B as produced water discharged directly into Seminoe Reservoir via pipelines.	None; water would be injected into underground formation (Dad Sandstone)
Land Use				
Total area disturbed by initial construction and drilling activities	146 acres (1.8% of 8,320 acre Pilot Project area)	6,174 acres (4.5% of 137,000 acre EIS analysis area)	Similar to Alternative B	Similar to Alternative B
Total operational disturbance area following interim reclamation activities	69 acres (0.8% of 8,320 acre Pilot Project area)	2,349 acres (1.7% of EIS analysis area)	Similar to Alternative B	Similar to Alternative B
Initial land disturbance by ownership BLM Private State	73 acres 73 acres 0 acres	3,014 acres 3,014 acres 144 acres	Similar to Alternative B	Similar to Alternative B

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Changes in future land use	None; after completion of Pilot Project, the disturbed area reclaimed to pre-disturbance land use as rangeland.	None: after 30-year project life, the operational disturbed areas would be reclaimed as rangeland for livestock grazing and wildlife habitat.	Same as Alternative B	Same as Alternative B
Noise				
Construction and drilling noise effects	Construction and drilling completed.	Average construction and drilling noise estimated at 85 dBA at 50 feet	Same as Alternative B	Same as Alternative B
Operational noise effects from surface facilities	Individual motors and generators provide power to well pumps at Pilot Project and they operate 24 hours per day, creating 70 to 80 dBA at 50 feet.	Electrified option; negligible noise at well sites; electric compressor noise at 50 to 60 dBA at 50 feet; if enclosed, noise levels are negligible.	Non-electric alternative: gas powered compressor noise estimated at 80 to 90 dBA at 50 feet; if in enclosed structure, noise estimated at 55 to 65 dBA at 50 feet from structure.	Same as Alternative B
Weeds				
Spread of weeds	Weed infestation has occurred at some disturbed sites at Pilot Project.	Potential for weed infestations in some disturbed sites is high to very high.	Similar as Alternative B	Same as Alternative B
Public and Worker Health and Safety				
Potential possibility of accident that would necessitate an emergency response	The probability of accidents always exists, but incident level is expected to remain low given safety awareness and safety protection measures.	Potential for accidents expected to be low, but slightly greater than Alternative A as this alternative contemplates full project build-out.	Same as Alternative B	Same as Alternative B
Possible impact to WAPA 115 kV electric transmission line	Pilot Project has not caused any impacts to this transmission line.	Project would obtain electricity from this line. Road crossings beneath line minimal and perpendicular to the line to avoid impacts.	Non-electric alternative; no impacts to WAPA line anticipated. Road crossings beneath line minimal at perpendicular to line.	Same as Alternative B
Recreation				
Disruption to undeveloped recreational opportunities	Public access to site is limited by checkerboard ownership pattern. Access to site from private surface is gated. Small extent of Pilot Project has not affected guided hunting opportunities in EIS analysis area.	Similar to Alternative A in that public access to site would be limited. Guided hunting experience in EIS analysis area would be diminished given impacts to wildlife and the natural setting by construction, drilling, roads and well facilities.	Similar to Alternative B, but no produced water is discharged into surface drainage channels. Temporary (20 o 30 years vegetation and wildlife benefits would not occur.	Similar to Alternative B, but no produced water is discharged into surface drainage channels. Temporary (20 to 30 years) vegetation and wildlife benefits would not occur.

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Disruption to developed recreation facilities	No direct effect; no developed recreation facilities exist in Pilot Project area	No developed recreation facilities exist in EIS analysis area; users of Dugway Recreational site may notice increased traffic on Carbon County Road 351; fisherman at Coal Creek Bay area could be indirectly affected by construction and drilling activity.	Same as Alternative B; fisherman at Coal Creek Bay area would be subject to higher operational noise levels than Alternative B given gas-powered facilities.	Same as Alternative B
Possible impacts to recreation users of Country Road 351 (Seminoe Road) designated as national Back Country Byway.	Pilot project is visible to visitors on the Back Country Byway, but it does not dominate the view, although it does not attract attention from viewpoints due to coloration f facilities.	Similar to Alternative A, but increased well density and the associated road network would create an industrial setting along the Back Country Byway.	Similar to Alternative B, but additional noise and emissions from gas-powered facilities would further degrade the Back Country Byway experience.	Similar to Alternative B, but with the incremental increase of industrialization associated with the water re-injection pumping facilities.
Disruption to recreation at Seminoe State Park and at Miracle Mile on the North Platte River	No direct effect. Pilot Project is visible to recreational users traveling on Carbon County Road 351.	Similar to Alternative A with construction, drilling, operational facilities and roads being noticeable to travelers on Carbon County Road 351. For some travelers, the feeling of solitude could be diminished from increased project traffic.	Same as Alternative B	Same as Alternative B
Roads/Transportation				
Road use and traffic				
Maintenance impacts to Carbon County Road 351	Negligible as Carbon County Road 351 has been recently upgraded and traffic to Pilot Project is limited to operations workers.	Construction to cause 50% increase in traffic on Carbon County Road 351; expect increased maintenance needs for this road given construction traffic to involve more truck traffic.	Same as Alternative B	Same as Alternative B
Potential for accidents with increased construction and operational traffic	Negligible – Pilot Project only	With increase in traffic on Carbon County Road 351, the possibility for project-related traffic accidents also increases.	Same as Alternative B	Same as Alternative B

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Socioeconomics				
Projected project life	Unknown; depends on amount of time needed to assess the natural gas potential of the site.	Construction and drilling activities to occur over 10-year period. Total project life estimated at 30 years.	Same as Alternative B	Same as Alternative B
Employment Direct Indirect New Job Opportunities	Not Estimated	50 – 110 40 – 88 90 – 198	Similar to Alternative B	Similar to Alternative B
Total estimated tax revenues over 30-year project life	Not applicable	$480 million	Similar but slightly less than Alternative B	Similar by slightly less than Alternative B
Estimated ad valorem property taxes over 30-year project life	Not applicable	$121 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated Wyoming severance taxes over 30-year project life	Not applicable	$90 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated federal mineral royalties over 30-year project life	Not applicable	$186 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated state mineral royalties from state administered lands over 30-year project life	Not applicable	$3 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated sales and use taxes over 30-year project life	Not applicable	$4 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated corporate federal income taxes over 30-year project life	Not applicable	$35 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Estimated direct and indirect employee related taxes over 30-year project life	Not applicable	$ 41 million	Similar but slightly less than Alternative B	Similar but slightly less than Alternative B
Impacts to Rawlins housing utilities, public service, and present lifestyles	Very low as a result of Pilot Project	Low. Carbon County reports a vacancy rate of over 1,000 units for sale or rent (Rawlins has 500 vacant units). Peak project demand for Seminoe Project estimated at 60 units, with 25-30 units of long-term demand.	Similar to Alternative B	Similar to Alternative B

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Soils				
Potential for soil erosion	No erodible soils found in Pilot Project area	Approximately 19% of EIS analysis area covered with erodible soils; estimated 1,300 acres of erodible soils to be disturbed.	Similar to Alternative B	Similar to Alternative B
Potential for sedimentation	Channel head cutting and erosion in Pool Table Draw where produced water from Pilot Project discharged.	Discharge of produced water in drainage channels in EIS analysis area could contribute to channel erosion and down-channel sedimentation.	Channel sedimentation potential is low because produced water to be discharged directly into Seminoe Reservoir.	Channel sedimentation potential is low because produced water to be injected into underground "Dad Sandstone" formation.
Revegetation potential of disturbed soils	Low to Moderate	Low to Moderate	Same as Alternative B	Same as Alternative B
Vegetation				
Potential impacts to U.S. Fish & Wildlife threatened and endangered plant species	None. No threatened and endangered plant species occur in Pilot Project area.	None. No threatened and endangered plant species occur in the EIS analysis area.	Same as Alternative B	Same as Alternative B
Potential impacts to Wyoming BLM sensitive plant species	Persistent sepal yellow cress only BLM sensitive plant species known to occur in area. Produced water discharge in Pool Table Draw may enhance the development of this species, but effects would be reversed when water discharge ceases.	Persistent sepal yellow cress only BLM sensitive plant species known to occur in area. Produced water discharge in EIS analysis area drainages may enhance the development of this species, but effects would be reversed when water discharge ceases.	Low potential for effects to Persistent sepal yellow cress as produced water would be discharged directly into Seminoe Reservoir.	Low potential for effects to Persistent sepal yellow cress as produced water would be injected underground.
Potential impacts to wetlands and riparian areas	Pilot Project road and well pad construction avoided wetland and riparian areas.	Potential impacts would be minimal as construction disturbance would avoid wetland and riparian areas. Roads would cross drainage channels at right angles.	Same as Alternative B	Same as Alternative B
Impacts to vegetation in drainages where produced water is discharged	Increased vegetative cover and diversity of wetland and riparian species in Pool Table Draw below produced water discharge points. This would continue until discharge ceases.	Increase in vegetative cover and diversity of wetland and riparian species drainages where produced water is discharged. This would occur until discharge ceases. Long-term discharge could cause increase in salt tolerant species.	None. Produced water discharged directly to Seminoe Reservoir and North Platte River.	None. Produced water to be injected underground.

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Visual Resources				
Impact to Seminoe State Park recreationists	No direct effects. Pilot Project not visible to Seminoe State Park recreationists.	No direct effects. Travelers of Carbon County Road 351 may notice drilling activities, as well as well pads and roads during project operations. Boaters on Seminoe Reservoir may see drill rig masts during drilling activities	Same as Alternative B	Same as Alternative B
Impacts to travelers from Carbon County Road 351	Travelers can see some of the Pilot Project facilities adjacent to Carbon County Road 351.	Travelers would be able to observe construction and well drilling activities and operational well installations and roads adjacent to Carbon County Road 351. Facilities that draw the attention of the viewer from Carbon County Road 351 would exceed VRM Class II objectives.	Same as Alternative B	Same as Alternative B
Impacts from Bennett Mountain Wilderness Study Area	Portions of Pilot Project visible from ridges of Seminoe Mountains but view would be visible from nearly 10 miles away, which would diminish the visual impacts.	Portions of the project activities within the EIS analysis area would be visible from ridges of Seminoe Mountains but view would be from nearly 10 miles away, which would diminish the visual impacts.	Same as Alternative B	Same as Alternative B
Wildlife (Terrestrial)				
Impacts to wildlife habitat	Loss of 69 acres of wildlife habitat during Pilot Project operations. Habitat to be restored with reclamation after cessation of Pilot Project operations.	Loss of 2,321 acres of wildlife habitat during long-term operations (1.7% of EIS analysis area). Habitat to be restored after cessation of operations in 30 yrs.	Similar to Alternative B	Similar to Alternative B
Impacts to sage grouse	No sage grouse leks in Pilot Project area and no sagebrush habitat directly disturbed.	No direct disturbance in 0.25- mile radius of known sage grouse leks in the EIS analysis area. Nearly 3,000 acres of sagebrush habitat would be disturbed, with approximately half of the habitat within 2–mile radius of sage grouse leks.	Same as Alternative B	Same as Alternative B

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Impacts to mountain plover	Pilot Project disturbed approximately 146 acres of mountain plover habitat, but 77 acres of that disturbance has been reclaimed and returned to mountain plover habitat.	Project development would cause loss of approximately 850 acres of the estimated 43,000 acres of this habitat in the EIS analysis area over 30 year project life (a 2% loss in mountain plover habitat). However, interim reclamation to grasses of nearly 4,000 acres of disturbance would increase mountain plover habitat.	Same as Alternative B	Same as Alternative B
Impacts to prairie dogs	Impacts similar to mountain plover impacts under Alternative A.	Impacts similar to mountain plover impacts under Alternative B.	Same as Alternative B	Same as Alternative B
Impacts to pronghorn	No crucial winter/yearlong pronghorn habitat in the Pilot Project area; however, displacement of the species during construction and drilling. Pronghorn seem to be habituating to Pilot Project operations traffic and human presence.	Approximately 9,500 acres of crucial winter/yearlong pronghorn habitat in the EIS analysis area; some displacement of the species expected in areas adjacent to construction and drilling. Pronghorn expected to habituate to operations traffic and human presence.	Same as Alternative B	Same as Alternative B
Impacts to mule deer	No crucial winter mule deer range in the Pilot Project area; however, displacement of the species during construction and drilling. Mule deer seem to be habituating to Pilot Project operations traffic and human presence.	No crucial winter mule deer range in the EIS analysis area; however, displacement of the species expected in areas adjacent to construction and drilling. Mule deer expected to habituate to operations traffic and human presence.	Same as Alternative B	Same as Alternative B
Impacts to ferruginous hawks	Ferruginous hawk generally avoids human activity and presence so construction and development likely to reduce foraging habitat.	Same as Alternative A but extended to the entire EIS analysis area.	Same as Alternative B	Same as Alternative B

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Impacts to black-footed ferret	No black-footed ferrets sighted made within and surrounding Pilot Project during surveys in 2000, 2001, 2002 and 2003. No impacts to this species	Black-footed surveys would continue to be conducted in white-tailed prairie dog towns greater than 200 acres in size. Based on surveys conducted from 2000 to 2003, no black-footed ferrets have been sighted. Not likely to adversely affect this species	Same as Alternative B	Same as Alternative B
Impacts to bald eagles	No nesting or winter roosting habitat found in Pilot Project area. Some nesting and nesting habitat found along North Platte River South of Pilot Project area. Bald eagles may fly over area but no impacts expected to this species as a result of operations.	Some nesting and winter roosting habitat found along North Platte River within and adjacent to the EIS analysis area. Federal laws and regulations prohibit any disturbance to within a 1-mile radius of nesting sites. Bald eagles may fly over area but no impacts expected to this species as a result of operations.	Same as Alternative B	Same as Alternative B
Impacts to North Platte River species such as whooping crane, least tern, pallid sturgeon, Eskimo curlew and piping plover	No suitable habitat for these species within or surrounding the Pilot Project area. No water deletions to affect these species.	No suitable habitat for these species within or surrounding the EIS analysis area. No water depletions to affect these species. Discharge of produced water to area drainages could provide extra water to benefit these downstream species.	No suitable habitat for these species within or surrounding the EIS analysis area. No water depletions to affect these species. Discharge of produced water to Seminoe Reservoir could provide extra water to benefit these downstream species.	No suitable habitat for these species within or surrounding the EIS analysis area. No water depletions to affect these species.
Notes: 1. This table summarizes the potential impacts of the alternatives. Environmental impacts of each alternative are described in detail in Chapter 4, Environmental Consequences. This table also compares alternatives to the issue used to develop alternatives and those issues identified as being important to assess the impacts of the alternatives. Issues are identified in Chapter 1, Purpose of and Need for Action. When reviewing specific alternative actions, please note that there may be some minor differences in acres and volumes. These differences are due to rounding and are not important to the descriptions of the actions or their effects.				

Chapter 3 – Affected Environment

This chapter describes the existing condition of the EIS analysis area and is provided to assist the reviewer in understanding the environmental consequences presented for each resource in Chapter 4, Environmental Consequences. The discussions are separated into individual resource topics such as air quality, soils, geology, surface water, ground water, etc. Resource specialists compiled existing and available information and, as appropriate, conducted on-the-ground surveys of the EIS analysis area.

The EIS analysis area is the specific area within which proposed surface disturbance and development activities would occur. The study area is the area where direct and indirect effects to a specific resource would occur. For certain resources, such as soils and vegetation, the study area was considered to be the area of potential direct disturbance. For other resources, such as wildlife, transportation and socioeconomics, a broader study area was utilized to account for the potential off-site effects related to these resource categories.

3.1 Air Quality/Climate

3.1.1 Regional Climate

The EIS analysis area is located in a semi-arid, steppe (dry and cold), mid-continental climate regime typified by dry windy conditions, limited rainfall, and long cold winters.

Temperature and precipitation data for the Seminoe Dam and for the Rawlins airport are listed in **Table 3.1-1, Temperature and Precipitation Data.** Seminoe Dam is located approximately 7 miles north of the EIS analysis area, while the Rawlins airport is located about 12 miles southeast of the EIS analysis area. See **Figure 19, Regional Activity**.

Annual mean temperatures in this region of south-central Wyoming range from a low of about 13°F in January to a high near 85°F in July. Prolonged cold conditions are frequent in the winter, with temperatures plunging below 0°F. Conversely, summertime temperatures can climb above 100°F.

Table 3.1-1, Temperature and Precipitation Data for Rawlins, Wyoming

Month	Mean Temperature (°F)					
	Daily Max		Daily Min		Mean	
	Seminoe Dam	Rawlins Airport	Seminoe Dam	Rawlins Airport	Seminoe Dam	Rawlins Airport
January	30.0	33.4	12.5	12.5	21.3	23.0
February	33.6	37.1	15.1	15.1	24.6	26.1
March	40.6	45.5	19.7	22.1	33.0	33.8
April	52.8	55.1	28.3	28.0	41.0	41.6
May	63.7	65.7	37.4	36.1	50.8	50.9
June	75.0	77.9	46.8	44.6	61.8	61.3
July	83.6	85.3	53.8	50.5	68.6	67.9
August	81.5	83.8	52.0	49.2	67.1	66.5
September	71.3	73.3	42.7	40.5	57.1	56.9
October	57.8	59.8	32.9	31.1	45.4	45.5
November	41.4	42.9	22.6	20.1	31.7	31.5
December	32.3	34.6	15.3	13.5	23.7	24.1
ANNUAL	**55.3**	**57.9**	**31.6**	**30.3**	**43.8**	**44.1**
Month	**Precipitation (inches)**					
	Mean Total		**As Snowfall**		**Mean Snow Dept**	
	Seminoe Dam	**Rawlins Airport**	**Seminoe Dam**	**Rawlins Airport**	**Seminoe Dam**	**Rawlins Airport**
January	0.53	0.56	3.5	9.0	4	3
February	0.65	0.52	5.9	7.7	5	2
March	1.09	0.65	4.5	8.3	2	1
April	1.62	1.06	1.4	7.3	0	Trace
May	2.12	1.49	0.4	1.6	0	Trace
June	1.39	0.93	0.3	0.3	0	Trace
July	0.96	0.90	0.0	0.0	0	0
August	0.75	0.81	0.0	0.0	0	0
September	0.97	0.82	0.2	0.8	0	Trace
October	1.13	0.86	1.6	4.2	0	Trace
November	0.92	0.65	3.7	9.7	1	1
December	0.65	0.49	4.2	8.4	3	2
ANNUAL	**12.78**	**9.74**	**26.0**	**57.3**	**-**	**-**

Source: Western Regional Climate Center. Period of record for both stations used in this table is 1971-2000. Seminoe Dam station is in Carbon County at an elevation of 6,838 feet (Latitude 42° 09'N, Longitude 106° 55'W). The Rawlins Municipal Airport Station is in Carbon County at an elevation of 6,736 feet (Latitude 41° 48'N, Longitude 107° 12'W).

Annual precipitation typically ranges around 10 to 13 inches, with highest monthly amounts occurring in May. Snowfall is variable, and patterns are influenced by wind and topography and have an effect on vegetation, wildlife, hydrology and human activities. Summertime rain (June through August) is sporadic, often associated with passing thunderstorms, which can be locally intense.

Wind directions can vary in this region, but the predominant wind direction is west to east as illustrated on **Figure 21, Wind Rose – Rawlins, Wyoming**. Wind roses depict the joint frequency of occurrence, in percentage, of wind speed and direction categories for a particular location and time period. The radials of the wind rose indicate the direction from which the wind is blowing. The length of the radials indicates the frequency of occurrence for that direction for certain wind speed classes. The annual-average wind speed for this area ranges between 10 to 15 miles per hour (mph); with gusts frequently above 30 mph. Calm conditions rarely occur.

3.1.2 Ambient Air Quality Standards

The Federal Clean Air Act requires the EPA to set ambient air quality standards (AAQS) to protect public health and welfare. These standards were developed to protect public health (primary standards) with a margin of safety. EPA also has specified secondary standards that are more restrictive than the primary standard in instances when a primary standard does not adequately protect public property or resources (for example, ensuring that dust concentrations are low enough to prevent damage to crops or soiling of buildings). Further, the state of Wyoming has adopted ambient standards for SO_2 and H_2S that are more restrictive than EPA's limits.

The Prevention of Significant Deterioration (PSD) program set forth by 40 CFR 52.21 is designed to prevent the deterioration of air quality to the AAQS levels. EPA has established ambient air increments for selected air pollutants that limit incremental concentration increases of the selected pollutants. The allowable increments vary in magnitude depending upon the classification of the region regulated. Special areas that warrant greater protection, such as national parks and wilderness areas, are classified as Class I areas. Class II areas generally have less restrictive air quality standards that allow possible development. Applicable AAQS and ambient air increments are listed in **Table 3.1-2, Ambient Air Quality Standards**.

Table 3.1-2, Ambient Air Quality Standards and Air Increments (µg/m^3)

Pollutant	Averaging Time	Ambient Air Quality Standards		PSD Ambient Air Increment	
		National	Wyoming	Class I	Class II
CO	1-hour	40,000	40,000	None	
	8-hour	10,000	10,000		
NO_2	Annual	100	100	2.5	25
O_3	1-hour	235	235	None	
	8-hour	157	157		
PM_{10}	24-hour	150	150	8	30
	Annual	50	50	4	17
$PM_{2.5}$	24-hour	65	65	None	
	Annual	15	15		
SO_2	3-hour	1,300	1,300	25	512
	24-hour	365	260	5	91
	Annual	80	60	2	20

3.1.3 Regional Air Quality

No air quality monitoring has been conducted within the EIS analysis area. However, air quality constituents that have been measured throughout the region indicate that existing air quality in south-central Wyoming is generally good and achieves all state and national AAQS. Regional air quality data representative of the EIS analysis area is summarized in **Table 3.1-3, Representative Background Ambient Air Concentrations**.

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year (kilograms per hectare per year). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants).

Table 3.1-3, Representative Background Ambient Air Concentrations (µg/m³)

Pollutant	Averaging Period	Measured Background Concentration
CO[1]	1-hour	3,336
	8-hour	1,381
NO_2 [2]	Annual	3.4
O_3 [3]	1-hour	169
	8-hour	147
PM_{10} [4]	24-hour	33
	Annual	16
$PM_{2.5}$ [4]	24-hour	13
	Annual	5
SO_2 [5]	3-hour	132
	24-hour	43
	Annual	9

Notes:

1. Data collected by Amoco at Ryckman Creek for an 8-month period during 1978-1979 as summarized in the Rile Ridge EIS (BLM 1983)
2. Data collected at the Green River Basin Visibility Study Site, Green River, Wyoming, between January and December 2001 (Air Resource Specialists 2002)
3. Data collected at the Green River Basin Visibility Study Site, Green River, Wyoming, between June 10, 1998 and December 31, 2001 (Air Resource Specialists 2002)
4. Data collected by Wyoming DEQ, Air Quality Division at the Emerson Building, Cheyenne, Wyoming, for Year 2001. Second highest concentrations are listed for 24-hour averages
5. Data collected at the LaBarge Study Area, Northwest Pipeline Craven Creek Site, 1982-1983

Total deposition (wet and dry) reported as total sulfur and total nitrogen deposition for each of these sites for year 2001 is provided in **Table 3.1-4, 2001 Measured Acid Deposition Data (kg/ha-yr).**

Table 3.1-4, 2001 Measured Acid Deposition Data (kg/ha-yr)

Site Location	Nitrogen Deposition	Sulfur Deposition
Pinedale	1.6	0.8
Centennial/Brooklyn Lake	7.5	2.8

Total deposition levels of concern (LOC) have been estimated for several areas, including the Bridger Wilderness Area. The “red line” LOC is defined as the total deposition that the area can tolerate and the “green line” LOC is defined as the acceptable level of total deposition. Cumulative impacts plus background are compared to these LOCs. The Bridger Wilderness nitrogen deposition red line LOC is 10 kg/ha-yr and nitrogen deposition green line LOC is 3-5 kg/ha-yr. The Bridger Wilderness sulfur deposition red line LOC is 20 kg/ha-yr and sulfur deposition green line is 5 kg/ha-yr.

The levels of concern used for comparison in the deposition analysis have been a topic of discussion between the BLM and the Forest Service for the past few years. The Forest Service has expressed some concern that the LOC values are too high; but this agency has not, however, provided input as to what values would be more acceptable. These LOC values are presently the only comparison values available and have been in use for most acid deposition analyses conducted since the mid 1990s.

Site-specific lake chemistry background data (pH, acid neutralizing capacity, elemental concentrations, etc.) have been collected by the U.S. Geological Survey (Water Quality Division) in several high mountain lakes within wilderness areas in Wyoming and northern Colorado. Lake acidification is measured in terms of change in acid neutralizing capacity (ANC), which is the lake's buffering capacity to resist acidification from atmospheric deposition of acid compounds such as sulfates and nitrates. Measured baseline ANC data for sensitive lakes within the cumulative study domain are provided in **Table 3.1-5, Monitored Background Conditions at Sensitive Lakes**.

Table 3.1-5, Monitored Background Conditions at Sensitive Lakes

Sensitive Lake	Lake Location	Background ANC (µeq/l)[1]	Number of Samples	Period of Monitoring
Black Joe Lake	Bridger Wilderness Area	67.0	61	1984-2003
Deep Lake	Popo Agie Wilderness Area	59.9	58	1984-2003
Hobbs Lake	Bridger Wilderness Area	69.9	65	1984-2003
Lazy Boy Lake	Bridger Wilderness Area	18.8	1	1997
Upper Frozen Lake	Bridger Wilderness Area	5.0	6	1997-2003
Ross Lake	Fitzpatrick Wilderness Area	53.5	44	1988-2003
West Glacier Lake	Glacier Lakes Ecosystem Experiments Sites (GLEES)	35.2	14	1988-1996
Lake Elbert	Mount Zirkel Wilderness Area	51.9	55	1985-2003
Seven Lakes	Mount Zirkel Wilderness Area	36.2	55	1985-2003
Summit Lake	Mount Zirkel Wilderness Area	47.3	95	1985-2003
Lower Saddlebag Lake	Popo Agie Wilderness Area	55.5	43	1989-2003
Island Lake	Rawah Wilderness Area	68.7	15	1996-2002
Kelly Lake	Rawah Wilderness Area	181.1	13	1995-2202
Rawah #4 Lake	Rawah Wilderness Area	41.2	13	1996-2002

Note:
1. 10th Percentile Lowest ANC values reported. Values provided by Terry Svalberg U.S. Forest Service.

Lakes with ANC values ranging from 25 to 100 microequivalents per liter (µeq/l) are considered to be sensitive to atmospheric deposition, lakes with ANC values ranging from 10 to 20 µeq/l are considered very sensitive, and lakes with ANC values less than 10 µeq/l are considered extremely sensitive.

The Forest Service has identified specific “Level of Acceptable Change” (LAC) values, which are used to evaluate potential air quality impacts from deposition within their wilderness areas (USFS 2000). The Forest Service has identified a LAC of no greater than 1 µeq/l change in ANC (from human causes) for lakes with existing ANC levels less than 25 µeq/l. A limit of 10% change in ANC reduction was adopted for lakes with existing ANC greater than 25 µeq/l.

The EIS analysis area is located in the Hanna Basin, in an area known as the Laramie Air Basin, which includes much of south-central Wyoming. This basin is bordered by the Wyoming-Colorado state line to the south, the Laramie Mountains to the east, the Granite Mountains to the north, and the Great Divide Basin to the west. Air transport from the west and southwest dominates in level terrain areas, and dispersion results from unstable conditions induced by surface heating during the day. Conditions generally stabilize at night as air temperatures cool.

The EIS analysis area is located within a PSD Class II area, where the release of limited concentrations of certain pollutants is permitted as long as the AAQS are maintained, and modeled concentrations of increment-consuming sources are below stipulated PSD Class II increments.

The nearest PSD Class I area (an area where little air quality deterioration is allowed) is the Savage Run Wilderness Area, located approximately 47 miles south-southeast of the EIS analysis area. Another PSD Class I area in the region is the Mount Zirkel Wilderness Area, located in northern Colorado about 57 miles south of the EIS analysis area. The proximity of the proposed Seminoe Road Project to Class I areas is shown on **Figure 20, Air Quality Modeling Domain**.

3.1.4 Air Permitting Requirements for Industrial Sources

Wyoming industrial sources must secure a Construction Permit as required by Wyoming Air Quality Regulations, Chapter 6, Section 2 from the Wyoming DEQ, Air Quality Division prior to commencing construction of any source that has the potential to emit regulated air pollutants (see **Appendix D, Agency Jurisdictions (Permits and Approvals)**).

The Wyoming DEQ, Air Quality Division imposes stringent requirements for large industrial sources under a PSD program. PSD permitting applies only to projects that emit 250 tons per year or more of PM_{10}, NO_X, CO, SO_2 or other regulated air pollutants from stationary, non-fugitive sources. Non-fugitive sources are air pollutants that are typically emitted to the atmosphere through a vent or stack. The Seminoe Road Project is not expected to be subject to PSD permitting regulations because non-fugitive emissions would be low.

3.2 Soils

Information for the soils occurring to the north and west of the North Platte River and Seminoe Reservoir was provided by the BLM office in Rawlins, Wyoming (Foley 2002, Foley 2004, Simons 2003). (See **Figure 22, Soils Map.**) The information collected from the BLM included a general soils map providing an overview of the general soils present, a more detailed Order 3 soils map, and map unit and pedon descriptions. An interpretations table was also provided by the BLM depicting ratings for the majority of the map units occurring within the entire project area with respect to runoff potentials, water and wind erosion hazards, and the presence of elevated salt and sodium levels. This table provided the basic information used to identify and characterize potentially sensitive soils (saline/sodic, shallow, and highly erodible soils) on site.

Soil maps, map unit descriptions, and pedon descriptions for the remainder of the project area were provided by the Natural Resources Conservation Service (NRCS) (Cox 2004). Pertinent maps and descriptions on file in the NRCS Office in Saratoga, Wyoming were copied and the map unit boundaries drawn on a project map. The data gathered were the result of various contract soil surveys managed by the NRCS and remain unpublished at this time. For the area south of Seminoe Reservoir where no surveys had been conducted, existing soils data and mapping were used to interpolate the soil map units that could occur within this area.

The following section was based on the maps and data collected from these sources. Soil chemical and physical characteristics related to impact assessment, mitigation planning, and potential revegetation success are stressed. **Appendix N, Soils and Vegetation Information**, supports this discussion and identifies the map units overlying a majority of the project area across the dominant topographic features.

3.2.1 General Soil Characteristics

Soils range from shallow to deep with shallow soils dominating ridges, residual uplands, hills, and knolls. Deeper soils are most common on terraces, alluvial fans, floodplains, and bottomlands.

Surficial textures are generally sandy and loamy in nature. Heavy clay textures are uncommon. High profile coarse fragment contents are usually limited to soils overlying ridge, uplift, and similar topographic features.

The soils are typically alkaline with pH values of 7.5 to 8.8. High alkalinity, coupled with high soil salinity values, is a common condition associated with alluvial fans, bottomland, drainage bottom, pediment, and some upland topographic features. Saline soil profiles are more common in the northern portion of the EIS analysis area.

Available water capacities range from low to high depending upon soil depth and texture, with effective rooting depths following a similar pattern. Water erosion hazards range from slight to severe. With moderate to severe ratings most common, wind erosion hazards are typically moderate, although a number of the soils are subject to higher hazards.

No prime farmland soil units occur in the EIS analysis area (Cox 2004).

Soils classed as “sensitive” include soils having physical or chemical characteristics that could inhibit the revegetation of sites disturbed by construction or operational activities. Such soils include saline/sodic soils, soils overlying steep slopes, shallow, and highly erodible soils. These soils are described later in this section. It should be noted that the acreage calculations developed were based essentially on worst-case interpretations pertaining to soil mapping units as a whole. For example, a map unit made up of two soils, one of which is deep and one shallow, would have been classed as shallow in its entirety thereby skewing the map to display a worst-case scenario. This approach was unavoidable given the baseline data, map unit interpretations, and map scales available.

3.2.2 Saline/Sodic Soils

Saline and sodic soils typically occur on alluvial fans, terraces, bottomlands, and some residual uplands and pediment formations. **Figure 23, Saline and Sodic Soils** depicts areas overlain by soil map units that contain all or in part, soils that may be classed as saline and/or sodic. Saline soils are characterized by increased levels of soluble calcium, magnesium, and sodium salts resulting in electrical conductivities (ECs) greater than 4.0 milliohms per centimeter. These conditions result in droughty soils due to the salt compounds present that absorb soil moisture or otherwise render soil moisture unavailable to plant species. Sodic soils are typified by high levels of exchangeable sodium in the soil complex. Soils classed as sodic have SARs of 12 (unitless value) or greater. Increased soil sodium levels can cause soil particles to disperse resulting in reduced soil infiltration and permeability, particularly during wetting and drying cycles, resulting in a droughty seedbed with limited air exchange. These effects are most prevalent, and have the greatest negative impact on plant growth, when occurring in fine textured soils having high clay percentages.

Saline and sodic soils can form as a result of the weathering of parent materials high in salts or sodium or as a result of the deposition of these chemical constituents via sedimentation, overland flows, or flooding. Although neither salt nor sodium are toxic to plants, per se, high levels of either can reduce plant establishment, growth, and productivity, as well as limit the variety of plant species adapted to such conditions.

The revegetation potential of saline and sodic soils is directly related to the level of salts and sodium in the soil complex, as well as to soil texture, depth, moisture regime, etc.; higher levels generally, the lower the potential for the soil to support a diverse, productive plant community.

3.2.3 Shallow Soils

Shallow soils are generally characterized by a depth of 20 inches or less to bedrock or other layers incapable of serving as a growth medium. These soils have developed in association with steeper slope topographic positions and in conjunction with less weatherable parent material formations on low ridges, residual/sloping uplands, undulating hills, and low knolls. (**Figure 25, Shallow Soils**). Shallow soils are not typical of alluvial fans, pediments, terraces, and bottomlands. Shallow soils, by definition, are characterized by shallow rooting depths having limited fertility levels and low available water holding capacities. Overall, the revegetation potentials for shallow soils are considered to be limited given the edaphic characteristics noted. Mitigation techniques do exist whereby revegetation constraints associated with this soil condition can be reduced or overcome.

3.2.4 Soils Overlying Steep (>25 Percent) Slopes)

Soils overlying steep slopes are depicted on **Figure 24, Steep Slope Soils.** Steep slopes of the project area are typically found in association with ridge, rolling upland and prominent uplift formations. While soil depths ranging from shallow to moderately deep may occur across steeper slopes, shallow to very shallow soils are the norm. Soil depths on steep slopes are limited by a variety of factors including shallow depths to bedrock, as noted above, and increased surface runoff and erosion potentials. Shallow soil map units on steeper slopes may also include surface rock exposures and rock outcrop formations having little to no soil cover. Further, soils on steeper slopes may contain a higher percentage of coarse fragments (gravels, cobbles, and stones) throughout the profile. These characteristics, acting individually or in concert, serve to limit the revegetation potential of steep slope sites by limiting soil fertility and the soil moisture available for plant establishment and growth. Steep slope conditions may also limit soil salvage and handing efficiencies as well as the application of desirable revegetation techniques.

3.2.5 Highly Erodible Soils

Highly erodible soils include those soil map units, all or in part, that are considered to have severe susceptibilities to the erosive forces of wind and/or water (**Figure 26, Erodible Soils**). Wind erosion susceptibility is a function of soil structure, surface roughness, wind speed and direction, soil moisture, “field” length, and vegetative cover. A dry soil supporting little in the way of vegetation and having a sandy surface texture overlying a long, smooth unbroken topography would typically be considered to have a severe wind erosion potential. Conversely, a moist clay loam-textured soil supporting a dense stand of vegetation across a rough surface topography would typically be considered to have a slight susceptibility to wind erosion. The soil map units of the project area exhibit, in the main, moderate wind erosion susceptibilities. Soil map units having severe susceptibilities are somewhat rare across the project area.

Water erosion is a function of precipitation regimes, soil surface physical characteristics (texture, structure, coarse fragment content), slope angle and length, vegetation cover, and any practices or natural features that promote soil stability. A silty soil overlying a long, steep, sparsely vegetated slope would be considered to have a severe water erosion hazard. A loam soil, supporting a dense stand of vegetation and overlying a nearly level slope broken by an undulating topography would typically have a slight erosion hazard. A partial surface cover of gravels reducing the percent of exposed soil would, in turn, further reduce susceptibility. The likelihood of water erosion occurring to the greatest extent is correlated with the spring snowmelt period and intense summer thunderstorms that give rise to increased runoff and flooding. Soil map units having, all or in part, severe water erosion potentials are common across the proposed project area and generally correlate with high runoff potentials.

Revegetation potentials of soils having high erosion susceptibilities are considered to be low to moderate under ideal erosion - inducing conditions. However, conservation practices can be employed that dramatically reduce susceptibilities and underscore the positive chemical and physical characteristics of impacted soil map units.

3.2.6 Areas of Sensitive Soil Concentrations

Areas within the project boundaries exhibiting a combination of saline/sodic soil characteristics, shallow soil depths, and severe erosion potentials are depicted on **Figure 27, Areas of Sensitive Soil Concentrations.** The revegetation potentials of such sites are constrained by a combination of these three sensitive soil characteristics. Mitigation of such sites would require that soil handling and revegetation techniques designed to address all of these constraints be employed to achieve revegetation goals and objectives.

3.2.7 Cryptobiotic Soils

Cryptobiotic soils have recently become of greater concern to the BLM in terms of the ability of these types of soils to stabilize essentially undisturbed soil surfaces and enhance the growth of plant species in semi-arid areas. The EIS analysis area has not been inventoried for cryptobiotic soils, but they are found throughout semi-arid areas of the western U.S., often in association with pinyon-juniper vegetation. The EIS analysis area has very limited juniper vegetation. See Section 3.6.11, Juniper.

Cryptobiotic soils are biological soil crusts typically composed of cyanobacteria, green algae, lichens, mosses, microfungi and other bacteria (Beinap et al 2001). These crusts resemble a rough “carpet” on the surface of the soil, which reduces wind and water erosion, fixes nitrogen, and adds to the soil organic matter (Eldridge and Green 1994). The soil crust is essentially a matrix of bacteria and other organic matter that binds soil particles together (Beinap 1995).

3.3 Geology

The characteristics of the geology, specifically the coal seam deposits, dictate the most economical and practical method of coalbed natural gas development in the EIS analysis area.

Geologic data and the interpretations form the basis for gas extraction by providing coal seam location and general geologic structure data (such as strike, dip, faults, fracture patterns, etc.).

3.3.1 General Geology

The EIS analysis area is situated in the western portion of the Hanna Basin. The Shirley and Seminoe mountains bound the northern part of the basin; the St. Mary's and Pass Creek anticlines form the southern edge of the basin, the Rawlins Uplift bounds the basin on the west, and the eastern margin of the basin is defined by the Simpson Ridge anticline that separates the Hanna Basin from the Carbon Basin.

The geology at the site is shown **on Figure 28, Regional Geology** and includes a thick sequence of sedimentary rocks as shown on **Figure 29, General Stratigraphic Column and Geologic Cross-Section A-A'**.

The targeted zones for natural gas extraction in the EIS analysis area include the deeper Mesaverde coals and the shallower Medicine Bow/Fox Hills coals. **See Figure 29, General Stratigraphic Column and Geologic Cross-Section A-A'**.

Productive windows of natural gas extraction range from depths of 500 to 14,000 feet for the Mesaverde coals, with production depths of 500 to 10,000 feet for the overlying Medicine Bow/Fox Hills coals. The apparent duplication of production horizons is due to the locally steep dip of the Cretaceous age formations, which plunge east into the Hanna Basin at dips of 10 to 15 degrees. Both sets of coal targets outcrop at different points on the surface near the western edge of the Hanna Basin and rapidly dip to over 30,000 feet just 25 miles east of the outcrop.

Faulting is common within the Hanna Basin. A major thrust fault separates the Hanna Basin from the pre-Cambrian rocks to the north. Faults within the EIS analysis area are typically normal faults with a northerly trend. See **Figure 28, Regional Geology**. Cross faulting between major trending fault systems is also common, and major faults typically occur within 500 feet of one another.

3.3.2 Geologic Hazards

The seismic activity potential at the EIS analysis area is considered low. Twenty-five magnitude 2.0 or greater earthquakes have been recorded in Carbon County (Case et al. 2002). Most of the recorded earthquakes occurred in the 1970's. The most recent earthquake in the region was recorded in February 2000 with the epicenter located 27 miles northwest of the town of Hanna; this earthquake had a magnitude of 3.0 (Case et al. 2002).

Geologic hazards, such as landslides, are rare in the EIS analysis area because of the generally low topographic relief. However, isolated minor mass movements are found along drainage banks.

3.3.3 Paleontology

The EIS analysis area is primarily underlain by Cretaceous age deposits of the Lewis Shale and Medicine Bow formations and late Cretaceous/early Tertiary age strata of the Ferris Formation. No significant fossil-bearing sites have been reported in the EIS analysis area.

3.4 Surface Water

This section discusses the regional hydrologic setting, flow characteristics of surface drainages, and surface water quality within the EIS analysis and surrounding areas.

The following information resources were used for this evaluation:

- Surface water quality and quantity historical data collected by the United States Geological Survey (USGS);
- Surface water quality and quantity data collected for the Seminoe Road Pilot Project by the Proponent; and
- Surface water-monitoring data collected by the BLM for the Seminoe Road Pilot Project.

3.4.1 Hydrologic Setting

The EIS analysis area and surrounding region contains perennial rivers (North Platte and Medicine Bow rivers), Seminoe Reservoir, an intermittent stream (O'Brien Creek), stock ponds, playas, many ephemeral stream channel systems, and downstream water resources such as the Miracle Mile tail-water fishery and Pathfinder Reservoir used for irrigation storage.

There are numerous stock ponds and playas in the area that may receive Project produced water under some of the alternatives.

The North Platte and Medicine Bow rivers supply most of the water to Seminoe Reservoir during snow melt from the Medicine Bow, Snowy Mountains, Sierra Madres and other mountain ranges located in Colorado and Wyoming, but can have high flows in response to spring, summer and fall storm events (see hydrograph figures). Ephemeral channels occur throughout the Seminoe Road Project area and only flow in response to storm events.

The climate of the Seminoe Road Project area is arid with precipitation averaging 9-13 inches per year depending on elevation and geography. The mean annual precipitation measured on Seminoe Dam from 1948 to 2004 was 12.8 inches and mean annual precipitation measured near the town of Rawlins from 1951-2004 was 9.2 inches. Typical storm patterns in the Seminoe Road Project area are influenced by the North Platte River valley and surrounding uplifts such as the Haystack Ferris, and Seminoe mountains. Winter snow precipitation is subject to sublimation and wind deposits making spring melting events short lived and mainly in response to individual snowstorms. Spring has the highest monthly precipitation with May being the wettest month for both Rawlins and Seminoe Dam. Convective thunder storms in the spring, summer and late summer account for the most intense storms and can be very localized resulting in short duration precipitation of 0.5 to over 2 inches in a day (WRCC, 2005). During storm events, flooding in ephemeral drainages can result in substantial local erosion and sediment deposition.

3.4.2 North Platte River

The EIS analysis area is located in the North Platte River drainage basin. See **Figure 30, Platte River Drainage Basin**. The North Platte River flows from its source in northern Colorado into south-central Wyoming, passes through a series of water storage and power generation projects, then flows eastward into Nebraska, where it merges with the South Platte River. The Platte River ultimately flows into the Missouri River.

Flows in the North Platte River upstream of Seminoe Reservoir are unregulated; however, downstream of the Kortes Reservoir, North Platte River flows are influenced by reservoir discharges. North Platte River reservoirs provide and store water for irrigation, are utilized for hydroelectric power production, municipal and industrial water supplies, and provide for flood control, recreation, and fish and wildlife habitat. Additional information and details about the Seminoe, Kortes and Pathfinder dams and reservoirs along the North Platte River are set forth in **Appendix E, Regional Activity**.

3.4.2.1 General Overview of the North Platte Drainage System

The EIS analysis area is situated within the Hanna Basin, which is drained by the North Platte River. See **Figure 31, Hanna Basin**. The total surface relief of the Hanna Basin is approximately 1,600 feet with elevations reaching a maximum of about 7,900 at Pass Creek Ridge and a minimum of about 6,300 feet at Seminoe Dam. The Medicine Bow River is a major tributary to the North Platte River within the Hanna Basin and has its confluence with the North Platte in the central part of the Seminoe Reservoir. Other prominent drainages that are tributary to the North Platte River in the Hanna Basin include the Walcott Ditch, St. Mary's Ditch, Big Ditch, Middle Ditch and North Ditch.

Seminoe Reservoir bisects the eastern portion of the EIS analysis area. Downstream of Seminoe Reservoir, the North Platte River flows into and out of Kortes Reservoir, through a stretch known as "Miracle Mile" and finally into Pathfinder Reservoir. See **Figure 30, Platte River Drainage Basin,** and **Appendix E, Regional Activity**.

The Wyoming DEQ categorizes Wyoming streams and rivers into different water quality "classes." Water classes are a hierarchical categorization of waters according to existing and designated uses. The regulations defining water classes and other water quality standards are promulgated pursuant to Wyoming Statute 35-11-101 through 1507 specifically 302 (a) (i) and 302 (b) (i) and (ii). Examples of surface waters and their classes are presented in **Table 3.4-1, Summary of Surface Water Classes and Uses**.

Table 3.4-1, Summary of Surface Water Classes and Uses

Water Classification	Streams	Surface Water Type	Protected Uses	Comments
Class 1	North Platte River from the headwaters of Pathfinder Reservoir upstream to Kortes Dam ("Miracle Mile" segment) and some reaches of the North Platte River up stream of the Project area	Perennial, intermittent, or ephemeral	Water quality, physical, and biological integrity	Outstanding waters, non degradation by point sources, surface waters in parks or wilderness areas
Class 2		Perennial, intermittent, or ephemeral	Fisheries and drinking water	Waters other than those designated Class 1 that support fish or drinking water

Water Classification	Streams	Surface Water Type	Protected Uses	Comments
Class 2AB	N Platte R (Remainder) Seminoe Reservoir Medicine Bow River	Perennial, intermittent, or ephemeral	Game fisheries, drinking water, non-game fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Waters known to support game fisheries and used as a drinking water source
Class 2A	None in Project Area	Perennial, intermittent, or ephemeral	Drinking water, non-game fish, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Waters not known to support game fish but used as a drinking water source
Class 2B	None in Project Area	Perennial, intermittent, or ephemeral	Game fisheries, non-game fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic values	Water known to support game fish but not used for drinking water
Class 2C	None in Project Area	Perennial, intermittent, or ephemeral	Non-game fish, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Water known to support non-game fish
Class 3		Intermittent, ephemeral, or isolated including wetlands	Aquatic life other than fish, recreation, wildlife industry, agriculture, and scenic value	Not known to support fish or used as a drinking water source
Class 3A	None in Project Area	Wetlands or isolated	Aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Not known to support fish or used as a drinking water source
Class 3B	All proposed discharge drainages and playas in the EIS Analysis Area	Intermittent, ephemeral, or isolated waters including wetlands	Aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Generally characterized as frequent linear wetland occurrences or impoundments within or adjacent to the stream channel
Class 3C	None in Project Area	Perennial streams with wetland characteristics	Aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value	Includes geothermal waters and waters with high concentrations of salts, metals, or extreme pH
Class 4		Perennial, intermittent, ephemeral, artificial	Recreation, wildlife, industry, agriculture, and scenic value	Waters now known to support aquatic life
Class 4A	Big Ditch, Middle Ditch, North Ditch	Artificial canals or ditches	Recreation, wildlife, industry, agriculture, and scenic value	Waters not known to support aquatic life
Class 4B	None in Project Area	Intermittent or ephemeral stream channels	Recreation, wildlife, industry, agriculture, and scenic value	Infrequent wetland occurrences or impoundments within or adjacent to stream channels not known to support aquatic life
Class 4C	None in Project Area	Intermittent, ephemeral, or artificial stream channels	Recreation, wildlife, industry, agriculture, and scenic values	Effluent dominated streams
Adapted from WDEQ, 2001				

3.4.2.2 North Platte River Upstream of Seminoe Reservoir

The Wyoming DEQ classifies the North Platte River within the EIS study area and above Seminoe Reservoir as Class 2AB surface water.

Average, minimum and maximum monthly flows for the North Platte River above Seminoe Reservoir are shown in **Figure 32, Summary of Flow Data**. The monthly averages shown in this figure include data from the full period of record, December 1960 – August 2002 (HydroGeo 2003a). The flow-monitoring location is shown on **Figure 33, Hydrologic Monitoring Sites Location Map**. Flows are generally highest in the spring. Maximum daily flows as high as 15,000 cfs are possible during May and June; however, during drought cycles, maximum daily flows in spring months may be as low as 1,000 cfs. Flows are much lower in the fall months, and flows less than 50 cfs have been observed.

Water in the North Platte River above Seminoe Reservoir is calcium bicarbonate type with slightly alkaline pH. The USGS and the Proponent have compiled baseline and background water quality measurements for the North Platte River (USGS 2004, BLM 2001, HydroGeo et al. 2001, HydroGeo 2001 and 2003a). A summary of water quality data is presented in **Figure 34, Summary of Surface Water Salinity Data.** These data were collected at the monitoring locations shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

The water quality in the North Platte above Seminoe Reservoir varies with flow volume and, thus, exhibits seasonal changes. TDS, specific conductivity, and concentrations of calcium, magnesium, sodium and chloride are lowest during the high-flow months May and June. The variability in water quality in the North Platte Rive above Seminoe Reservoir is relatively high **(Figure 34, Summary of Surface Water Salinity Data)**.

3.4.2.3 Seminoe Reservoir

The construction and operation of Seminoe Reservoir has substantially impacted the surface water flows of the North Platte River downstream of Seminoe Reservoir. Seminoe Reservoir inundated a large portion of the North Platte River and its tributaries in the Hanna Basin. The drainage area for Seminoe Reservoir encompasses 7,210 square miles, and its storage capacity is approximately 1,017,000 acre-feet of water. The average volume of Seminoe Reservoir between 1939 and 2003 was 557,000 acre-feet, with a minimum volume of 56,000 acre-feet in

April 1961. In 2000, annual evaporation from Seminoe Reservoir was estimated at 62,800 acre-feet.

The Wyoming DEQ classifies Seminoe Reservoir as Class 2AB surface water. Average monthly discharges from Seminoe Reservoir are shown in **Figure 32, Summary of Flow Data**. The monthly averages shown in this table include data from the full period of record (HydroGeo 2003a). The U.S. Bureau of Reclamation manages discharges from Seminoe Reservoir to meet irrigation demands downstream, to maintain in-stream minimum flows below Kortes Reservoir, and to capture the large spring flows due to snowmelt in the North Platte River. The flow-monitoring location for Seminoe Reservoir is shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

Water in Seminoe Reservoir is calcium bicarbonate type with slightly alkaline pH. The USGS, the Wyoming Game and Fish Department, the EPA, and the Proponent have compiled water quality information for the Seminoe Reservoir (USGS 2004, BLM 2001, HydroGeo et al. 2001, HydroGeo 2001 and 2003a, WRDS 2005). The USGS conducted two days of water quality measurements in Seminoe Reservoir in August 1978 (USGS 2004). The Wyoming Game and Fish Department conducted annual measurements between 1969 and 1972 (WRDS 2005). The EPA conducted measurements in May, August and October 1975 for specific conductivity (WRDS 2005). The Proponent's water quality measurements in Seminoe Reservoir have been ongoing since the spring of 2000 (HydroGeo 2003a).

There are a number of arms in Seminoe Reservoir formed by major tributary drainages that are typically inundated. Since these arms are backwater systems with little input from their tributary drainages, there is less mixing potential as compared to arms with substantial tributary input such as the Medicine Bow arm of the reservoir. Of particular note is the Coal Creek arm, which is a popular local fishery, especially in the winter.

A summary of the water quality data for Seminoe Reservoir is presented in **Figure 34, Summary of Surface Water Salinity Data**. These data were collected at the monitoring locations shown on **Figure 33, Hydrologic Monitoring Sites Location Map**. No seasonal water trends can be established from historic data for the Seminoe Reservoir, because existing water quality data are highly variable between the different monitoring locations and times.

3.4.2.4 Kortes Reservoir

Kortes Reservoir is located about 2 miles below the Seminoe Reservoir dam. Details about Kortes Reservoir and dam are set forth in **Appendix E, Regional Activity**. Kortes Reservoir is a small 4,700 acre-foot reservoir, whose main purpose is to provide water for power generation. Water released from Seminoe Dam to Pathfinder Reservoir passes through the Kortes turbines to generate power. Maximum power generation benefits are obtained when Kortes Reservoir remains full and the power releases are coordinated with those from the Seminoe power plant. Thus, discharges from Kortes Reservoir are generally kept the same as Seminoe Reservoir. Wyoming DEQ classifies Kortes Reservoir as Class 2AB surface water.

Average monthly discharge flows from Kortes Reservoir are the same as from Seminoe Reservoir dam as shown in **Figure 32, Summary of Flow Data**. The monthly averages shown in this table include data for the full period of record (HydroGeo 2003b). The flow-monitoring location is shown on **Figure 33, Hydrologic Monitoring Sites Location Map**. No water quality data are available for Kortes Reservoir.

3.4.2.5 Miracle Mile

The Wyoming DEQ classifies the North Platte River below Kortes Reservoir (the stretch known as the Miracle Mile) as a blue ribbon fishery and as Class 1 surface water. Class 1 waters are surface waters in which no further water quality degradation by point source discharges are allowed.

Flows in the Miracle Mile are determined by discharge from Kortes Reservoir. Senate Bill 2553 passed by the 90th Congress (1967-1968) mandated operational modification of Kortes Dam to provide a minimum stream flow of 500 cubic feet per second (cfs) in the North Platte River between Kortes Reservoir and the headwaters of Pathfinder Reservoir. The minimum flow permits the maintenance of a fishery in the Miracle Mile stretch of the North Platte River. **See Appendix E, Regional Activity**. Several small tributary streams also contribute water to this stretch of the North Platte.

The USGS and the Proponent compiled baseline water quality information for the Miracle Mile (USGS 2004, HydroGeo 2004). A summary of the collected data is presented in **Figure 34, Summary of Surface Water Salinity Data**. These data were collected at monitoring locations shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

The USGS analyzed Miracle Mile from 1969 through 1989 for temperature, specific conductivity, dissolved oxygen, and pH. Between 1987 and 1989, the USGS expanded their water quality monitoring to include major ions, calcium, magnesium, sodium, chloride, and TDS. The Proponent sampled water from the Miracle Mile in May 2003. Based on specific conductivity data, there are no definite seasonal trends in the Miracle Mile water quality. Water storage in the Seminoe and Kortes reservoirs tends to abate and nullify seasonal water quality variability. Therefore, waters released into the Miracle Mile reach of the North Platte River do not exhibit the more definitive seasonal water quality variability observed in the North Platte River upstream of the Seminoe Reservoir.

3.4.2.6 Pathfinder Reservoir

The Pathfinder Reservoir is located downstream of the Miracle Mile. The Sweetwater River is a tributary of the North Platte River and empties into the Pathfinder Reservoir. Pathfinder Reservoir collects water from a 14,600 square mile drainage area and has an estimated storage capacity of 1,016,000 acre-feet of water. The U.S. Bureau of Reclamation manages discharges from Pathfinder Reservoir mainly to meet downstream irrigation demands. During the non-irritation season, water is released to satisfy other water rights, enhance fish and wildlife habitat, and provide water to operate downstream power plants.

Wyoming DEQ classifies the Pathfinder Reservoir as Class 2AB surface water. Average discharges from Pathfinder Reservoir are shown in **Figure 32, Summary of Flow Data**. The monthly averages shown in this table include data from full period of record (HydroGeo 2003a). The flow-monitoring location is shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

3.4.2.7 North Platte River Downstream of Pathfinder Reservoir

Flows in the North Platte River between the Pathfinder Dam and the Alcova Reservoir (a stretch of approximately 5 miles) are largely determined by discharge from the Pathfinder Reservoir. The WDEQ has classified this stretch of the North Platte River as Class 2AB surface water.

Average, minimum and maximum monthly flows for the North Platte River below Pathfinder Reservoir are shown in **Figure 32, Summary of Flow Data**. The monthly averages shown in this figure include data from full period of record (HydroGeo 2003a). Maximum flows generally occur in the spring, when natural flows are high; however, high average flows can be and often are maintained for irrigation purposes throughout the growing season. This is the first place that irrigation occurs form the North Platte River below the Seminoe Reservoir. The flow-monitoring location for this stretch of the North Platte River is shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

The USGS analyzed water quality for the North Platte River at Alcova Reservoir from 1965 to 1983 (USGS 2004). A summary of water quality data is presented in **Figure 34, Summary of Surface Water Salinity Data**. No seasonal water quality trends are apparent from the historic data.

3.4.3 Medicine Bow River

The Medicine Bow River is a perennial stream and enters the central portion of Seminoe Reservoir from the east. See **Figure 30, Platte River Drainage Basin**. Wyoming DEQ classifies the Medicine Bow River as Class 2AB surface water. The Medicine Bow River inflows into Seminoe Reservoir are about 10% to 25% of total North Platte River inflows. The Medicine Bow River is outside the EIS analysis area.

3.4.4 Intermittent Drainages Within the EIS Analysis Area

An “intermittent drainage” means a steam or a reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge. O’Brien Creek is the sole intermittent drainage in the EIS analysis area. A general summary of the EIS analysis area intermittent drainage characteristics is presented in **Table 3.4-2, Intermittent Drainage Watershed Characteristics**.

Table 3.4-2, Intermittent Drainage Watershed Characteristics

Watershed / Drainage	Characteristic	Sub-watershed	Area (acres)	Length (ft)	Headwaters Elevation (ft)	Discharge Elevation (ft)	Average Gradient (%)	Discharge End Point
O’Brien Creek	Intermittent	--	19,302	58,000	7,400	6,360	1.8	Seminoe Reservoir

3.4.4.1 O’Brien Creek

The Wyoming DEQ classifies O’Brien Creek as Class 3B water, and this intermittent drainage does not support fish populations; however other aquatic life, such as macro-invertebrates, can be present.

The USGS monitored O'Brien Creek in 1967 (WRDS 2005); the BLM in 1979 (WRDS 2005); and the Proponent in 2001 and 2002 (HydroGeo 2003a). Measurement locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**. O'Brien Creek was dry during the 2002 fall survey (HydroGeo 2003a), but a flow of 30 gpm was measured in the fall of 2001. The water in O'Brien Creek can be classified as sodium sulfate\bicarbonate with a variable TDS concentration (961 to 2,720 mg/l), and with moderate alkalinity pH (7.5 -8.3). O'Brien Creek flows into the Coal Creek arm of Seminoe Reservoir.

3.4.5 Ephemeral Drainages Within the EIS Analysis Area

An "ephemeral drainage" means a drainage that flows only in direct response to precipitation in the immediate watershed or in response to melting of a cover of snow or ice, and a drainage, which has a channel bottom that is nearly always above the local water table. The EIS analysis area includes ten main ephemeral drainages that are being considered as potential discharge drainages for Seminoe Road Project produced water. The potential discharge drainages are Pool Table Draw (East, West, and Main forks), Ayers Draw, Dirtyman Draw, Dry Ditch, Unnamed Drainage 1, Longhart Draw, Unnamed Drainage 2, St. Mary's Ditch, Mountain Lion Draw, and Unnamed Drainage 3. See **Figure 33, Hydrologic Monitoring Sites Location Map**.

The Wyoming DEQ classifies ephemeral drainages and closed basins in the EIS analysis area as Class 3 waters (WDEQ 2001). Class 3 waters are defined as waters that are intermittent, ephemeral, or isolated and, because of natural habitat conditions, do not have the potential to support fish populations (WDEQ 2001). See **Table 3.4-1, Summary of Surface Water Classes and Uses**. The Wyoming DEQ classifies St. Mary's Ditch and Pool Table Draw as Class 3B waters. These ephemeral drainages do not support fish populations, but other aquatic life, such as macro-invertebrates, can be present during certain times of the year when water is flowing in the lower reaches of these drainages.

Ephemeral drainage channels dry out between storm events, which reduce infiltration and increases surface runoff along the bottom of the channels. Sediment moves in pulses with these storm events resulting in wide channel forms with fine textured bed deposited material. Due to the dry soils in these channel bottoms, water predominantly moves as sheet flow or in macropores created by preferential erosion and/or animal burrows. Abrupt changes in surface water flows due to surface roughness from vegetation (sagebrush, greasewood, and grasses), the channel gradient, and/or preferential channels have formed in features like animal trails cause surface water to concentrate and velocities to increase. This process can increase the erosive energy of the water during storm events. See **Figure 35, Hydrologic Process and Geomorphic Cycle (Part I)**. Erosion potential was evaluated during baseline data collection efforts. (See **Table 3.4-3, Erosion Potential of Proposed Discharge Drainages**).

Flood events are usually short lived since a typical summer thunderstorm lasts less than several hours. The majority of the water in these systems moves quickly through the drainage in flash floods and storm pulses that are only attenuated based on the travel time of the water.

Table 3.4-3, Erosion Potential of Proposed Discharge Drainages

Drainage	Drainage Type	Erosion Potential [1]
Pool Table Draw	Ephemeral	Minor
Ayers Draw	Ephemeral	Moderate
Dry Ditch	Ephemeral	Moderate
Dirtyman Draw	Ephemeral	High
Longhart Draw	Ephemeral	Moderate
Unnamed Drainage #2	Ephemeral	Moderate
O'Brien Creek	Intermittent	Minor
Unnamed Drainage #1	Ephemeral	Moderate
Mountain Lion Draw	Ephemeral	High
St. Mary's Ditch	Ephemeral	Moderate to High
Unnamed Drainage #3	Ephemeral	Moderate to High

Note:
1. General erosion potential based on observations made during the baseline drainage surveys (HydroGeo, 2001, 2003a, and 2003b). Location of drainages shown on **Figure 37, Watershed Map.**

Ephemeral channels are susceptible to vertical erosion in the drainage channel bed, called "headcuts." A headcut is an abrupt vertical drop in a channel that is a result of the breakdown of soil structure or an increase in flow concentration or velocity. Erosion can continue in the channel below a headcut causing a gulley to form, and can cause the channel to be incised deeper than before, a process called downcutting. The abrupt change in elevation over the headcut increases the erosive energy of the water and can allow the headcut to migrate upstream (See **Figures 35 and 36, Hydrologic Process and Geomorphic Cycle (Parts I and II**). Downcutting of the drainage channels causes gulley formation and sediment deltas at the mouth of the drainages or where the gradient is less (i.e. when water velocity drops). In natural ephemeral drainages, most of the erosion activity occurs during storm events or during spring runoff caused by snowmelt.

The initial causes of headcut and gulley formation are typically the result of changes in water discharge timing and amount resulting from improved channel conveyance capacity upstream, the removal of water storage areas such as wetlands or stockponds upstream, less surface roughness in the channel, loss of soil structure, and/or changes in the water table. Gulley formation is accelerated by the breakdown of soil structures that might normally protect channel sides and bottoms; this can result from animal hoof action on soils, animal burrows, changes in the water table or grazing by livestock or wildlife.

During periods of maximum reservoir pool levels, the drainage channels flowing into Seminoe Reservoir become inundated further upstream than during low water levels. Sediments transported by drainage flows tend to settle where the drainage enters the reservoir pool. As the reservoir pool level falls (due to irrigation demands or climatic conditions such as drought), the newly deposited sediments again become exposed. As this cycle of inundation and drying repeats itself, erosion activity is exacerbated. Previously inundated channels and newly exposed areas are extremely susceptible to erosion, and runoff from the drainages can wash out the exposed sediments, leading to bank erosion of the drainage channel and headcuts.

Soil samples were collected at each of the ephemeral drainage being considered for surface discharge to measure baseline conditions and to assess the potential geochemical interactions that could occur with project produced water (HydroGeo, 2003a). Based on data collected from Pool Table Draw, there appear to be seasonal changes in these geochemical interactions, which change surface water quality. See **Appendix I, Monitoring Results for Seminoe Road Pilot Project**.

A general summary of the EIS analysis area potential discharge drainage characteristics is presented in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics.**

3.4.5.1 Pool Table Draw

Pool Table Draw has two unnamed tributary forks, referred to as the East and West forks of Pool Table Draw. The East and West forks merge to form the Main Fork of Pool Table Draw. See also **Figure 37, Watershed Map,** and **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

The drainage channel of the Main Fork of Pool Table Draw is characterized by a low gradient and, in places, its natural incision ranges from 3 to 20 feet deep. The channel bottom averages about 1 to 3 feet across.

Table 3.4-4, Ephemeral Drainage Watershed Characteristics

Watershed / Drainage	Characteristic	Sub-watershed	Area (acres)	Length (ft)	Headwaters Elevation (ft)	Discharge Elevation (ft)	Average Gradient (%)	Discharge End Point
Pool Table Draw	Ephemeral	West Fork	6,572	39,800	7,300	6,420	2.2	Confluence of E. and W. Forks
Pool Table Draw	Ephemeral	East Fork	3,634	27,800	6,670	6,420	0.9	Confluence of E. and W. Forks
Pool Table Draw from E&W Forks Confluence to Seminoe Reservoir	Ephemeral	Main Fork	980	14,400	6,400	6,360	0.4	Seminoe Reservoir
Ayers Draw	Ephemeral	--	7,229	24,787	6,660	6,360	1.3	Seminoe Reservoir
Dirtyman Draw	Ephemeral	Main Fork	18,880	48,000	7,200	6,373	1.7	North Platte River
Dry Ditch	Ephemeral	--	9,984	35,100	6,760	6,360	1.0	Seminoe Reservoir
Unnamed Drainage #1	Ephemeral	--	2,285	8,000	6,580	6,360	2.8	Seminoe Reservoir
Longhart Draw	Ephemeral	--	3,744	16,000	6,720	6,360	2.3	North Platte River
Unnamed Drainage #2	Ephemeral	--	2,330	20,000	6,680	6,360	1.5	Seminoe Reservoir
St. Mary's Ditch	Ephemeral	From Project Boundary	3,690	17,500	6,580	6,360	1.3	Seminoe Reservoir
Mt. Lion Draw	Ephemeral	--	1,113	11,000	6,550	6,360	1.7	Seminoe Reservoir
Unnamed Drainage #3	Ephemeral	--	2,797	14,000	7,000	6,360	4.4	North Platte River

Pool Table Draw Reservoir is a constructed stock pond located on the West Fork of Pool Table Draw, and this stock pond reservoir is fed by Pilot Project produced water. Photos of Pool Table Draw and Pool Table Draw Reservoir prior to and during the Pilot Project are shown on **Figure 38, Pool Table Draw Photographs.**

When Seminoe Reservoir is full, Pool Table Draw flows into the Coal Creek arm of Seminoe Reservoir. Under low water conditions in Seminoe Reservoir, Pool Table Draw flows into O'Brien Creek, which then flows into Seminoe Reservoir via the Coal Creek arm. See **Figure 37, Watershed Map**. In 2002, given extreme drought conditions, O'Brien Creek was dry, and the Pilot Project produced water flowed down Pool Table Draw and into O'Brien Creek before entering into Seminoe Reservoir (HydroGeo 2003a).

Pilot Project produced water has been continuously discharged into the West Fork of Pool Table Draw from discharge point DS-2 since December 2001. In May 2002, discharge commenced from

DS-3 into the East Fork of Pool Table Draw. Pilot Project produced water from discharge point DS-1 was discharged into the West Fork of Pool Table Draw beginning in November 2002. These discharges were permitted by Wyoming DEQ Water Quality Division under Permit 37-WY0041807. See **Figure 37, Watershed Map**. The average flows from the Pilot Project are about 1 cfs as shown on **Figure 39, Pilot Project Discharge Rates**. Continuous flows from the Pilot Project have initiated downcutting in the Pool Table Draw, increasing the potential for bank erosion during storm events. Given this increased potential for erosion, several storm and runoff events have accelerated gulley formation. This erosion is mostly near the confluence with O'Brien Creek and the high pool elevation of Seminoe Reservoir. Several small headcuts were also noted downstream of the high water mark of Seminoe Reservoir in lake bottom sediments that are typically submerged.

A small headcut (less than 1 foot) in the West Fork of Pool Table Draw has developed as a result of the Pilot Project produced water, this headcut area is present near the Conoco pipeline access road, and a larger headcut, about 10 feet deep, occurs near the mouth of the drainage at Seminoe Reservoir. See **Figure 38, Pool Table Draw Photographs.** This headcut was noted in the baseline survey (HydroGeo et al, 2001) but has eroded and increased in size due, in part, to the Pilot Project produced water flow. The Proponent placed riprap at this headcut site in November 2002, but these efforts were ineffective in stopping the upstream migration of the headcut.

3.4.5.2 Ayers Draw

Pilot Project-produced water is not currently discharged to this drainage. See also **Figure 37, Watershed Map,** and **Table 3.4-4, Ephemeral Drainage Water Characteristics**.

Ayers Draw has several areas of headcutting and ponding at the head of the drainage near a stock pond and along the central portion of the drainage (HydroGeo 2003a). The channel in Ayers Draw varies from deeply incised zones to broad areas of dispersed flow. The maximum size of the incised channel is about 30 feet deep by 5 feet wide. The channel sediments are uniform, composed of porous sandy loam soil. An abandoned and a new stock pond are located in the upper reaches of Ayers Draw, but both ponds are unnamed. The new pond was full of water at the time of the 2001 survey and had a surface area of about 0.5 acres. The new pond was noted as being partially full during the 2002 riparian vegetation survey (HydroGeo 2003a). The abandoned pond was dry during both 2001 and 2002 surveys (HydroGeo 2003a).

3.4.5.3 Dirtyman Draw

The Dirtyman Draw watershed is shown on **Figure 37, Watershed Map**. Particulars about Dirtyman Draw are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

Dirtyman Draw sediments are primarily a sandy loam texture. Headcutting and ponding were noted at isolated areas throughout the drainage, particularly in the lower reaches (HydroGeo 2003a). The upper portion of the drainage is a low gradient overland flow area with little headcutting and no ponding. The middle portion of the drainage has minor headcutting and the flow channel varies from moderately incised to overland flow. The drainage is deeply incised in the lower portions of the drainage with sections over 25 feet deep and 10 feet wide. Several areas of ponding occur in the lower reach of the drainage. These ponded areas were flooded in the spring of 2001 due to snowmelt, but were dry at the time of the 2002 survey.

Two small stock ponds are located in the upper reaches of Dirtyman Draw, one stock pond area is located in the middle portion of the drainage, and another occurs in the lower reaches. The stock ponds in the upper and middle reaches of the drainage were dry at the time of the 2001 and 2002 surveys. The stock pond area in the lower reaches of Dirtyman Draw was dry at the time of both the 2001 and 2002 surveys, but water was present in 2003 (HydroGeo, 2003a). An off channel storage basin is located adjacent to the lower stock pond. Water was present in the storage basin during the 2001 survey, but the basin was dry in 2002 and in 2003 (HydroGeo, 2003a).

3.4.5.4 Dry Ditch

Dry Ditch drains the east side of the EIS analysis area. See **Figure 37, Watershed Map**. Particulars about Dry Ditch are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

Dry Ditch sediments range from a sandy loam to a clay loam texture. Headcutting and ponding were noted at dispersed areas throughout the drainage, particularly in the upper and middle reaches (HydroGeo 2003a). The channel is deeply incised in the upper and middle portion of the drainage reaching over 20 feet deep and 10 feet wide. Isolated areas of ponding associated with headcuts were found throughout the drainage. All ponded areas were dry during the 2002 field survey (HydroGeo 2003a).

Three stock ponds occur in Dry Ditch, and these are identified as Pond #1, Pond #2, and Pond #3 located in the upper, middle, and lower portions of the drainage, respectively. All three ponds were dry during the surveys (HydroGeo 2003a), but they showed signs of having been flooded. These signs included hydric soils, well-defined shoreline marks, mud cracks, and hydrophytic vegetation. Shallow wells are located below the upper and middle stock ponds. Pond #1 is approximately one acre in size, Pond #2 is approximately 4 acres in size, and Pond #3 has an area of 2.5 acres. Hydric soils and hydrophytic vegetation were present downstream of these ponds.

Two sediment samples were collected from Dry Ditch in September 2002. One sample was collected at Pond #2 in the middle part of the drainage, and the second sample was collected toward the bottom of the drainage near the road crossing. The sediment sample from the pond was a dry sandy clay loam material.

3.4.5.5 Unnamed Drainage #1

The Unnamed Drainage #1 is shown on **Figure 37, Watershed Map**, and details about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

3.4.5.6 Longhart Draw

Longhart Draw is shown on **Figure 37, Watershed Map**, and details about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

3.4.5.7 Unnamed Drainage #2

Unnamed Drainage #2 is shown on **Figure 37, Watershed Map**, and details about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

3.4.5.8 St. Mary's Ditch

St. Mary's Ditch drains the east side of the EIS analysis area south of the North Platte River. This drainage is shown on **Figure 37, Watershed Map**, and details about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

St. Mary's Ditch several large headcut areas and associated ponding areas were dispersed throughout the middle portion of the drainage (HydroGeo 2003a). The channel is deeply incised more than 10 feet deep and 15 feet wide in the middle portion of the drainage. The channel sediments range from a sandy loam to a clay loam texture.

One stock pond, referred to as St. Mary's Spring, is located off channel but adjacent to St. Mary's Ditch. The spring was flowing and the pond was full at the time of the 2002 and 2003 surveys (HydroGeo, 2003a). The stock pond and spring area together encompass an area of approximately 0.5 acre in size.

3.4.5.9 Mountain Lion Draw

Mountain Lion Draw drains the north central side of the EIS analysis area south of the North Platte River. See **Figure 37, Watershed Map**. Particulars about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

Mountain Lion Draw has several small to medium headcut areas and associated minor ponding areas were dispersed throughout the upper portion of the drainage (HydroGeo 2003a). The channel is deeply incised more than 10 feet deep and 15 feet wide in the middle and lower portion of the drainage. The channel sediment ranges from a sandy loam to a clay loam texture in the upper reaches, within a very sandy texture in the middle and lower reaches.

3.4.5.10 Unnamed Drainage #3

Unnamed Drainage #3 is shown on **Figure 37, Watershed Map**, and details about this drainage are set forth in **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**.

3.4.6 Playas Within the EIS Analysis Area

Three closed playa basins (Ferris Lake, Alkali Flats, and St. Mary's Anticline Basin) are located in the EIS analysis area south of Seminoe Reservoir. **See Figure 37, Watershed Map.**

Particulars about the three playas are presented in **Table 3.4-5, Playa Characteristics Summary**.

Table 3.4-5, Playa Characteristics Summary

Watershed / Drainage	Characteristic	Contributing Area (acres)	Natural Extent (acres)
Ferris Lake	Ephemeral (Closed Basin)	4,491	20-25
Alkali Flats	Ephemeral (Closed Basin)	12,094	50-60
St. Mary's Anticline Basin	Ephemeral (Closed Basin)	11,002	10-50

3.4.6.1 Ferris Lake

The Ferris Lake playa is a broad, flat, sparsely vegetated area about 20 to 25 acres in size. Drainage into the Ferris Lake occurs primarily by overland flow with poorly defined channels. However, occasional channels do occur intermittently in higher gradient portions of the area. No headcuts or other erosional features have been observed in these channels (HydroGeo, 2003a).

3.4.6.2 Alkali Flats

Taylor Draw drains into Alkali Flats and has poorly defined channels. However, some channeling occurs intermittently in higher gradient portions of the watershed. The Alkali Flats playa covers a broad area of approximately 1,000 acres, with a barren lake bottom zone of approximately 50 to 60 acres in size.

A soil sample was collected near the center of Alkali Flats. The sediment was a dry clay loam material with a high concentration of salts and trace metals. The soil sample results were typical of evaporative basins (HydroGeo 2003a) and were as follows: aluminum (47,800 mg/kg), iron (29,500 mg/kg), manganese (373.9 mg/kg), zinc (105.9 mg/kg), arsenic (7.7 mg/kg), chromium (42.0 mg/kg), copper (24.2 mg/kg), nickel (24.5 mg/kg), mercury (7.5 mg/kg), and lead (24.0 mg/kg). The soil pH was neutral at 7.5 units. The EC, SAR and alkalinity were 1.5 mmhos/cm, 15.89 (unitless), and 250.1 mg/kg, respectively.

3.4.6.3 St Mary's Anticline Basin

The St. Mary's Anticline playa is a broad, flat, sparsely vegetated area about 50 acres in size, with a barren lake bottom of approximately 10 acres. Two unnamed drainages enter this basin.

3.5 Ground Water

3.5.1 Hanna Basin

The Seminoe Road Project is located within the Hanna Basin, which is a deep closed geologic basin containing sedimentary rock that extends to a depth over 30,000 feet. The Hanna Basin covers an area of approximately 1,750 square miles (1.1 million acres). The aerial extent of the Hanna Basin and its relation to the EIS analysis area and Pilot Project are shown on **Figure 31, Hanna Basin**. Additional geologic discussion is presented in Section 3.3, Geology.

The ground water-bearing zones in the Hanna Basin include both shallow and deep bedrock ground water systems. Minor ground water resources are also present in the surficial unconsolidated and alluvial sediments within the region's drainages.

Recharge to the ground water system occurs by infiltration of precipitation into the shallow sediments or bedrock exposed at the surface, typically on the edges of the Hanna Basin. Ground water recharge from precipitation is estimated to range between 5 to 10% of the average annual precipitation (Lowham et al. 1985). A small amount of ground water recharge also comes from infiltration along losing reaches of streams, ponds, and lakes. Recharge to the deep ground water system is at a much lower rate.

Shallow ground water zones generally discharge to the surface as springs and seeps and underflow into local streams and rivers. It is possible that some ground water also exits the Basin along marginal faults and fracture systems. Deep ground water is believed to be very old, relatively stagnant, and effectively not connected to surface water. Deep basin ground water generally flows from the edges toward the center of the Hanna Basin. See **Figure 31, Hanna Basin**.

3.5.2 Hanna Basin Bedrock Ground Water Systems in the EIS Analysis Area

This section focuses on the ground water systems that could be directly affected by operations of the Seminoe Road Project. The discussion starts with the deepest (oldest) bedrock formations in the Mesaverde Group and concludes with the shallowest (youngest) bedrock formations of the Fox Hills Sandstone\Medicine Bow Formation. See **Figure 29, General Stratigraphic Column and Geologic Cross Section A-A'**.

3.5.2.1 Mesaverde Group (Deep ground water bearing formations)

The Mesaverde Group is approximately 4,000 feet thick in the EIS analysis area and is composed of sandstone, shale, and coalbeds of the Haystack Mountain, Allen Ridge, Pine Ridge, and Almond formations. The Seminoe Road Project would develop and produce natural gas from coalbeds in the Allen Ridge and Almond formations.

Ground water is known to occur in the sandstone and coalbeds in the Mesaverde strata. The water-bearing strata of the Mesaverde formations are unconfined near the fringes of the Hanna

Basin and become confined toward the center of the Hanna Basin as the Mesaverde formations dip beneath the overlying Lewis Shale. See **Figure 29, General Stratigraphic Column and Geologic Cross Section A-A'**. Mesaverde water-bearing zones are not considered major aquifers in the EIS analysis area; however, a few low yield stock wells are completed in the Mesaverde strata on the flanks of the Haystack Mountains to the west and southwest of the EIS analysis area. No known domestic water wells are installed in this area, but several springs do issue from the Mesaverde strata in this area. See **Figure 33, Hydrologic Monitoring Sites Location Map**.

The Proponent has installed 16 coalbed natural gas test wells as part of their Pilot Project. These wells are installed in the Almond and Allen Ridge formations of the Mesaverde Group strata at a depth of about 5,000 feet below the surface. The wells produce about 35 gpm and have generally good water quality, suitable for domestic or stock watering purposes. The water from these wells do not meet secondary domestic drinking water criteria for TDS (limit of 500 mg/l) or agricultural water quality criteria because of high SAR (agricultural limit of 8.0). Secondary domestic water quality limits are based on aesthetic criteria and not human health.

The Pilot Project produced water is sodium bicarbonate type with slightly alkaline pH (8.1 to 8.6) and moderate concentrations of TDS (600 to 1,200 mg/l). The produced water has low concentrations of trace constituents and moderately SAR ranging from 20 to 40. Passive aeration and filtration has been used to treat Pilot Project produced water to meet NPDES permit limitations prior to surface discharge to Pool Table Draw. Produced water quality has improved since the Pilot Project began pumping water in 2004. **See Figure 40, Pilot Project Water Quality**.

A water sample from Pilot Project well 4-35 was age-dated using carbon 14, tritium, and oxygen 18/16 stable isotope methods. The results of the analyses indicated that the water is over 5,000 years old. The antiquity of the ground water demonstrates that the deep Mesaverde ground water system is stagnant with little or no connectivity with shallow ground water-bearing zones or area surface water resources (BLM 2001).

3.5.2.2 Lewis Shale

The Lewis Shale is approximately 2,500 feet thick in the EIS analysis area and is composed primarily of shale with some interbedded sandstone layers (USGS 1978). The Lewis Shale as a whole has a very low permeability and acts as a confining unit that hydraulically separates the underlying Mesaverde Group rocks from younger Fox Hills Sandstone and Medicine Bow Formation strata (HydroGeo 2003b).

The Dad Sandstone is a member of the Lewis Shale and is thought to be a laterally extensive water-bearing unit; however; little information is available regarding the hydraulic properties or water quality of the Dad Sandstone because it is not considered a viable aquifer or a natural gas bearing zone.

The Dad Sandstone is being considered as a injection horizon for Project produced water under Alternative D (See Section 2.6, Underground Injection of Produced Water, Alternative D). There are no known water wells installed in the Dad Sandstone within the EIS analysis area.

3.5.2.3 Fox Hills Sandstone\Medicine Bow Formation (Shallow Ground Water Bearing Formations)

The Fox Hills Sandstone is about 970 feet thick in the EIS analysis area. It is composed of interbedded sandstone, shale and coal units. The Fox Hills Sandstone has moderate to good permeability and is considered an aquifer that yields ground water to wells where the formation occurs near the surface.

The Medicine Bow Formation is about 4,500 feet thick in the EIS analysis area. Medicine Bow Formation strata consist of sandstone, shale and coal units. The lower portion of the formation is composed of massive bedded to cross-bedded brown sandstone with numerous coalbeds. The Seminoe Road Project would develop and produce natural gas from coalbeds of the lower Medicine Bow Formation. Locally, the formation exhibits moderate permeability and can be considered an aquifer, but intervening shale beds limit the formation ability to transmit ground water vertically (USGS 1978).

Several wells are completed in the Fox Hills Sandstone\Medicine Bow Formation ground water-bearing strata and several springs issue from this system. Water from these wells and springs are utilized for livestock and wildlife watering. No known domestic water wells are installed in these strata within the EIS analysis area.

In addition to the Fox Hills Sandstone\Medicine Bow Formation, several other shallow ground water-bearing formations are present in the EIS analysis area including the Hanna and Ferris formations, which overly the Medicine Bow Formation. Water-bearing zones in these formations have limited hydraulic connectivity and exist under both unconfined and semi-confined conditions. Several wells are completed in these zones, and a few springs issue from this system. Water from these wells and springs are primarily utilized for livestock and wildlife watering; however; the ID Ranch domestic well is believed to be installed in this formation. See **Figure 33, Hydrologic Monitoring Sites Location Map.** No other known domestic water wells are installed in these strata within or surrounding the EIS analysis area.

3.5.3 Hanna Basin Alluvial Ground Water Systems

Ground water exists in the alluvial sediments along the North Platte River and the terrace deposits surrounding Seminoe Reservoir. These zones are generally unconfined. These water-bearing sediments are locally considered an aquifer and contain shallow water wells. Several domestic wells in the area (Boat Club and Sheller) are completed in alluvial sediments (Hydro Geo 2003a). See **Figure 33, Hydrologic Monitoring Sites Location Map**.

Limited ground water resources also exist in the surficial unconsolidated and alluvial sediments within and adjacent to the area's ephemeral drainages where ground water presence is generally seasonal, the result of precipitation and snowmelt events; however, no know wells are installed in the shallow sediments along ephemeral drainages within the EIS analysis area.

3.5.4 Springs Within and Adjacent to the EIS Analysis Area

The primary springs in the area are part of the baseline monitoring for the Seminoe Road Project. A summary of the spring monitoring sites is presented in **Table 3.5-1, Spring Information**. A complete listing of the spring water quality data is presented in HydroGeo (2003a). Spring flow and water quality generally shows large ranges of natural\seasonal variability because they are recharged from nearby surface areas.

3.5.4.1 O'Brien Spring

O'Brien Spring was monitored in May 2000, May 2001, September 2001, and September 2002 (HydroGeo 2003a). The spring flows at a rate of about 30 to 60 gpm and issues from faulted Mesaverde bedrock. The water at this site is good quality meeting domestic, agricultural and livestock water criteria and is classified as sodium/calcium bicarbonate/sulfate type, with a moderate TDS concentration (728 to 767 mg/l), slightly alkaline pH (8.0 to 8.4), and low

Table 3.5-1, Spring Information

Spring	Location[1]	Flow Rate (gpm)	Total Dissolved Solids (mg/l)	pH	Occurrence
O'Brien	NE ¼ SW ¼ Section 9 T25N R85W	30 to 60	728 – 767	8.0 – 8.4	Mesaverde sandstone bedrock fault
Corral Creek	NE ¼ SE ¼ Section 27 T24N R86W	<1	608 – 990	7.0 – 8.4	Mesaverde shallow bedrock or alluvium
Ayers	SW ¼ NE ¼ Section 19 T24N R84W	<1 to Dry	19,400	8.3	Medicine Bow shallow bedrock or alluvium
Miller Bend	SE ¼ SE ¼ Section 12 T22N R86W	<1	10,852	8.1	Mesaverde fractured bedrock
Alkali Flat #1	SW ¼ SW ¼ Section 12 T21N R84W	32	1,464	7.9	Medicine Bow shallow bedrock or alluvium
Alkali Flat #2	SE ¼ NW ¼ Section 3 T22N R84W	<1	3,517	8.0	Medicine Bow shallow bedrock or alluvium
St. Mary's	SE ¼ NE ¼ Section 12 T22N R84W	3	2,430	8.0	Ferris Formation shallow bedrock fracture

Note:
1. Spring locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

concentrations of trace constituents with the exception of total manganese (66 to 266 µg/l) and sulfate (241 to 275 mg/l).

3.5.4.2 Corral Creek Spring

Corral Creek Spring was monitored in June 2000, May 2001, September 2001, and September 2002 (HydroGeo 2003a). The spring flows at a rate of less than one gpm and issues from shallow Mesaverde bedrock or alluvium. Corral Creek Spring water is poor quality and does not meet domestic water quality criteria. It is classified as a sodium bicarbonate type with moderate TDS concentrations (608 to 990 mg/l) and neutral to slightly alkaline pH (7.0 to 8.4). The water from this spring has low concentrations of trace constituents with the exception of elevated concentrations of aluminum (164 µg/l), total iron (72 to 4,900 µg/l), and total manganese (140 to 200 µg/l).

3.5.4.3 Ayers Draw Spring

Ayers Spring was monitored in September 2001 and September 2002 (HydroGeo 2001 and 2003a). The spring was not flowing in 2002 and a laboratory sample was not collected, but field water quality measurements were taken from a small stagnant pond below the spring. This spring issues from shallow Medicine Bow bedrock or alluvium. The spring is very poor quality and does not meet domestic, agricultural, or livestock standards. The pH of the spring water was slightly alkaline (8.3), the EC was >20,000 µmhos/cm, and the temperature was 68.2° F. In 2001, a water quality sample from Ayers Creek Spring indicated that it was sodium sulfate type. The water was highly saline with high concentrations of many trace constituents including sodium (4,200 mg/l), sulfate (9,400 mg/l), chloride (698 mg/l), TDS (19,400 mg/l), dissolved manganese (268 µg/l), and SAR (36 unitless) (HydroGeo 2003a).

3.5.4.4 Miller Bend Spring

Miller Bend Spring was monitored in September 2002 (HydroGeo 2003a). The spring was flowing at a rate of less than one gpm and issues from fractured shallow Mesaverde bedrock. Miller Bend Spring water is poor quality and does not meet water quality criteria for domestic, agricultural, or livestock. It is classified as a sodium sulfate type with a slightly alkaline pH (8.1) and a high concentration of TDS (10,852 mg/l). The water from this spring has low concentrations of trace constituents with the exception of elevated concentrations of sulfate (6,940 mg/l), total iron (1,803 µg/l), total manganese (161.5 µg/l), and SAR (10.8 unitless). This spring was located outside the 2000 and 2001 survey areas and was not sampled during those years.

3.5.4.5 Alkali Flat Spring #1

Alkali Flat Spring #1 was monitored in September 2002 (HydroGeo 2003a). This is a developed spring with a solar powered pump and stock tank. Flow into the stock tank was measured as 32 gpm. This spring issues from shallow Medicine Bow bedrock or alluvium. Alkali Flat Spring #1 water is of moderate quality and meets water quality criteria for agriculture and livestock, but not for domestic purposes. It is classified as a sodium sulfate type with slightly alkaline pH (7.9) and moderate TDS concentration (1,464 mg/l). The water from this spring has low concentrations of trace constituents with the exception of elevated concentrations of sulfate (911 mg/l), total iron (1,248 µg/l), and total manganese (156.9 µg/l). This spring was located outside the 2000 and 2001 survey areas and was not sampled during those years.

3.5.4.6 Alkali Flat Spring #2

Alkali Flat Spring #2 was monitored in September 2002 (HydroGeo 2003a). Flow from this small is less than one gpm, into a small pond, and the water has a foul odor. This spring issues from shallow Mesaverde bedrock or alluvium. Alkali Flat Spring #2 is poor quality and only meets livestock water quality criteria. The water is sodium sulfate type with a slightly alkaline pH (8.0) and a high TDS concentration (3,517 mg/l). The water from this spring has low concentrations of trace constituents with the exception of elevated concentrations of sulfate (1,988 mg/l), aluminum (850 µg/l), total iron (5,430 µg/l), total manganese (330.6 µg/l), and SAR (18.4 unitless). This spring was located outside the 2000 and 2001 survey areas and was not sampled.

3.5.4.7 St. Mary's Spring

St. Mary's Spring was monitored in September 2002 (HydroGeo 2003a). This spring flow is about 3 gpm into a small stock pond and issues from a fractured Ferris Formation sandstone bed. St. Mary's Spring water is poor quality meeting only livestock water quality criteria. The water is sodium sulfate type with a slightly alkaline pH (8.0) and a high TDS concentration (2,430 mg/l). The water from this spring has low concentrations of trace constituents with the exception of elevated concentrations of sulfate (1,452 mg/l), aluminum (434 µg/l), total iron (5,040 µg/l), and total manganese (609.7 µg/l). This spring was located outside the 2000 and 2001 survey areas and was not sampled.

3.5.5 Stock Wells Within and Adjacent to the EIS Analysis Area

The primary stock wells in the area are part of the baseline monitoring for the Seminoe Road Project. Well producing zones were projected based on preliminary geologic mapping of the area and estimated well depth; in many cases well completion information was not available. Shallow well levels and water quality generally shows large ranges of natural\seasonal variability because they are recharged from nearby surface sources. A summary of the well monitoring sites is presented in **Table 3.5-2, Well Information**. A complete listing of the well water quality data is presented in HydroGeo (2003a).

3.5.5.1 Section 19 Well

The Section 19 Well was monitored in May 2000, June 2000, May 2001, September 2001, and September 2002 (HydroGeo 2003a). This well is artesian, and flows are diverted to a stock tank one-half mile to the east. This well is believed to be completed in the Mesaverde strata. The water at this site is poor quality only suitable for livestock but not for domestic or agricultural purposes. The water at this site is calcium sulfate/bicarbonate type with a slightly alkaline pH (7.2 to 7.8) and a moderate TDS concentration (842 to 969 mg/l). The water has low concentrations of trace constituents, with the exception of high concentrations of sulfate (220 to 411 mg/l), and total iron (230 to 2,800 µg/l). Flow from the well is about 2 gpm.

Table 3.5-2, Well Information

Well	Location (1)	Type of Well	Well Depth (fee)	Water Level Below Surface (feet or Flow Rate (gpm)	Total Dissolved Solids (mg/l)	pH	Projected Producing Interval
Section 19	SW ¼ NW ¼ Section 19 T23 N R85W	Stock watering	NA	2 gpm	842 – 969	7.2 – 7.8	Mesaverde
Miller #1	NW ¼ NE ¼ Section 33 T23N R85W	Stock watering	246	2 gpm	775 – 860	8.2 – 8.7	Medicine Bow
Little Shoe	NE ¼ NW ¼ Section 1 T23N R86W	Stock watering	520	23–24.5 ft	1,150 – 1,720	7.9 – 8.2	Mesaverde
Dry Ditch #1	NW ¼ NE ¼ Section 7 T23N R84W	Stock watering	NA	30 ft	1,372	7.8	Medicine Bow
Dry Ditch #2	SE ¼ NW ¼ Section 11NA T23N R85W	Stock watering	NA	6 ft	2,574	7.9	Medicine Bow
Alkali Flat	SW ¼ NE ¼ Section 23 T22N R84W	Stock watering	NA	34 ft	4,372	7.9	Mesaverde
ID Ranch	NE ¼ SW ¼ Section 29 T24N R84W	Domestic use	NA	NA	497 – 1,720	7.7 – 8.3	Medicine Bow
Seminoe Boat Club (winter)	NW ¼ NW ¼ Section 9 T24N R84W	Domestic use	287	16 ft	1,130 – 1,360	8.0 – 8.2	Medicine Bow or Seminoe Reservoir Alluvium
Sheller	SE ¼ NE ¼ Section 18 T22N R85W	Domestic use	55	9 ft	329	7.1	North Fork Alluvium

Note:
1. Water well locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

3.5.5.2 Miller #1 Well

The Miller #1 well was monitored in May 2001, September 2001, and September 2002 (HydroGeo 2003a). This well is artesian, and its flow is diverted to a stock tank next to the well. This well is believed to be complete in the Medicine Bow Formation. The water at this site is poor quality and only meets livestock water quality criteria. It is unsuitable for domestic or agricultural purposes. The water is sodium bicarbonate type with a moderately alkaline pH (8.2 to 8.7) and a moderate TDS concentration (775 to 860 mg/l). The water has low concentrations of trace constituents and has a high value of SAR (22.0 to 26.8). Flow into the stock tank is about 2 gpm.

3.5.5.3 Little Shoe Well

The Little Shoe Well was monitored in May 2001, September 2001, and September 2002 (HydroGeo 2003a). The water level in this well is between 23 to 24.5 feet below surface. This well is believed to be complete in the Mesaverde strata. The water at this site is poor quality and is only suitable for livestock watering. It does not meet domestic or agricultural standards. The water is sodium sulfate type with a slightly alkaline pH (7.9 to 8.2) and a high TDS concentration (1,150 to 1,720 mg/l). The water has moderate concentrations of trace constituents including sulfate (497 to 945 mg/l), total aluminum (<50 to 291 μg/l), total iron (381 to 16,200 μg/l), total manganese (62 to 166 μg/l), and a high value of SAR (7.1 to 11.1).

3.5.5.4 Dry Ditch Well #1

The Dry Ditch #1 well was monitored in September 2002 (HydroGeo 2003a). The water level in this well was about 30 feet below surface. This well is believed to be complete in the Medicine Bow Formation. The water at this site is poor quality and is only suitable for livestock watering. Water quality does not meet domestic or agricultural water quality criteria. The water is sodium sulfate type with a slightly alkaline pH (7.8) and a high TDS concentration (1,372 mg/l). The water has moderate concentrations of trace constituents including sulfate (827 mg/l), total aluminum (365 μg/l), total iron (3,363 μg/l), total manganese (62 μg/l), and SAR (12.4). This well is located outside the 2000 and 2001 survey areas and was not monitored during those years.

3.5.5.5 Dry Ditch Well #2

The Dry Ditch #2 well was monitored in September 2002 (HydroGeo 2003a). The water level in this well was about six feet below surface. This well is believed to be complete in the Medicine Bow Formation. The water at this site is sodium sulfate type with a slightly alkaline pH (7.9) and a high TDS concentration (2,574 mg/l). The water has high concentrations of trace constituents including sulfate (1,451 mg/l), total aluminum (786.5 μg/l), total iron (5910 μg/l), and total manganese (261 μg/l). This well was located outside the 2000 and 2001 survey areas and was not monitored during those years.

3.5.5.6 Alkali Flat Well

The Alkali Flat Well was monitored in September 2002 (HydroGeo 2003a). The water level in this well was about 34 feet below surface. This well is believed to be complete in the Mesaverde strata. The water at this site is poor quality and only meets livestock water quality criteria. It is not suitable for domestic or agricultural purposes. The water is sodium sulfate type with a slightly alkaline pH (7.9) and a high TDS concentration (4,372 mg/l). The water has high concentrations of trace constituents including sulfate (2,751 mg/l), total iron (791 μg/l), total manganese (453 μg/l), and SAR (11.8). This well was located outside the 2000 and 2001 survey areas and was not monitored during those years.

3.5.6 Domestic Wells Within and Adjacent to the EIS Analysis Area

Three domestic water wells were identified and monitored for the Seminoe Road Project (ID Ranch, Seminoe Boat Club (Winter), and Sheller domestic wells). See **Figure 33, Hydrologic Monitoring Sites Location Map**. Two additional domestic wells in the Dugway home site area were located but have been abandoned (HydroGeo 2003a). The general producing zones of these wells were projected based on preliminary geologic mapping of the area and estimated well depth; well completion information was not available for these wells. Shallow well levels and water quality generally shows large ranges of natural\seasonal variability because they are recharged from nearby surface sources. A summary of the well monitoring sites is presented in **Table 3.5-2, Well Information**. A complete listing of the well water quality data is presented in HydroGeo (2003a).

3.5.6.1 ID Ranch Well

The ID Ranch Well was monitored in May 2000, May 2001, September 2001, and September 2002 (HydroGeo 2003a). The water level in this well was not measured because the wellhead was sealed, though it is reported to be shallow. The water at this site does not meet secondary domestic drinking water criteria for TDS (limit of 500 mg/l). Secondary domestic water quality limits are based on aesthetic criteria and not human health. Water from this well is calcium bicarbonate type with a slightly alkaline pH (7.7 to 8.3) and a high TDS concentration (497 to 1720 mg/l). The water has low concentrations of trace constituents.

3.5.6.2 Boat Club "Winter" Well

The Boat Club "Winter" Well was sampled in May 2001, September 2001, and September 2002 (HydroGeo 2003a). The water level was not measured because the wellhead was sealed. This well is completed in the Medicine Bow Formation. The water at this site does not meet secondary domestic drinking water criteria for TDS (limit of 500 mg/l) or sulfate (250 mg/l). Secondary domestic water quality limits are based on aesthetic criteria and not human health. The water is sodium sulfate type with a slightly alkaline pH (8.0 to 8.2) and has high TDS concentrations (1,130 to 1,360 mg/l). The water has low concentrations of trace constituents with the exception of moderately high concentrations of sulfate (482 to 657 mg/l).

3.5.6.3 Sheller Well

The Sheller Well was sampled in September 2002 (HydroGeo 2003a). The water level in the well was 9 feet below surface. This well is completed in the North Platte River alluvium. The well water does not meet secondary domestic drinking water criteria for iron (300 µg/l), manganese (50 µg/l), and zinc (500 µg/l). Secondary domestic water quality limits are based on aesthetic criteria and not human health. The water is sodium chloride\bicarbonate type with a neutral pH (7.1) and a low TDS concentration (329 mg/l). The water has low concentrations of trace constituents with the exception of high concentrations of total iron (6,530 µg/l), total manganese (265 µg/l), and total zinc (2,288 µg/l). This well was located outside the 2000 and 2001 survey areas and was not monitored during those years.

3.6 Vegetation

3.6.1 Vegetation Communities

Fourteen upland vegetation types were mapped within the EIS analysis area. **See Figure 44, Vegetation Map**. The acreage of each vegetation community within the EIS analysis area is presented in **Table 3.6-1, Vegetation Communities**.

Aerial photos obtained from the Proponent were used to map vegetation. This “office” mapping was followed by a 2003 field reconnaissance survey to corroborate the vegetation delineations made from examination of aerial photos.

3.6.1.1 Wyoming Sagebrush/Mixed Grass

This vegetation community occurs over broad expanses in the EIS analysis area on level to gently rolling uplands and alluvial plains.

Wyoming sagebrush (*Artemisia* var. *tridentata wyomingensis*) dominates this community with an understory composed of a variety of grass species including Sandberg bluegrass (*Poa secunda*), threadleaf sedge (*Carex filifolia*), green needlegrass (*Nassella viridula*), Indian ricegrass (*Achnatherum hymenoides*), thickspike wheatgrass (*Elymus lanceolatus*) and western wheatgrass (*Pascopyrum smithii*). Sandberg bluegrass is the most common grass species. Needle-and-thread (*Hesperostipa comata* var. *comata*) dominates on more sandy soils to the general exclusion of most other grass species. Plant cover typically ranges from 25 to 40%, although cover values up to 50% may be found.

Table 3.6-1, Vegetation Communities

Vegetation Community[1]	Area[2] (acres)	Portion of EIS Analysis Area (%)	Reclamation Potential
Wyoming Sagebrush/Mixed Grass	29,320	21.4	Moderate
Wyoming Sagebrush/Threadleaf Sedge	29,230	21.3	Moderate
Wyoming Sagebrush/Green Rabbitbrush	1,910	1.4	Moderate
Low Shrub/Mixed Grass	34,010	24.9	Low to Moderate
Mixed Sagebrush	3,250	2.4	Low to Moderate
Mixed Shrub	12,180	8.9	Low to Moderate
Mixed Grass	3,120	2.3	Moderate
Threadleaf Sedge/Mixed Grass	1,260	0.9	Moderate
Basin Big Sagebrush/Greasewood	1,970	1.4	Low to Moderate
Greasewood	1,080	0.8	Low to Moderate
Juniper	250	0.2	Low
Rock Outcrop	5,670	4.1	Low
Mined Area[3]	4,400	3.2	Low to Moderate
Seminoe Reservoir Lake[4]	9,350	6.8	--
Total	137,000	100.0	--

Notes:

1. See **Figure 44, Vegetation Map**.
2. These represent the estimated areas of the various vegetation communities within the EIS analysis area.
3. Because coal mining companies maintain reclamation bonds on reclaimed land with the Wyoming DEQ, Land Quality Division, any redisturbance of bonded mine reclaimed areas by operations at the Seminoe Road Project would require a transfer of reclamation success liability and responsibility from the coal mining company to the Proponent.
4. Acreage at normal high water level of Seminoe Reservoir, not vegetation community, but listed here to illustrate relative size of reservoir within EIS analysis area.

Reference (HydroGeo 2004)

Pedestalling and sheet wash have commonly occurred across this vegetation community, and transition zones are moderately broad. The broadest zone is located in the northern portion of the EIS analysis area where this unit borders the Low Shrub/Mixed Grass Community.

3.6.1.2 Wyoming Sagebrush/Threadleaf Sedge

This vegetation community shares many characteristics of the Wyoming Sagebrush/Mixed Grass Community but differs in its overall vegetation composition. The community occurs over broad expanses on all aspects and is most prevalent in the eastern half of the EIS analysis area. The upland topography is nearly level to moderately rolling.

Wyoming Sagebrush dominates this community, with threadleaf sedge the most common understory species. Sandberg bluegrass, green needlegrass, Indian ricegrass, and thickspike wheatgrass are also found in the understory of this community. In sandy soils, green needlegrass or needle-and-thread dominates the understory. Vegetation cover typically ranges from 30 to 40%, although cover values up to 50% may be found.

Pedestalling and sheet wash are common across this vegetation community, and vegetation transition zones are also moderately broad, but not to the extent displayed by the Wyoming Sagebrush/Mixed Grass Community.

3.6.1.3 Wyoming Sagebrush/Green Rabbitbrush

This vegetation community occurs on rolling hills and ridges in the southeastern part of the EIS analysis area. Wyoming sagebrush and Green rabbitbrush (*Chrysothamnus viscidiflorus)* dominate this community. Rubber rabbitbrush (*Chrysothamnus nauseosus*) may be an occasional co-dominant species. Threadleaf sedge is the most common understory species with Sandberg bluegrass also present. Vegetation cover typically ranges from 25 to 35%. Pedestalling was common.

Broad transition zones exist between this community and the adjacent Wyoming Sagebrush/ Mixed Grass and Wyoming Sagebrush/Threadleaf Sedge communities.

3.6.1.4 Low Shrub/Mixed Grass

This vegetation community is common across the central portion of the EIS analysis area and occupies a wide variety of sites including upland ridge tops and dissected side-slopes, broad alluvial plains, saline basins, and alkali flats. This community also comprises the largest vegetation delineation in the EIS analysis area, and occurs on flat to steeply sloping areas although it is most prevalent on gentle slopes. The soils supporting this community are typically alkaline and may or may not be saline.

This community is typically dominated by a Gardner's saltbush (*Atriplex gardneri*)/Sandberg bluegrass association. A Gardner saltbush/birdsfoot sagebrush (*Artemisia pedatifida*) type is also common on more level areas and, with a notable percentage of foxtail barley (*Critesion jubatum*), can be found in association with playa areas. In certain locales, birdsfoot sagebrush can be locally dominant on hillsides and ridge tops. Plant cover values for this community generally range from 20 to 30%, but values can approach 40%.

Pedestalling was common and some sheet wash is found in this unit. Transition zones can be exceptionally broad, particularly when bordering the Wyoming Sagebrush/Mixed Grass and Wyoming Sagebrush/Threadleaf Sedge communities.

3.6.1.5 Mixed Sagebrush

This vegetation community is limited to the southern half of the EIS analysis area on moderately steep to steep ridges and hills. Wyoming sagebrush, birdsfoot sagebrush, fringed sagebrush (*Artemisia frigida*), and black sagebrush (*Artemisia nova*) are interspersed throughout this community, depending on site-specific conditions. A few isolated stands of Rocky Mountain juniper (*Juniperus scopulorum*) to small to delicate trees are also found in this unit. Understory grass species include threadleaf sedge, Sandberg bluegrass, and western wheatgrass. Percent total plant cover is highly variable across this unit ranging, on average, from 25 to 70%.

Vegetation transition zones are narrow to moderately broad, depending on slope and soil characteristics. Pedestalling, sheet wash and riling are common, and some gullying was observed.

3.6.1.6 Mixed Shrub

This vegetation community occurs primarily on ridge complexes and hills where slopes are moderate to steep. At higher elevations, mountain mahogany (*Cercocarpus montanus*), skunkbush sumac (*Rhus aromatica* var. *trilobata*), squaw current *(Ribes cereum*), and black sagebrush are present. Further downslope, Wyoming sagebrush becomes a sub-dominant community component with shrub species such as broom snakeweed (*Gutierrezia sarothrae*) and shadscale saltbush (*Atriplex confertifolia*) occurring in association. On south-facing slopes, shadscale saltbush dominates where soil moisture regimes are drier. A Wyoming sagebrush/greasewood (*Sarcobatus vermiculatus*) association occurs in drainages along toe slopes.

Plant cover is highly variable within this community ranging from 10% (across surface rock exposures) to 70% (on north- and east-facing aspects with deeper soils). Herbaceous understory species include Sandberg bluegrass, green needlegrass, Indian ricegrass, and western wheatgrass.

Transition zone and erosion characteristics of this unit are similar to those of the Mixed Sagebrush Community.

3.6.1.7 Mixed Grass

Threadleaf sedge, Sandberg bluegrass, Indian ricegrass, and thickspike wheatgrass dominate this vegetation community, which is found on nearly level to gently rolling areas. Green needlegrass dominates where more sandy soils occur. Plant cover ranges from about 25 to 35%. Wyoming sagebrush has established in incised drainages within this unit where soils are sufficiently deep, while mountain mahogany occurs as an occasional community inclusion.

Vegetation community transition zones range from abrupt in the Mixed Sage Community (due to slope) to comparatively broad where it borders the Wyoming Sagebrush/Mixed Grass Community. Pedestalling and sheet wash are common in this community.

3.6.1.8 Threadleaf Sedge/Mixed Grass

This vegetation community is similar to the Mixed Grass Community with the exception that threadleaf sedge is the dominant herbaceous species. This unit occurs over nearly level to gently rolling uplands and is typified by vegetation cover values ranging from 20 to 30%. Community component species include Sandberg bluegrass, needle-and-thread, Indian ricegrass, and western wheatgrass. Broom snakeweed and low density Wyoming sagebrush stands are also present. The Alkali Flat playa is included in this unit.

Pedestalling was noted in this community. Transition zone characteristics parallel the Mixed Grass Community.

3.6.1.9 Basin Big Sagebrush/Greasewood

This vegetation community has become established along drainages and depressions, and in swales where greasewood does not dominate. It can also be found in association with alkali flat and playa communities upslope from areas dominated by more calcareous and salt tolerant species. Mixed shrub species are often intermixed with the Basin Big Sagebrush (*Artemisia tridentata* var. *tridentata*)/Greasewood (*Sarcobatus vermiculatus*) Community where better quality soils border drainages. This community is more common than the Greasewood Community on broad stream terraces because of the adaptive capabilities of Basin Big Sagebrush.

Plant cover ranges between 50 and 80%. This community often transitions into a Greasewood Community in drainage topographies. Pedestalling and sheet wash are common.

3.6.1.10 Greasewood

Similar to the Basin Big Sagebrush/Greasewood Community described in Section 3.6.1.9, Basin Big Sagebrush/Greasewood, this community is found in depressions, basins, stream courses and stream terraces where wetter soil moisture regimes have developed. It is also commonly associated with alkali flats and playas. Slopes are typically gentle, with deep soils that exhibit a basic (high) pH. Higher than normal soil salinities may occur. Pedestalling and sheet wash are common in this community.

Plant cover typically ranges from 50 to 80% with alkali sacaton (*Sporobolus airoides*) a common understory component. Vegetation community transition zones range from abrupt to broad, particularly where this community intergrades with the Basin Big Sagebrush/Greasewood Community.

3.6.1.11 Juniper

This vegetation community is rare but does occur sporadically on foothills, ridge tops and steep ridges in the southwest part of the EIS analysis area. This community may also be found intermixed at higher elevations within the Mixed Shrub and Mixed Sagebrush communities where steep to very steep slopes are overlain by shallow soils having a high coarse fragment content. Surface rock exposures and rock outcrops are relatively common.

Rocky Mountain juniper is the dominant species in this community. Plant cover ranges from 30 to 50% (including the tree canopy) though significant bare areas can be found. The plant understory ranges from a mixed shrub type on slopes to black sagebrush stands on more exposed ridge tops. A gravel pavement is common indicating a susceptibility to erosion. Vegetation community transition zones are abrupt to narrow along toe-slopes where an increase in soil depths promote the establishment of shrub and grass-dominated communities.

3.6.1.12 Playas

Ferris Lake, Alkali Flat and St. Mary’s Anticline Basin are playas occurring within the EIS analysis area. Each consists of a closed basin into which drainage flows from the surrounding terrain. Playas pond water during springtime snowmelt or after an intense summer thunderstorm, but are relatively dry for most of the year. Depending upon annual precipitation rates, playas are either unvegetated or support limited stands of herbaceous species. Foxtail barley and annual species such as prostrate knotweed (*Polygonum aviculare*), and silverscale saltbush (*Atriplex argentea*) are commonly supported by playas where growing conditions are amenable.

3.6.1.13 Rock Outcrop/Broken Land/Miscellaneous Land Types

Rock outcrops, surface rock exposures and highly weathered geologic formations are scattered throughout the EIS analysis area. These sites are typified by little or no soil, high surficial coarse fragments and sparse vegetation. Sand beaches along the shoreline of Seminoe Reservoir are also included in this unit. Where soils have accumulated along toe slopes, in depressions, or in broader incised drainages, a variation of the Mixed Shrub Community often develops. The potential for erosion is highly variable, given the lack of soil across major portions of this unit, though considered “high” where soil exists and a gravel pavement is absent.

3.6.1.14 Mined Area

Surface coal mining has occurred within the EIS analysis area. See **Appendix E, Regional Activity**. The areas affected by this mining activity have been delineated into a unique category and are in various stages of reclamation.

3.6.2 Wetlands and Riparian Areas

No formal delineations of jurisdictional wetlands or other Waters of the U.S. have been completed for the EIS analysis area. To complete this section, information from 2001, 2002, 2003 and 2004 baseline and follow up field surveys were used to describe the essential characteristics of drainage vegetation, wetlands and riparian areas. (TRC Mariah 2001; HydroGeo 2003a, 2004c). In addition, National Wetlands Inventory maps, utilizing the wetland classification described by Cowardin et al. (1979), were reviewed.

Wetland and riparian plant communities occur in all 14 sub-watersheds in the EIS analysis area. Other than those associated with Seminoe Reservoir, the North Platte River, seeps, springs, stock ponds and playas, they are typically confined to areas in or adjacent to the drainage channels. Wetland hydrology is provided by channel flooding, lateral flow and subirrigation. The wetland hydrology in Pool Table Draw is also enhanced by the continuous flows of Pilot Project produced water.

Wetland and riparian zones along drainages are generally characterized by narrow vegetation communities that have wetter soil hydrologic conditions than the surrounding upland areas.

Wetland and riparian vegetation communities vary across the EIS analysis area, but they are comparatively simplistic in terms of diversity. Species occurring within these wetland and riparian areas have become established in direct response to soil/hydrologic conditions reflecting soil depth, water holding capacity, and period of saturation. Six wetland and riparian plant communities are found in the EIS analysis area.

Herbaceous Riparian. This community is confined to areas within drainages and occurs primarily on the banks and in channel bottoms of ephemeral drainages. Hydrophytic grasses, rushes (*Juncus* spp.), sedges (*Carex* spp.) and forbs are the dominant species. The plant species presented in the upper, drier reaches of the drainages varies from those found in lower, wetter reaches, including those drainage sections that have standing or gently flowing water. Aquatic and floating vegetation growing in standing or gently flowing water is included in this community.

Shrubby Riparian. This community is confined to areas within and along drainages. It is characterized by shrubby vegetation growing in channel bottoms and on the banks of ephemeral drainages. The dominant shrub species varies throughout drainages and overlaps the Basin Big Sagebrush/Greasewood and Greasewood communities immediately upslope from the drainage proper as described in sections 3.6.1.9, Basin Big Sagebrush/Greasewood and 3.6.1.10, Greasewood. This community also includes areas in the lower reaches of most drainages where the water table is high and sandbar willow (*Salix exigua*) and tamarisk (*Tamarisk chinensis*) are the dominant shrubs.

Wet Meadow. This community typically occurs in areas adjacent to drainage flow channels and springs where soils are saturated for a portion of the growing season. This community also includes sub-irrigated vegetated terraces and drainage areas downstream of stock ponds. Hydrophytic grasses, rushes, sedges, and forbs are the dominant species.

Forested Riparian. This community is characterized by deciduous trees such as cottonwood (*Populus* spp.). Cottonwood trees are very rare in the EIS analysis area; however, they do occur in small isolated locations along the North Platte River.

Playa. The Ferris Lake and Alkali Flat and St. Mary's Anticline playa areas occur in the EIS analysis area south of the North Platte River. These closed playa basins can be inundated with water for a few months of the year (depending on weather conditions) and support hydrophytic vegetation. During drought cycles, vegetation cover can disappear (HydroGeo 2003a, 2004c). This community is also described in Section 3.6.1.12, Playas.

Shoreline/Sandy Beach. The fluctuating water levels of the Seminoe Reservoir create shoreline and sandy beach conditions. During drought conditions (such as experienced over the past several years), vast areas of shoreline are exposed, and little or no vegetation grows in these areas with the exception of scattered weedy and annual species, and alkali-tolerant hydrophytic grasses, rushes and forbs. Although highly variable in size depending on weather conditions and reservoir storage levels, wetland plant communities have developed in the lower reaches of many EIS analysis area drainages, above the normal high water level of the Seminoe Reservoir. These areas are subjected to varying water levels and erosion. The shoreline/sandy beach community overlaps the community described in Section 3.6.1.13, Rock Outcrop/Broken Land/Miscellaneous Land Types.

3.6.2.1 Pilot Project Produced Water Riparian and Wetland Areas

Since December 2001, Pilot Project produced water has been released into Pool Table Draw. Prior to the introduction of produced water, Pool Table Draw was a sparsely vegetated ephemeral stream channel (TRC Mariah 2001). The presence of continuous, low velocity flows of Pilot Project produced water have enhanced the development of hydric soils and increased the vegetative cover and diversity of riparian and wetland species along narrow bands of Pool Table Draw and some localized areas in Pool Table Draw where the gradient flattens along the channel (HydroGeo 2003a, 2004c). Sagebrush and greasewood are less tolerant of anaerobic conditions and are stressed or dying in isolated areas where soils are becoming saturated due to the continuous flows of Pilot Project produced water.

3.6.2.2 Seeps, Springs and Stock Ponds

Seeps and springs are naturally occurring and exhibit seasonal or perennial flows with recharge coming from direct precipitation or snowmelt infiltration. Known springs in the EIS analysis area are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**. It is estimated that 10 to 15 stock ponds are located within the EIS analysis area. Depending on soil moisture conditions, the areas surrounding seeps, springs, and stock ponds support hydrophytic wetland vegetation, occurring in herbaceous and shrubby riparian to wet meadow communities.

Stock ponds are man-made features that are filled by flow from springs or overland flow. Hydrophytic vegetation often grows in areas surrounding stock ponds due to seepage. The areal extent is typically limited and such vegetation can be damaged by animal use or the stock ponds.

3.6.3 Weeds

The existence, extent and type of weeds likely to inhabit an area is affected by many factors including elevation, slope aspect, soil pH, soil texture, distance from water sources, distance from disturbance, proximity to existing infestations, annual precipitation, and vegetation cover. Additionally, with the windy conditions of south-central Wyoming, weed seeds can be blown from great distances to gain “foot holds” in disturbed or stressed sites.

The EIS analysis area is comparatively undisturbed and dominated by native vegetation species with relatively low weed and cover. Weeds are prone to establishment on disturbed sites such as those resulting from human (recreation, ranching, and livestock) activities. The drought conditions of the past several years have also contributed to the spread of weeds.

Pilot Project related activities such as the construction of roads, drill pads, pipelines, reservoir improvements, and ancillary facilities have resulted in surface disturbances of 146 acres that have enhanced the establishment and spread of weeds. The presence of continuous flows of produced water in Pool Table Draw has also resulted in increased growth and diversity of plant species including weeds (HydroGeo 2003a, 2004c). In general, weeds develop in disturbed sites throughout the EIS analysis area with varying density and composition (TRC Mariah 2001, HydroGeo 2003a, 2004c). Weeds are typically confined to narrow corridors along roadways, areas disturbed by ranching, recreational use; areas disturbed by the Pilot Project and County Road 351 construction activities; areas impacted by livestock such as surrounding stock ponds; areas subject to erosion including headcuts; and areas exposed by fluctuating water storage levels in Seminoe Reservoir.

The state of Wyoming, Carbon County, and BLM weedy species of concern known to occur in the EIS analysis area are presented on **Table 3.6.2, State of Wyoming Designated Noxious**

Weeds, **BLM Weedy Species of Concern, and Carbon County Declared Weeds Known to Occur in the EIS Analysis Area**.

The information on weed species occurrences was based on information provided by the BLM Field Office (Foley 2003) and data collected in surveys conducted in 2001-2004 (TRC Mariah 2001; HydroGeo 2003a, 2004c). Nine designated noxious weeds, four BLM weedy species of concern, and three Carbon County declared weeds are known to occur in or near the EIS analysis area. BLM and State of Wyoming regulations require that noxious weeds be controlled where they become newly established.

3.6.4 Threatened and Endangered Plant Species

There are no known threatened, endangered, candidate, or proposed plant species or critical habitats in the EIS analysis area (TRC Mariah 2001, HydroGeo 2003, 2003a, WYNDD 2003, 2004). However, the blowout penstemon (*Penstemon haydenii*), an endangered plant species, is known to occur in the Ferris and Seminoe mountains north of the EIS analysis area (WYNDD 2004). There are no known active sand dunes or areas of potential habitat for blowout penstemon in the EIS analysis area. Based on known distribution and habitat characteristics for blowout penstemon, this species is not likely to occur in the EIS analysis area.

3.6.5 Sensitive Plant Species

Persistent sepal yellow-cress, the only BLM sensitive plant species of concern known to be present in the EIS analysis area, occurs in portions of Pool Table Draw, Ayers Draw, Dry Ditch, St. Mary's Ditch, Mountain Lion Draw and the Ferris Lake playa (TRC Mariah 2001). It occurs on banks adjacent to standing or flowing water, along the shoreline of Seminoe Reservoir near the high water line, and in areas subject to flooding. It frequently occurs in semi-disturbed and recently flooded areas, so it occurs with varying density from year to year and may not be observed when water levels are high. There are seven known occurrences of persistent sepal yellow-cress, mostly on the shores of Seminoe Reservoir, that represent nearly 33% of all occurrences in Wyoming and there are no extant occurrences of this species outside of Wyoming (WYNDD 2004). The WYNDD (2002) notes occurrences of persistent sepal yellow-cress as comprising "one of the highest concentrations of this species in the state."

Table 3.6-2, State of Wyoming Designated Noxious Weeds, BLM Weedy Species of Concern, and Carbon County Declared Weeds Known to Occur in the EIS Analysis Area

Common Name	Scientific Name	Comments[3,4]	Observed in Field Surveys[4]
State of Wyoming Designated Noxious Weeds[1]			
Canada thistle	*Cirsium arvense*		Yes
Dalmation toadflax	*Linaria dalmatica*	Known t occur north of the project area along road right-of-way and outside right-of-way in native rangeland	No
Diffuse knapweed	*Centaurea diffusa*	Known to occur north of the project area along road right-of-way and outside right-of-way in native rangeland. Some areas are being treated already.[3]	No
Leafy spurge	*Euphoribia esula*	Known to occur along the North Platte River where pipeline route is proposed to bore under.[3]	No
Russian knapweed	*Centaurea repens*	Known to occur north of the project area along road right-of-way and outside right-of-way in native rangeland.[3]	Yes
Salt cedar, tamarisk	*Tamarisk spp.*	Known to occur along Seminoe Reservoir.[3]	Yes
Scotch thistle	*Onopordum acanthium*	Known to occur near CBM well on west side of road in drainage bottom. Small patch being treated.[3] Not observed in 2002 or 2003 surveys but three individuals observed in summer 2004.[3]	Yes
Spotted knapweed	*Centaurea maculosa*	Known to occur north of the project area along road right-of-way and outside right-of-way in native rangeland. Some areas are being treated already.[3]	No
Whitetop, Hoary cress	*Cardaria spp.*	Known to occur along highway.[3]	Yes
BLM Weed Species of Concern[2]			
Cheatgrass	*Bromus (Anisantha) tectorum*		Yes
Curlycup gumweed	*Grindelia squarrosa*		Yes
Halogeton	*Halogeton glomeratus*		Yes
Russian thistle	*Salsola tragus*		Yes
Annual chenopods		Specific plant species not identified by BLM	Yes
Annual mustards		Specific plant species not identified by BLM	Yes
2003 List of Declared Weeds for Carbon County[5]			
Halogeton	*Halogeton glomeratus*		Yes
Plains larkspur	*Delphinium geyeri*		Yes
Plains pricklypear	*Opuntia polyacantha*		Yes
Wyeth lupine	*Lupinus wyethi*		No

Notes:

1. Adapted from Designated Noxious Weed List – Wyoming Weed and Pest Control Act (Wyoming Weed and Pest Council).
2. BLM Weed Species of Concern (Foley 2003)
3. Adapted from Foley (2003, 2004).
4. Adapted from HydroGeo (2003a, 2004); TRC Mariah (2001).
5. Adapted from 2003 Declared List of Weed and Pests for Carbon County (Wyoming Weed and Pest Council).

3.7 Wildlife/Fisheries

Information regarding wildlife species and current habitat conditions within and near the EIS analysis area was obtained from field surveys and reports completed for the Seminoe Road Pilot Project Area and Gas Gathering Pipeline and Access Roads Project (USDI, BLM 2001; TRC 2000, 2002a, 2002b, 2002c, 2002d, 2002e; and Cedar Creek Associates, Inc. 2004), published sources pertinent to the area, BLM file information, and WGFD information, discussions with the USFWS, and Wyoming Natural Heritage Program (WNHP) file and mapping data.

3.7.1 Big Game

Pronghorn, mule deer, elk and bighorn sheep are the four big game species that occupy habitats on or near the EIS analysis area. Populations of mule deer, elk and bighorn sheep are mostly peripheral to the EIS analysis area, while pronghorn is the only common big game resident. The following information presented on population trends for big game animals is taken from the WGFD's *2002 Annual Big Game Unit JCRs*.

3.7.1.1 Mule Deer

Mule deer populations in the region are part of the Ferris Herd Unit (647, Hunt Area 87) west of Seminoe Reservoir and north of the North Platte River and part of the Platte Valley Herd Unit (541, Hunt Area 161) east of Seminoe Reservoir and south of the North Platte River. The EIS analysis area north of the North Platte River is outside of occupied mule deer range, but the area south of the river is yearlong mule deer range. Crucial winter/yearlong mule deer range is located to the south along the North Platte River and west and north of the EIS analysis area (see **Figure 45, Wildlife Map**). Crucial winter/yearlong range is defined by the WGFD as winter/yearlong range that has been documented as the determining factor in a population's ability to maintain itself at a desired level over the long-term.

Since 1990, the Ferris Mule Deer Unit has not met the WGFD population objective of 5,000 animals. Poor fawn production in 1991 and 1992, coupled with heavy losses in the 1992-93 winter, reduced the herd to less than one half the objective size. Reductions in fawn production continued until 1998 when fawning returned to more normal levels; however, there were increased losses of fawns during the 2000-01 winter. Current estimates place the overall population at less than half the objective population in spite of conservative harvests over the past decade.

The Platte Valley Herd Unit includes the west slope of the Snowy Range and the east slope of the Sierra Madre Range, including the North Platte River valley. The eastern edge of the EIS analysis area (Hunt Area 161) supports drier and less productive habitats for mule deer, but it is included in the Platte Valley Herd Unit because during more severe winters mule deer migrate from higher elevation habitats to winter range in Hunt Areas 161 and 83. Summer and fall densities of mule deer in Hunt Areas 161 and 83 are low. The mule deer population objective for the Platte Valley Herd Unit is 20,000 animals. Following the 2002 hunting seasons, the population was estimated at 25,900 deer, almost 30% above the WGFD objective.

3.7.1.2 Elk

The entire EIS analysis area is outside of occupied elk range, but elk may occasionally pass through the project area. Elk populations west of the Seminoe Reservoir and north of the North Platte River are part of the Ferris Herd Unit (639, Hunt Area 111). Elk populations east of Seminoe Reservoir and south of the North Platte River are part of the Shirley Mountain Herd Unit (534, Hunt Area 16).

3.7.1.3 Bighorn Sheep

Bighorn sheep reside north of the EIS analysis area in the Ferris/Seminoe Mountains. The area is closed to hunting.

3.7.1.4 Pronghorn

Pronghorn populations within and surrounding the EIS analysis area are separated into two herd units:

- South Ferris Herd Unit (637, Hunt Area 62) - located west of Seminoe Reservoir and north of the North Platte River; and,
- Medicine Bow Herd Unit (525, Hunt Area 48) - located east of Seminoe Reservoir and south of the North Platte River.

The majority of the EIS analysis area is classified as winter/yearlong range. See **Figure 45, Wildlife Map**. Winter/yearlong winter range is defined by the WGFD as range that is used yearlong; but, during winter, the area has a substantial influx of pronghorn from other seasonal ranges.

The WGFD population objective of 6,500 animals for the South Ferris Pronghorn Herd Unit has not been met since the 1992-93 winter, and subsequent years of poor fawn production have hindered recovery from that winter. Fawn production improved in the late 1990s but decreased from 2000 to 2002. The estimated post-hunt population in 2002 was roughly 20% less than the objective population.

The pronghorn population in the Medicine Bow Herd Unit likewise declined after the 1992-93 winter. The WGFD population objective of 60,000 animals has not been met since 1991, despite mild winters over the last several years and conservative hunting license numbers. Poor habitat conditions appear to be limiting population growth in this herd unit, and hunting license numbers were increased in 2002 and 2003 to reduce pronghorn foraging pressure on habitat.

3.7.2 Predators, Furbearers, and Small Mammals

Due to the secretive nature and nocturnal habits of many furbearers and other small mammals, the specific distribution and population densities within the EIS analysis and surrounding areas are unknown. Furbearers and predators known or likely to occur in the area include coyote, badger, red fox, swift fox, ermine, long-tailed weasel, western spotted skunk, striped skunk, bobcat, and beaver. All of these species, except for beaver, are adapted to a wide range of grassland and shrubland habitats. Distribution of beaver is restricted to aquatic habitat along the North Platte River. Further discussion of swift fox is provided in Section 3.7.8.3, Swift Fox.

Other small mammals known or likely to be common inhabitants of the region include desert cottontail, white-tailed jackrabbit, white-tailed prairie dog, thirteen-lined ground squirrel, least chipmunk, Wyoming ground squirrel, deer mouse, olive-backed pocket mouse, Ord’s kangaroo rat, and sagebrush vole. Further discussion of white-tailed prairie dog is provided in Section 3.7.8.1, White-tailed Prairie Dog.

3.7.3 Waterbirds

Waterbirds include waterfowl, shorebirds and other wading birds typically associated with wetlands and bodies of surface water. Within the EIS analysis area, aquatic and wetland habitat for waterbirds is restricted to the North Platte River, Seminoe Reservoir, and a few scattered stock ponds. Various species of waterfowl, shorebirds and waders utilize these water bodies during spring and fall migration, but few remain as summer residents and breeders. Fluctuations in Seminoe Reservoir water levels prohibits the development of shallow water shoreline areas with emergent vegetation, favored by many species of waterfowl and shorebirds. Therefore, waterbird nesting use of the reservoir is limited. Waterbird nesting in the area is limited primarily to species such as puddle ducks (mallard, teal, etc.), spotted sandpiper, and killdeer. White pelicans and double-crested cormorants are known to forage for fish in Seminoe Reservoir (WGFD 1998).

3.7.4 Raptors

Raptor species known or likely to hunt in the open shrublands and grasslands and possibly nest within the EIS analysis area are turkey vulture, northern harrier, bald eagle, golden eagle, peregrine falcon, prairie falcon, red-tailed hawk, ferruginous hawk, American kestrel, burrowing owl, short-eared owl, and great horned owl. BLM file information and recent field surveys (TRC 2000 and Cedar Creek Associates 2004) have documented nesting by golden eagle, ferruginous hawk, red-tailed hawk, American kestrel, great horned owl, and burrowing owl. Additional discussion of bald eagle, peregrine falcon, and ferruginous hawk is provided in Section 3.7.8, Threatened, Endangered and Other Species of Concern.

Suitable nest sites for red-tailed hawk, golden eagle, and great horned owl are provided by large cottonwood trees, cliff ledges, and rock outcrops along the North Platte River and Seminoe Reservoir, as well as by isolated rock outcrop and escarpments scattered throughout the upland areas. Great horned owls do not build their own nests and often occupy old nests of eagles, hawks, ravens, and crows, in larger trees or on cliff faces. Turkey vultures nest on cliff ledges, in hollows in snags or stumps, or in caves, while prairie falcons nest on cliff ledges or in rock cavities.

Northern harriers usually nest on the ground or in low shrubs in pockets of dense shrub and grass cover, along drainages or near wetlands. The American kestrel is a cavity nester using abandoned woodpecker holes, magpie nests and rock outcrop crevices. Short-eared owls prefer habitats of shortgrass prairie, agricultural areas, and marshes (Andrews and Righter 1992; Ehrlich et al. 1988),

3.7.5 Upland Game Birds

Greater sage-grouse are the only upland game bird inhabitants in the EIS analysis area. A discussion of greater sage-grouse is provided in Section 3.7.8.10, Greater Sage-grouse.

3.7.6 Migratory Birds

The Migratory Bird Treaty Act (MBTA) provides federal legal protection of migratory bird species, and the BLM is required to evaluate the potential effects of a project on such species. A draft USFWS Memorandum of Understanding (MOU) defines BLM responsibilities under the MBTA. The MOU directs the BLM to avoid or minimize the unintentional take of migratory birds to the extent practicable. The MOU also places high management priority on Birds of Conservation Concern (BCC) identified by the USFWS (USFWS 2002).

The BCC listings for the Badlands and Prairies, Shortgrass Prairie, and USFWS Region 6 (USFWS 2002) were reviewed and the birds on these listings that are known or potential breeders within the EIS analysis area include golden eagle, ferruginous hawk, northern harrier, peregrine falcon, prairie falcon, burrowing owl, short-eared owl, mountain plover, long-billed curlew, Wilson's phalarope, loggerhead shrike, and Brewer's sparrow. A number of other species, including the American golden plover, marbled godwit, buff-breasted sandpiper, sanderling, Sprague's pipit, and Le Conte's sparrow, may occur as occasional or accidental migrants in the EIS analysis area during spring and fall migration.

Potential nesting habitat for raptors is discussed in Sections 3.7.4, Raptors. Bird species listed as threatened, endangered or BLM sensitive are discussed in Section 3.7.8, Threatened, Endangered and Other Species of Concern.

Long-billed curlew, mountain plover and Brewer's sparrow are Neotropical migrants which may occur in the area from spring through early fall. Loggerhead shrike and Brewer's sparrow winter in the southwestern United States and Mexico. The mountain plover winters in California and Mexico. Additional discussion on these three bird species is found in Section 3.7.8, Threatened, Endangered and Other Species of Concern.

The breeding range of Wilson's phalarope includes the EIS analysis area; this Neotropical migrant is a semi-colonial nester that prefers to nest at the margins of quiet, shallow waters of ponds and sloughs, ashore or on islets (Terres 1980). Nests for Wilson's phalarope are well concealed in moist meadows or other wetland habitats often surrounded by water (Ehrlich et al. 1988). Suitable nesting habitat for this species within the EIS analysis area is limited to backwater areas along the North Platte River or stock ponds with a semi-permanent water source and well-developed peripheral wetlands.

3.7.7 Fisheries

Aquatic habitats supporting fisheries in the area are limited to Seminoe Reservoir and the North Platte River. The “Miracle Mile” reach of the North Platte River, considered to be a “world-class” tailwater fishery, is located north of the EIS analysis area between Kortes Dam and Pathfinder Reservoir. Data on the North Platte River between Seminoe Reservoir and Interstate 80 (I-80) was obtained from Regional River Data provided by Mike Snigg, WGFD 2004.

The Seminoe Reservoir exhibits large annual water level fluctuations, averaging 37 vertical feet between 1968 and 1998 (WGFD 1998). Drought conditions over the last several years have resulted in an even greater seasonal decline in minimum water levels. The reservoir fills during spring and early summer, then water levels decrease during the mid and late summer irrigation season. Water levels further drop as water is released for downstream storage in Glendo Reservoir. These annual water level fluctuations in the Seminoe Reservoir tend to limit fisheries productivity.

The principal game fish in Seminoe Reservoir are walleye, rainbow trout, and brown trout, although some remnants of the historically-planted Snake River cutthroat trout are also present. Other common non-game fish species (carp, lake chub, emerald shiner, white sucker, longnose sucker and fathead minnow) are also present in the reservoir. Fishermen first reported walleye in Seminoe Reservoir in 1961. Walleye apparently drifted into the reservoir from upstream stocking in Colorado, and this species is now abundant in the reservoir. Brown trout exist as a wild self-sustaining population after historic stocking efforts in the North Platte River above the Seminoe Reservoir. The WGFD’s current fishery management emphasis for the Seminoe Reservoir is on annual autumn stocking of approximately 120,000 9-inch rainbow trout and on maintaining a wild walleye fishery (Condor 2004).

Boats provide most of (and probably the best) access for fishing in the Seminoe Reservoir; there are one private and three public boat ramps. Road access for bank fishing is poor, given surrounding private property. Further, for most of the year, expanses of exposed shoreline “mudflats” also restrict bank fishing opportunities. The WGFD’s angler use management objective for the Seminoe Reservoir is to support 40,000 angler days per year (Condor 2004). Actual angler use was estimated at 33,250 angler days per year in 1998 (WGFD 1998).

The North Platte River between Seminoe Reservoir and I-80 is managed by the WGFD as a wild trout fishery, and its Wyoming Trout Stream Class is “yellow.” Game fish management emphasizes brown trout, rainbow trout, cutthroat trout, and walleye. Brown trout are the most abundant game fish in this stretch of the North Platte River, with rainbow trout, walleye, and Snake River cutthroat also present in descending order of abundance. Other native and non-native non-game fish species present in the river are bigmouth shiner, creek chub, carp, emerald shiner, Iowa darter, longnose dace, longnose sucker, and white sucker (Snigg 2004).

3.7.8 Threatened, Endangered and Other Species of Concern

The USFWS provided a listing of threatened, endangered and candidate species for south-central Wyoming, and the BLM provided a listing of their sensitive species for the Rawlins Field Office area. See **Table 3.7-1, Threatened, Endangered and BLM Sensitive Species Potentially Occurring Within the EIS Analysis Area**. Based on the initial evaluation and screening of the listed species, one federal endangered, one federal threatened species, and thirteen BLM listed sensitive species may occur within the EIS analysis area. In addition, four federal endangered and two threatened species have been identified as susceptible to downstream water depletions in the North Platte River system. Discussions of these species follow.

Table 3.7-1, Threatened, Endangered and BLM Sensitive Species Potentially Occurring Within the EIS Analysis Area

Species Common Name	Scientific Name	USFWS Status/ or BLM Sensitive	Exclusion from Analysis	Reason for Exclusion from or Inclusion in Analysis
Mammals				
Long-eared myotis	*Myotis evotis*	Sensitive	Yes	No suitable habitat in EIS analysis area
Fringed myotis	*Myotis thysanodes*	Sensitive	Yes	No suitable habitat in EIS analysis area
Townsend’s big-eared bat	*Corynorhinus townsendii*	Sensitive	Yes	No suitable habitat in EIS analysis area
White-tailed prairie dog	*Cynomys leucurus*	Sensitive	No	Species documented in EIS analysis area
Black-tailed prairie dog	*Cynomys ludovicianus*	Candidate	Yes	EIS analysis area is outside of known range of this species

Species Common Name	Scientific Name	USFWS Status/ or BLM Sensitive	Exclusion from Analysis	Reason for Exclusion from or Inclusion in Analysis
Wyoming pocket gopher	*Thomomys clusius*	Sensitive	Yes	EIS analysis area is outside of known range of this species
Black-footed ferret	*Mustela nigripes*	Endangered	No	Potential habitat exists for this species in EIS analysis area
Swift fox	*Vulpes velox*	Sensitive	No	Potential habitat exists for this species in EIS analysis area
Birds				
White-faced ibis	*Plegadis chihi*	Sensitive	No	Suitable nesting habitat lacking in EIS analysis area. May be present as occasional migrant
Trumpeter swan	*Cygnus buccinator*	Sensitive	No	Suitable nesting habitat lacking in EIS analysis area. May be present as occasional migrant
Whooping crane	*Grus americana*	Endangered	No	Vulnerable to water depletions in Platte River system
Least tern	*Sterna antilla7rum*	Endangered	No	Vulnerable to water depletions in Platte River system
Eskimo curlew	*Numenius borealis*	Endangered	No	Vulnerable to water depletions in Platte River system
Piping plover	*Charadrius melodus*	Threatened	No	Vulnerable to water depletions in Platte River system
Mountain plover	*Charadrius montanus*	Sensitive	No	Species documented in EIS analysis area
Bald eagle	*Haliaeetus leucocephalus*	Threatened	No	Vulnerable to water depletions in Platte River system; observed in EIS analysis area
Northern goshawk	*Accipiter gentiles*	Sensitive	Yes	No suitable habitat in EIS analysis area

Species Common Name	Scientific Name	USFWS Status/ or BLM Sensitive	Exclusion from Analysis	Reason for Exclusion from or Inclusion in Analysis
Ferruginous hawk	*Buteo regalis*	Sensitive	No	Species documented in EIS analysis area
Peregrine falcon	*Falco peregrinus*	Sensitive	No	Potential foraging and nesting habitat along N. Platte River
Greater sage-grouse	*Centrocercus urophasianus*	Sensitive	No	Species documented in EIS analysis area
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	Petitioned for listing/Sensitive	Yes	No suitable habitat in EIS analysis area
Long-billed curlew	*Numenius americanus*	Sensitive	No	
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate/Sensitive	Yes	No suitable habitat in EIS analysis area
Burrowing owl	*Athene cunicularia*	Sensitive	No	Species documented in EIS analysis area
Sage thrasher	*Oreoscoptes montanus*	Sensitive	No	Species documented in EIS analysis area
Loggerhead shrike	*Lanius ludovicianus*	Sensitive	No	Species documented in EIS analysis area
Brewer's sparrow	*Spizella breweri*	Sensitive	No	Species documented in EIS analysis area
Sage sparrow	*Amphispiza belli*	Sensitive	No	Potential habitat exists for this species in EIS analysis area
Baird's sparrow	*Ammodramus bairdii*	Sensitive	Yes	Possible migrant only in EIS analysis area
Fish				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	No	Vulnerable to water depletions in Platte River system
Roundtail chub	*Gila robusta*	Sensitive	Yes	Activities in EIS analysis area would have no effect on Colorado River system

Species Common Name	Scientific Name	USFWS Status/ or BLM Sensitive	Exclusion from Analysis	Reason for Exclusion from or Inclusion in Analysis
Bluehead sucker	*Catostomus discobolus*	Sensitive	Yes	Activities in EIS analysis area would have no effect on downstream rivers systems supporting this species
Flannelmouth sucker	*Catostomus latipinnis*	Sensitive	Yes	Activities in EIS analysis area would have no effect on Colorado River system
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	Sensitive	Yes	Activities in EIS analysis area would have no effect on Colorado River system
Amphibians				
Northern leopard frog	*Rana pipiens*	Sensitive	No	EIS analysis area is within the range of this species and suitable habitat may exist
Great Basin spadefoot toad	*Spea intermontana*	Sensitive	Yes	EIS analysis area is outside of known range of this species
Boreal toad	*Bufo boreas boreas*	Candidate/ Sensitive	Yes	EIS analysis area is below the elevation range of this species

3.7.8.1 White-tailed Prairie Dog (BLM Sensitive)

In Wyoming, white-tailed prairie dogs inhabit grasslands and sparse shrublands east of the Continental Divide (Clark and Stromberg 1987). White-tailed prairie dogs feed on a variety of grasses, forbs and woody plants. Overgrazing by livestock may result in increased prairie dog density on favorable sites (Fitzgerald et al. 1994).

White-tailed prairie dogs typically form loosely organized colonies or towns. Burrow densities in towns surveyed within the Pilot Project area ranged from 3.6 to 20.6 per acre (TRC 2000). White-tailed prairie dogs are prey to a variety of predators including eagles, hawks, badgers, coyotes, foxes, black-footed ferrets and rattlesnakes (Campbell and Clark 1981).

White-tailed prairie dog towns are located throughout the EIS analysis area, particularly in the vegetative communities of low shrub/mixed grass, threadleaf sedge/mixed grass, mixed grass, and disturbed sites, as described in Section 3.6, Vegetation. See **Figure 46, Mountain Plover and Prairie Dog Habitat**.

3.7.8.2 Black-footed Ferret (Federal Endangered)

Black-footed ferrets were historically distributed throughout the high plains of the Rocky Mountain and western Great Plains regions. Their distribution was closely tied to white-tailed and black-tailed prairie dogs, their principal prey. Prairie dog burrows were also used by ferrets for shelter and denning.

Black-footed ferrets were considered extinct until a small population was discovered near Meeteetsee, Wyoming in 1981. Much of the current knowledge of this species is based on studies completed on the Meeteetsee population. Following an outbreak of distemper, all surviving ferrets were brought into captivity, and a captive breeding program was initiated (USFWS 2004). Since then, an experimental population of black-footed ferrets has been reintroduced in the Shirley Basin/Medicine Bow Special Management Area northeast of the Seminoe Road Project. The physical barrier imposed by Seminoe Reservoir and the Medicine Bow River precludes any potential movement of ferrets from this reintroduced population into the EIS analysis area.

White-tailed prairie dog towns represent potential habitat for black-footed ferret in the EIS analysis area. According to USFWS guidelines (2004), white-tailed prairie dog towns or complexes greater than 200 acres in size represent potential habitat for black-footed ferrets. A town complex is defined as two or more neighboring towns each less than 7 kilometers (approximately 4 miles) from the other. A number of towns met these criteria within the Pilot Project and Pipeline Project areas and were surveyed for ferrets by TRC (2002a, 2002e). The results of these 2002 surveys were negative.

3.7.8.3 Swift Fox (BLM Sensitive)

The swift fox resides in shortgrass and midgrass prairies over most of the Great Plains including central and eastern Wyoming (Clark and Stromberg 1987). The swift fox will also use agricultural lands and irrigated meadows. Swift foxes prey on a variety of small rodents, lagomorphs and birds. In many areas, cottontails and jackrabbits constitute the bulk of their diet (Fitzgerald et al. 1994).

The EIS analysis area is near the periphery of the known range of the swift fox, but expanses of shortgrass prairie are generally lacking within the EIS analysis area. Swift fox has not been observed within or in the vicinity of the EIS analysis area (WNHP 2004).

3.7.8.4 White-faced Ibis (BLM Sensitive)

The EIS analysis area is located within the breeding range of white-faced ibis, but suitable nesting habitat is essentially lacking. This species nests in small colonies in freshwater marshes or wet meadows. Backwater and associated riparian areas along the North Platte River within the EIS analysis area may provide marginal habitat for the white-faced ibis; however, the large annual water level fluctuations in Seminoe Reservoir preclude the development of suitable nesting habitat for white-faced ibis adjacent to reservoir shoreline. This species is most likely to occur within the EIS analysis area as occasional migrants or transitory birds in small wetlands surrounding stock ponds or in marshy areas along the North Platte River.

3.7.8.5 Trumpeter Swan (BLM Sensitive)

No known trumpeter swan breeding areas exist in the EIS analysis area (Dorn and Dorn 1990), and suitable nesting habitat is lacking. Trumpeter swan are most likely to occur as occasional spring and fall migrants on the North Platte River and Seminoe Reservoir.

3.7.8.6 Mountain Plover (BLM Sensitive)

The mountain plover was previously proposed as a federal candidate for listing as threatened or endangered, but its proposed listing has been withdrawn. Mountain plover is one of the few shorebirds that do not prefer habitats near or associated with water, but prefers to inhabit arid shortgrass prairie. Potential mountain plover habitat within the EIS analysis area includes low shrub/mixed grass, threadleaf sedge/mixed grass, mixed grass, disturbed sites and playas. See Section 3.6, Vegetation. Mountain plovers are relatively common in the low shrub/mixed grass habitats and in prairie dog towns.

3.7.8.7 Bald Eagle (Federal Threatened, Proposed for Delisting)

Summer bald eagle nesting habitat consists of large trees, cliffs or sheltered canyons associated with preferred food sources that consist of fisheries or waterfowl concentration areas along large rivers, lakes or reservoirs. During the non-breeding season (fall and winter), bald eagles forage along rivers and over uplands with big game carrion or prairie dog populations. Winter roosting sites are generally large trees protected from the weather along open water portions of rivers or on lakes and reservoirs where waterfowl are available as prey.

Potential bald eagle foraging, perching, and nesting habitat exists along the North Platte River. Bald eagles foraging along the river may occasionally fly over upland portions of the EIS analysis area.

3.7.8.8 Ferruginous Hawk (BLM Sensitive)

The ferruginous hawk inhabits grasslands, shrublands, and steppe-deserts of the Western United States. During the winter months, they migrate to similar habitats in the southwestern United States and northern Mexico. Foraging habitat consists of non-forested, non-mountainous areas such as desert shrub and grassland communities. Nesting habitat consists of low shrub or grassland communities with isolated trees, bluffs, buttes, rock outcrop and open country with rolling topographic relief. This hawk nests on a variety of substrates including rock outcrops or pillars, high points on open ground, and low trees or shrubs. Because of their habit of nesting on or near the ground, nest sites are often vulnerable to predation.

Carbon County contains one of the highest densities of ferruginous hawks in Wyoming. The BLM Rawlins Field Office and other entities have established a number of elevated nesting platforms in the region to improve ferruginous hawk nesting opportunities and nest security. Ferruginous hawk nests are scattered throughout the EIS analysis area, although many are currently inactive. Most of these nest sites are located on man-made rock pillars or natural rock outcrops.

3.7.8.9 Peregrine Falcon (BLM Sensitive)

On August 25, 1999, the American peregrine falcon was “delisted” as a federally endangered species. The EIS analysis area is located within the nesting range of the American peregrine falcon. The peregrine's preferred nest sites are rugged, remote cliffs (100 to 300 feet in height) that usually overlook water, marshes or riparian areas where prey is abundant (USFWS 1984). Preferred hunting areas include cropland, meadows, river bottoms, marshes and lakes that attract abundant bird life. Peregrines prey on small to moderate sized birds such as blackbirds, doves, robins, flickers, jays, meadowlarks, waterfowl and pigeons, and they can travel up to 17 miles to hunt (USFWS 1984).

Potential peregrine falcon foraging, perching and nesting habitats within the EIS analysis area exist along the North Platte River, although there are no records of nesting use in this area (WNHP 2004). Peregrine falcons may forage along the river and occasionally fly over upland portions of the EIS analysis area.

3.7.8.10 Greater Sage-grouse (BLM Sensitive)

Greater sage-grouse have declined throughout its range, although the causes of the decline have not been quantified (WGFD 2003). USFWS has reviewed petitions for listing the greater sage-grouse as threatened or endangered, but has determined that listing the greater sage-grouse is not warranted at this time (Federal Register 70(8): 2244-2249, 1/12/05). The WGFD has developed the *Wyoming Greater Sage-grouse Conservation Plan* (WGFD 2003) to identify reasons for the decline of sage-grouse and to increase the present distribution and abundance of sage-grouse in Wyoming.

Sagebrush with interspersed diverse native grass and forb understory is key to sage-grouse habitat (WGFD 2003). Sagebrush provides forage and nesting, security and thermal cover for sage-grouse. During the summer, moist areas that support succulent herbaceous vegetation are used as brood rearing habitat. During the winter, sage-grouse feed on sagebrush leaves and buds, and require sagebrush above snow (WGFD 2003).

Sagebrush habitat is available throughout the EIS analysis area, and open areas within the sagebrush vegetation serve as breeding areas (strutting ground or lek). A total of 10 active or historic sage-grouse leks are known to be located within the EIS analysis area, with an additional 10 leks located within 2 miles of the EIS analysis area boundaries. See **Figure 45, Wildlife Map**.

3.7.8.11 Long-billed Curlew (BLM Sensitive)

The EIS analysis area is located near the periphery of the breeding range of long-billed curlew. This Neotropical migrant winters along beaches and mudflats on the California coast and as far south as Honduras and Costa Rica (Ehrlich et al. 1988). This species nests in shortgrass prairie, rangeland, and meadows, usually near water. Meadows and grassland habitats along the North Platte River, Seminoe Reservoir, and stock ponds represent potential breeding habitat within the EIS analysis area. These species may also migrate through the EIS analysis area and utilize the shoreline areas of the North Platte River and the Seminoe Reservoir during their migration.

3.7.8.12 Burrowing Owl (BLM Sensitive)

Burrowing owls are a migratory species in Wyoming and are known to occur in the EIS analysis area. This species resides in the state from early March through October, typically in grasslands and mountain parks in or near prairie dog towns. Abandoned prairie dog holes are used for cover and nesting, and burrowing owls hide in burrows when they feel threatened. Families of owls remain together in a prairie dog town until they migrate south to Mexico and Central America to spend the winter.

3.7.8.13 Loggerhead Shrike (BLM Sensitive)

The loggerhead shrike is a summer resident in Wyoming and migrates to the southwestern United States and as far south as central Mexico in the winter (Ehrlich et al. 1988). This species prefers open country, thinly wooded, or scrubby land with clearings (Terres 1980). Robbins et al. (1989) indicate that this species has shown population declines over most of North America. Sagebrush and greasewood communities within the EIS analysis area represent suitable habitat for summer loggerhead shrike populations and this species was commonly observed during field surveys.

3.7.8.14 Sage Thrasher, Sage Sparrow and Brewer's Sparrow (BLM Sensitive)

These birds are summer residents in Wyoming and winter in the southwestern United States and Mexico. These birds breed in sagebrush habitats such as those found in the EIS analysis area. Field surveys documented the presence of sage thrasher and Brewer’s sparrow.

3.7.8.15 Northern Leopard Frog (BLM Sensitive)

The northern leopard frog occurs in Wyoming along the banks and in the shallow water areas of marshes, ponds, streams, lakes and reservoirs. Water bodies with rooted aquatic or emergent vegetation are preferred (Baxter and Stone 1985). Backwater areas of the North Platte River and upland stock ponds with rooted emergent vegetation represent suitable northern leopard frog habitat in the EIS analysis area. Large water level fluctuations in Seminoe Reservoir preclude the development of suitable northern leopard frog habitat along the reservoir’s shoreline.

3.7.8.16 North Platte River Species (Federal Threatened and Endangered)

No suitable habitat exists within or near the EIS analysis area for the whooping crane (endangered), least tern (endangered), pallid sturgeon (endangered), Eskimo curlew (endangered), and piping plover (threatened). However, important habitat areas do exist for these species along downstream portions of the Platte River system, particularly in Nebraska. The USFWS requires Section 7 Consultations where federal actions in the Platte River system result in water depletions.

3.8 Land Use

Dominant land uses within the region are agriculture (livestock grazing), recreation, mining, and oil and gas development. Specifics about land use within and adjacent to the EIS analysis area are set forth in **Appendix E, Regional Activity**.

3.8.1 Private and Public Lands

Mixed surface ownership occurs within the 137,000-acre EIS analysis area as shown on **Figure 2, Surface Ownership Map**. Ownership assumes a “checkerboard” pattern of mostly federal (>49%) and private (>49%) control. State lands are less than 1% of the EIS analysis area. Within this checkerboard surface ownership, the general public does not typically have access to the BLM lands because the public needs permission to cross private surface. Although two-track roads crisscross the entire EIS analysis area, use of these roads is restricted, and public access is limited, in particular to the shoreline of the Seminoe Reservoir.

3.8.2 Rangeland

The predominate land use activity within the EIS analysis area is livestock grazing. Portions of five BLM grazing allotments are contained within the EIS analysis area. See **Figure 47, Grazing Allotments**. Grazing management on BLM-administered lands is directed towards meeting and/or exceeding, “Healthy Rangeland Standards”. Presently, livestock grazing is permitted on all five allotments. Some range improvements, such as fencing and stock ponds, have been made to the BLM grazing allotments in this region. **Table 3.8-1, Allotment Summary**, displays permitted use and allotment management.

3.8.3 Residential and Urban Land

Residential and urban lands are outside of the EIS analysis area, primarily concentrated in the towns of Rawlins, Sinclair and Hanna. The community known locally as the “Boat Club” is located adjacent to Seminoe Reservoir north of the EIS analysis area (Section 9, T24N, R84W).

A few cabins and houses are located on privately owned surface north of the North Platte River in the EIS analysis area; these structures are used principally for recreational purposes.

The "Miller Bend" development is a grouping of (5-20 acres) lots located in Section 17, T22N, R85W. To date, only one building and well permit application has been received in this platted development.

Table 3.8-1, Allotment Summary[1]

	Allotment Name				
	Ft. Steele Breaks	**North Walcott**	**Quealey Block**	**Seminoe**	**Horseshoe Ridge**
Allotment Number	00816	00819	00820	10218	00807
Total Allotment Size (acres)	18,946	70,680	54,262	157,703	44,036
Allotment Size in EIS Analysis Area (acres)[2]	5,300	41,400	5,850	75,000	100
Percentage of Allotment in EIS Analysis Area (%)	28%	59%	11%	48%	>1%
Total Animal Unit Month (AUMs)[3]	790	2,348	3,848	11,066	2,279
Acres/AUM	23.98	30.10	14.10	14.25	19.32
AUMs/Acre	0.042	0.033	0.071	0.070	0.052
Class of Livestock	Cattle/Sheep	Cattle/Sheep	Cattle/Sheep	Cattle	Cattle/Sheep
Grazing System Management	Deferred Rotation	Year Long Permit	Year Long Permit	Deferred Rotation	Year Long Permit
Current Number of Cattle/Sheep Permitted[4]	67 Cattle 335 Sheep	425 Cattle	682 Cattle	1,808 Cattle	250 Cattle 1,249 Sheep

Notes:

1. For location of allotments, see **Figure 47, Grazing Allotments**.
2. Acreage calculations for allotments within EIS analysis area assume an estimated 9,350 acres for the Seminoe Reservoir at the high water level within the EIS analysis area.
3. AUMs = Animal Unit Month: the amount of forage required by an "animal unit" grazing for one month. The standard animal unit is defined as one mature 1,000 pound cow with a calf, or equivalent, and is based upon average daily forage intake of 26 pounds dry matter per day. That consumption, combined with a factor for tramping and waste of about 25%, results in an estimate of about 1,000 pounds of dry matter from forage to supply one animal unit each month.
4. Animal numbers may vary based on operator's annual application for use.

Source: BLM 2004, Murray personal communication

3.8.4 Mining

Surface and underground coal mining activities have and continue to be conducted on lands within and adjacent to the EIS analysis area. Much of the land disturbed by these coal mining activities has been reclaimed. The mines are now either closed, conducting reclamation work, or operating in a reduced capacity. See **Appendix E, Regional Activity**.

3.8.5 Recreation

No developed recreation facilities are operated by the BLM or the State of Wyoming within the EIS analysis area; however, developed recreation sites are located on Seminoe Reservoir north of the

EIS analysis area and on the North Platte River (Dugway Recreational Site) south of the EIS analysis area. Hunting is the primary dispersed recreation activity within and adjacent to the EIS analysis area, however, much of the hunting within the EIS analysis area is conducted through outfitters. Another popular recreational activity in the EIS analysis area is fishing, both on Seminoe Reservoir and on the North Platte River. See Section 3.11, Recreation and **Appendix E, Regional Activity**.

3.8.6 Oil and Gas

The Seminoe Road Pilot Project is the principal oil and gas development within the EIS analysis area; its target is coalbed natural gas. Attempts by the Proponent and others to develop conventional oil and gas resources within and immediately adjacent to the EIS analysis area have not been successful to date. Numerous exploration boreholes and wells have been drilled, but no economic oil and gas reserves have been discovered. One gas well, located on Windy Ridge north of the EIS analysis area, is reported to have been productive, but it is currently capped. (BLM, personal communication 2004a).

Oil and gas development and operations in the general area are discussed in **Appendix E, Regional Activity**.

3.8.7 Utilities

A WAPA 69kV transmission line and a Conoco high-pressure oil pipeline cross the EIS analysis area. See **Appendix E, Regional Activity**.

3.8.8 Land Use Plans and Policies

The EIS analysis area is zoned ranching, mining and agriculture and is located within an area recommended for oil and gas exploration and development (Carbon County Land Use Plan, Chapter 7, June 16, 1998).

The BLM Great Divide Resource Area RMP (dated November 1990) states that the area encompassed by the EIS analysis area is open to oil and gas leasing and operations.

3.9 Noise

Noise is defined as unwanted, disturbing sound. The impact of a noise source depends on the levels and characteristics of the background sound, as well as the characteristics of the sound.

Sound is transmitted through the atmosphere as low-intensity pressure waves. People can detect and respond to a wide range of sound intensities and frequencies.

The logarithmic decibel scale (dB) is used to indicate the intensity of sound. To measure sound on a scale that approximates the way people hear, more emphasis must be placed on those sound frequencies (or pitch) that people hear. EPA recommends the use of "A-weighted" sound pressure levels, expressed as A-weighted decibels or dBA, for analyzing community noise issues.

Table 3.9-1, Typical Range of Common Sounds, shows the range of dBA sound intensities that are produced by various noise sources. The threshold of human hearing is 0 dBA. Quiet whispers and birdcalls produce about 25 to 40 dBA. Ambulance sirens can reach 100 dBA, while a military jet takeoff with an after burner can exceed 140 dBA.

Table 3.9-1, Typical Range of Common Sounds

Noise Source (at a given distance)	A-Weighted Sound Level (dBA)
Military jet take-off with after burner (50 feet)	140
Commercial jet take-off (200 feet)	120
Ambulance siren (100 feet)	100
Power lawn mower (3 feet)	100
Motorcycle (25 feet)	90
Propeller plane flyover (1,000 feet)	90
Diesel truck, 40 mph (50 feet)	90
Garbage disposal (3 feet)	80
Passenger car, 65 mph (25 feet)	70
Vacuum cleaner (3 feet)	70
Normal conversation (5 feet)	60
Light traffic (9,100 feet)	50
Birdcalls (distant)	40
Soft whisper in quiet room (5 feet)	30
Recording studio	20
Threshold of hearing	0

Because decibels are a logarithmic scale, a doubling of the sound pressure corresponds to a noise increase of 3 dBA. For example, a single bulldozer typically produces about 85 dBA of noise at a distance of 50 feet from the bulldozer. Therefore, two identical bulldozers operating side-by-side (with each bulldozer producing 85 dBA) produce a theoretical noise level of 88 dBA.

Many factors determine whether an increase in the noise level above the existing background is "audible." The most important factor is the nature of the new noise source as compared to the nature of the background noise. In the case of the proposed Seminoe Road Project, the noise caused by drilling activities would be different from the rural background sounds, so relatively small increases in noise levels caused by the mechanical equipment would be noticeable.

The EIS analysis area is unpopulated and relatively remote. There are no permanently occupied residences or human receptors in the vicinity of the project area. The closest site with daily, year-around human activity is the “Boat Club” area, which is located approximately 1 mile north of the northern boundary of the EIS analysis area (Section 9, T24N, R84W). An undeveloped fishing site known locally as Coal Creek Bay is used by local fishermen. This site is located within the project boundary in Section 12, T24N, R85W. These sites, along with the Seminoe Reservoir, experience year-round daily recreational use.

In general, the background noise of the EIS analysis area would be relatively quiet, with wind noise being a principal sound source. The existing Pilot Project creates some noise, as a result of propane-powered water pumps. In addition, traffic along Carbon County Road 351 (Seminoe Road) would generate noise. There could also be localized noise from all-terrain vehicles (ATVs), dirt bikes, and/or four-wheel drive vehicles using the two-track roads in the area, as well as the occasional over flight by jet aircraft. In addition, recreationists on Seminoe Reservoir and at shoreline campgrounds would create noise with powerboats, jet skis, trailers, stereos, parties, and bug zappers.

Neither Carbon County, the state of Wyoming nor the BLM has noise regulations that would affect natural gas development and operations in the EIS analysis area. In 1974, the EPA established a 24-hour average level of 55 dBA as a guideline threshold for acceptable environmental noise. This level is used as a general basis for evaluating effects from noise when no other local, county or state standards have been established. Typically, this guideline level would be directed at areas where people would live and work, not the remote region found in the EIS analysis area; however, this 55 dBA threshold level would serve as a general target level by which to assess noise levels at the Seminoe Road Project.

OSHA regulations require worker hearing protection when noise levels exceed 90 dBA. See **Table 3.9-2, Permissible Occupational Noise Exposures**.

3.10 Cultural Resources

3.10.1 Introduction

Cultural resources on public lands, including prehistoric and historic properties, are protected by various laws and regulations. The most notable federal regulation is the National Historic Preservation Act (NHPA) of 1966, as amended with its implementation regulations contained in 36

Table 3.9-2, Permissible Occupational Noise Exposures[1]

Sound Level (dBA)	Duration (hr/day)
90	8
92	6
95	4
97	3
100	2
102	1.5
105	1
110	0.5
115	$\leq$0.25

Notes:
1. U.S. Department of Labor, "Occupational Noise Exposure," Code of Federal Regulations, Title 29, Part 1926.

CFR 800. The laws and regulations require that any proposed activities, which disturb public lands, take into consideration the effects of the activities on significant cultural resources. herefore, cultural resources within the disturbed area boundaries of the Seminoe Road Project must be identified and evaluated. The laws and regulations require that appropriate mitigation measures be taken to prevent, minimize, or mitigate adverse effects to cultural resources included in, or eligible for, the National Register of Historic Places (NRHP).

The existing cultural resource database for the Seminoe Road Project analysis area indicates that roughly 16% of the area has been inventoried for cultural resources, and 277 sites have been recorded. Based on the existing inventory, 44% of the recorded sites are eligible or recommended to be eligible for the NRHP, while 40% are ineligible and 16% remain unevaluated. A description of these existing inventoried sites is discussed later in this section. Potential for impacts to cultural resource sites and the procedures for analyzing the potential impacts are discussed in Section 4.10, Cultural Resources.

This section of the Seminoe Road EIS contains a summary of the cultural chronology of the general region, a summary of the previous cultural resource investigations, a description of existing cultural resources and the potential for new cultural resources in uninventoried areas.

3.10.2 Cultural Chronology of the General Region

Archaeological investigations in the Wyoming Basin indicate that this region was occupied by prehistoric people for more than 11,000 years, from the Paleoindian through Protohistoric periods. The Wyoming Basin prehistoric chronology, with periods, phases, and ages is presented in **Table 3.10-1, Prehistoric Chronology of the Wyoming Basin**.

Table 3.10-1, Prehistoric Chronology of the Wyoming Basin

Period	Phase	Age (B.P.)[1]
Paleoindian	NA	12000 – 8500
Archaic		
Early Archaic	Great Divide	8500 – 6500
	Opal	6500 – 4300
Late Archaic	Pine Spring	4300 – 2800
	Deadman Wash	2800 – 2000/1800
Late Prehistoric	Uinta	2000/1800 – 650
	Firehole	650 – 300/250
Protohistoric	NA	300/250 - 150

Note:
1. B.P. = Before Present

The following discussion of the cultural chronology of the Wyoming Basin includes sites that are not necessarily located within the Seminoe Road Project analysis area.

3.10.2.1 Paleoindian Period

The oldest period for which there is solid archaeological evidence is the Paleoindian, beginning circa 12,000 years before present (B.P.) and ending around 8500 B.P. This is the transition period from the periglacial conditions of the Wisconsin Ice Advance during the terminal Pleistocene to the warmer and drier climate conditions of the Holocene. A savanna-like environment with higher precipitation than occurs today was prevalent in southwest Wyoming. Paleoindian sites are relatively rare, although isolated surface finds of Paleoindian projectile points are not uncommon and suggest that site preservation may be a major factor affecting the number of known sites. The Paleoindian tool assemblage includes lanceolate points, gravers, and end-scrapers. Within the Wyoming Basin, about twenty sites with Paleoindian components have been excavated, including the Seminoe Beach Site (48CR1166), located about 1 mile north of the EIS analysis area.

3.10.2.2 Archaic Period

Settlement and subsistence practices in the Wyoming Basin remained largely unchanged from the end of the Paleoindian Period through the Archaic Period. In some places these practices continued until at least the introduction of the horse and historic contact. Reduced precipitation and warmer temperatures prevailed until 8500 B.P. This environmental change led to a pattern of broad spectrum resource exploitation associated with more diverse subsistence and settlement practices. The Archaic Period is divided into the early and late periods, which are subdivided into the Great Divide and Opal and the Pine Spring and Deadman Wash phases, respectively. Large side- and corner-notched dart points were used for hunting. The presence of groundstone implements suggests a greater use of plant resources during the Archaic Period. Faunal assemblages from Archaic components document increased use of small animals. Large side-notched points from areas adjacent to the Wyoming Basin occurred as early as 7000 B.P. Within the Wyoming Basin at least 30 sites with Archaic Period components have been excavated. At least three such sites are in the general vicinity of the EIS analysis area, including the Scoggin site, the Muddy Creek site, and the Shoreline site (48CR122). The Shoreline site located within the Seminoe Road Project analysis area has been radiocarbon dated to 5000 – 5220 B.P.

The remains of dwelling structures referred to as houspits also appear during this period. At least twenty sites with housepits are known in Carbon County. Housepits from this period generally consist of semi-subterranean dwellings with interior hearths, storage pits and other interior features. At least one housepit was identified during excavation of the Shoreline site, which is located within the Seminoe Road Project analysis area.

3.10.2.3 Late Prehistoric Period

The Late Prehistoric Period in the Wyoming Basin dates between 2000/1800 B.P. and 300/250 B.P. and is subdivided into the Uinta and the Firehole phases. Large scale seed processing and an increase in the number of cultural features is noted in the Late Prehistoric Period, as is the presence of pottery and the introduction of bow and arrow technology. A characteristic of the Uinta phase is clusters of semi-subterranean structures dating to 1050 B.P. In the southern Wyoming Basin, west of the current EIS analysis area, at least two different types of structures have been identified; a more substantial, cold weather habitation structure at the Nova site and a less substantial, warm weather structure serving more as a windbreak at the Buffalo Hump site.

The Firehole phase is distinguished from the preceding Uinta phase by a dramatic decline in components that have been radiocarbon dated to that phase, possibly reflecting a decline in population density. Several sites within the EIS analysis area have Late Prehistoric components as well as Archaic components. Two of these sites are the Seminoe Beach and Shoreline sites that were previously described in Section 3.10.2.2, Archaic Period.

3.10.2.4 Protohistoric Period

The Protohistoric Period generally begins after 300 years B.P. with the introduction of European trade goods into the area, and ends with the development of the Rocky Mountain fur trade approximately 150 years ago. The Wyoming Basin was the heart of Shoshone territory during this period although there were occasional forays into the area by other peoples such as the Crow and the Ute. The most profound influence on native cultures during this time was the introduction of the horse, enabling Native Americans to expand their range. All forms of rock art denoting horses, metal projectile points and other metal implements and other Euro-American trade goods are associated with the Protohistoric Period. Metal projectile points associated with this period have been recovered from both surface and subsurface excavations in the Wyoming Basin. At least ten sites with Protohistoric components have been identified within the EIS analysis area.

3.10.2.5 Historic Period

Historic use of the Wyoming Basin has been influenced largely by the exploitation of various natural resources, including rangeland, minerals, timber, and surface water. Areas with difficult terrain and limited or no exploitable natural resources have remained largely unsettled and have been used only for limited ranching. (See **Table 3.10-2, Historic Chronology of the Wyoming Basin**).

Table 3.10-2, Historic Chronology of the Wyoming Basin

Phase	Age A.D.
Pre-Territorial	1842-1868
Territorial	1868-1890
Expansion	1890-1920
Depression	1920-1939
Modern	1939-Present

The Pre-Territorial and Territorial phases are represented to the south of the EIS analysis area by the Transcontinental Railroad and Fort Fred Steele, both of which date to the 1860s.

Homesteading as well as sheep and cattle ranching began in this area during the Territorial phase in the 1870s. The expansion, depression and modern phases are dominated within the EIS analysis area by a coal mining theme, which began in the late 19th Century and continues to the present. The modern phase includes continued ranching as well as the 1930s era construction of Seminoe Reservoir and by ongoing coal and oil and gas developments.

3.10.3 Summary of Previous Cultural Resource Investigations

Research conducted through the Wyoming Cultural Records Office provided information on the previous archaeological work and recorded cultural resources sites within the EIS analysis area. A total of 136 cultural resource investigations have been conducted in the past within the analysis area, covering 22,434 acres (or 16% of the analysis area). Nearly all of these investigations (130) have been Class III Intensive Inventories. The other six investigations consisted of Class II

Sampling Inventories, test excavations, and construction monitoring. All past investigations were conducted between 1975 and 2002. Past investigations were conducted to provide NHPA compliance for various projects including coal mining, seismic exploration, oil and gas well and pipeline construction, access roads, and transmission lines. The majority of these cultural resource investigations have covered relatively small areas, mostly in the 20 to 50 acre range, including 10 acre blocks for well sites and 100 foot corridors for seismic lines, access roads, and pipelines. Several larger block investigations have been conducted for coal mining projects, involving between 1,000 and 4,800 acres per inventory.

3.10.3.1 Summary of Recorded Cultural Resources

A total of 277 sites have been recorded within the EIS analysis area, consisting of 262 prehistoric sites (95%), eight of which have historic components and fifteen historic sites (5% of total). Most of the prehistoric sites are described as prehistoric campsites with lithic scatters and/or hearths. Tipi ring or stone circle sites, some of which can also be interpreted as campsites, are the second most numerous prehistoric site types comprising 11% of the total prehistoric sites. The remaining 14% of the total prehistoric sites consists of one large lithic procurement site, two human burials, three bison/processing sites, several cairn sites and one housepit site.

3.10.3.2 National Register of Historic Places Sites

The Wyoming SHPO lists 23 (8%) of the 277 recorded cultural resource sites as eligible for the NRHP. An additional 100 sites (36%) have been field evaluated as eligible but presently lack SHPO concurrence. The SHPO database lists 111 sites (40%) as ineligible for the NRHP. The remaining 43 sites (16%) are unevaluated for the NRHP. However, those sites, which are unevaluated, that are managed as though they are eligible to the NRHP until they are formally evaluated; at which time they are managed according to the formal eligibility determination.

3.10.3.3 Prehistoric Sites

Prehistoric open campsites comprise the majority of the total cultural resource sites within the Seminoe Road Project analysis area, as shown in **Table 3.10-3, Summary of Prehistoric and Historic Sites Within the Seminoe Road Analysis Area**. Ninety percent of the prehistoric sites in this category contain hearth remains, and most also contain lithic reduction debris and/or groundstone.

Table 3.10-3, Summary of Prehistoric and Historic Sites Within the Seminoe Road Analysis Area

Site Type	Number of Sites	Percent of Site Type
Prehistoric Sites		
Open campsite, with hearths and/or flaked stone/groundstone lithics	193	71
Tipi ring/stone circle sites	29	11
Lithic scatters	34	12
Sites with human remains	2	0.7
Kill/butchering sites	3	1.0
Housepit sites	1	0.4
Total Prehistoric Sites	**262**	
Historic Sites		
Mine Sites	4	1.4
Stockherding camps	5	1.8
Historic transmission line segments	3	1.0
Historic trash scatters	3	1.0
Total Historic Sites	**15**	
Notes: Site types and sites containing less common/rare components and features (e.g. ceramics and stone circles,) are listed separately.		

Prehistoric campsites are present throughout the Wyoming Basin and generally are interpreted as representing short-term activities (lithic reduction, food preparation, and short-term occupation). One lithic procurement site (48CR2680) has been recorded in the EIS analysis area. Lithic procurement sites or quarries occur where raw materials such as cherts and quartzite were obtained from natural geologic deposits and initially processed for use in making flaked stone tools. Ceramics are rare in the project area. Only three sites containing pottery have been recorded, all of which have been identified as Shoshonean. Two sites with steatite have also been identified. These materials are generally associated with the Uinta phase of the Late Prehistoric Period. Also, Late Prehistoric glass trade beads have been identified at three sites. As noted earlier, one site within the EIS analysis area contained at least one semi-subterranean housepit, apparently dating to the early portion of the Late Prehistoric Period.

Two bison kill/butchering sites, 48CR74 and 48CR4112 have been recorded within the project analysis area. Site 48CR74 was reported as a bison trap, located at the head of a canyon. One or more hunting blinds and several stone circles were associated with this discovery. Site 48CR4112 was described as a butchering site, located on a river terrace, and containing a quantity of bison bone and hearth remains.

A few sites located within and immediately surrounding the EIS analysis area have been identified as being sensitive or sacred to Native Americans. These sites may include human burials, some rock alignments, and rock art. Consultation with appropriate Native American tribes concerning these areas of sacred or sensitive significance for traditional, cultural, or religious purposes will occur in accordance with the NEPA, the NHPA, the Federal Land Policy and Management Act, the American Indian Religious Freedom Act, and Executive Order 13084 on Consultation and Coordination with Indian Tribal Governments. Please refer to Section 4.10.5, Native American Consultation. Two sites listed as human burials have been recorded within the project site. A bundle burial, site 48CR933, was excavated by the University of Wyoming in the 1970s. No date was given for this site, although the bone beads associated with it suggest that it may date as early as the Late Archaic Period. Another burial, site 48CR405, was recorded in the early 1980s within the project area. This site was reported as a rock crevice burial, heavily disturbed and containing only two human bones. Glass trade beads and a small side-notched projectile point associated with this burial suggest a Late Prehistoric affiliation. Only three of the known sites within the EIS analysis area contain rock alignments, which may be the remains of disturbed tipi rings/ceremonial features, or linear alignments possibly associated with hunting. Rock art, which is primarily composed of pictographs or petroglyphs has not been identified within the project area boundaries.

A number of tipi ring or stone circle sites were identified in the database for the EIS analysis area. In addition to their presumed use to anchor hide covered tipis, stone circle sites may also have Native American religious significance.

3.10.3.4 Historic Sites

There are 15 historic sites that have been formally recorded within the EIS analysis area. Four of the historic sites are described as mines, five are sheep or cattle herder's camps, three are segments of an historic transmission line, and the remaining three are historic trash scatters. According to the 1883-1884 GLO Plats for the EIS analysis area, there appears to be two historic ranches also located within the project area. However, neither of these former ranches have been formally recorded and therefore are not included in the fifteen historic sites. It does appear however, that one of these ranches, the "Dorrety's Ranch" was probably covered by water when the Seminoe Dam was constructed.

The four mines that have been formally recorded consist of two mines described as gold mines and two described as "wagon" mines. The gold mines were reportedly operated sporadically between circa 1900 and as late as the 1950s era. The wagon mines were actually small coal mines and were only used by individual ranchers to obtain fuel for their own use and were fairly common in the late 19th-20th Century era. The coal mines were generally located on the surface where the coal outcropped. They were mostly on public domain and were usually operated informally without legal title to the minerals.

In addition to the fifteen recorded historic sites, the 1983-1984 GLO Plats show approximately eight historic wagon road segments, none of which have been formally recorded. One segment bears the name “Ferris” while the rest are unnamed. A few of these roads appear to roughly correspond to unimproved roads shown on the current quadrangle maps and at least one of these wagon roads is currently an improved county road. These wagon roads apparently served mostly local uses. There are no immigrant trails or other known historically-significant trails within the EIS analysis area.

3.10.3.5 Excavated Sites

Archaeological excavations have been conducted at a number of sites both within the EIS analysis area and the surrounding area. Excavated sites within the project area include the Shoreline site and site 48CR4112. Both of these are prehistoric campsites with hearths and butchered bone and both are located within about one-half mile of the North Platte River or Seminoe Reservoir. Excavated sites outside of the Seminoe Road analysis area but within 1 to 4 miles of the project boundaries include the Seminoe Beach site and the Scoggin site and several sites in the Seminoe coal mine area located east of the project. The Seminoe Beach site has yielded Hell Gap, McKean, and later artifacts demonstrating occupation from the late Paleoindian through the late Prehistoric periods. The Scoggin site is an Early Archaic bison kill/butchering site with McKean artifacts.

3.10.4 Site Frequency and Distribution

Based on the existing inventory in the EIS analysis area (22,434 acres inventoried) and the 277 previously recorded sites, a site density of 0.01 sites/surveyed acre or one site per 81 acres can be assumed. Projecting this average to the entire EIS analysis area, it could be assumed based on the existing data that an additional 1,400 sites could occur in the EIS analysis area.

3.10.5 Archaeologically Sensitive Areas

Archaeologically sensitive areas within the EIS analysis area would include the North Platte River valley and its adjoining terraces, bluffs, and side ravines, as well as its larger tributaries. Existing data for these areas demonstrate a high potential for significant sites, including but not limited to open campsites, lithic scatters, and kill/butchering sites. Because of the deeper soil depth in the alluvial depositional areas, there is potential for undisturbed archaeological sites from the Paleoindian through the Protohistoric periods. Areas of stabilized dunes and sand sheets also have potential for sites of these types. Additionally, most of the prominent topographic features, including hills and ridges such as the Cedar Ridge in the southern portion of the EIS analysis area may have relatively higher archaeological potential, especially for ceremonial sites. Areas containing surface deposits of siliceous lithic materials have potential for lithic procurement/quarry sites. Prehistoric campsites and lithic scatters may also occur in proximity to playa depressions and areas of more open, flat lands such as in the central portion of the EIS analysis area, south of the North Platte River.

3.10.5.1 Topography and Physiography Associated With Known Sites

The distribution of cultural sites within the EIS analysis area has been influenced by various environmental conditions, including topography, physiography, proximity to reliable water sources, and soil deposition, all of which are known to be factors in archaeological site formation and preservation. The known concentration of sites along the North Platte River suggests a preference for the floodplain and terrace areas, possibly related to higher concentrations of game and/or other food resources. Similarly, a relatively high number of sites occur in the stabilized dune formations as well as draws, which provide additional hunting opportunities. At least two bison kill sites are known in these areas. Several of the previously recorded cultural sites were discovered on relatively flat areas and in areas where soils averaged plus or minus 50 centimeters in depth. Nearly a third of the EIS analysis area has slopes generally less than 13 degrees and about half the project area has soils averaging greater than 50 centimeters. Areas with the deepest soils generally occur on the terraces, fans, floodplains and bottomlands and to some extent in Aeolian deposits. The eroded soils, which occur in about 25% of the EIS analysis area, and specifically in the northwestern portion, may be a factor in exposing buried archaeological sites. Based on the favorable topography, the grazing potential, and the known mining and ranching activities in the area, it can be assumed that the potential exists for more historic sites, including ranching and homestead structural remains, and adits and small surface coal mining pits.

Although there is no definitive means to accurately project how many and what typed of resource sites may be contained within the EIS analysis area, existing information on known recorded sites can be used and projected to areas within the project boundaries that have not been inventoried.

This includes using existing site frequency and distribution information, as well as knowledge of archaeologically sensitive areas associated with known sites and projecting this information to unknown areas within the project boundaries.

3.11 Recreation

There are no developed recreation facilities within the EIS analysis area. Recreation in the area is dispersed in nature, except at Seminoe State Park (and its associated facilities) and at the BLM Dugway Recreation Site.

The dominant dispersed recreation activity in the EIS analysis area is hunting, which mainly occurs during the fall hunting seasons. Due to the checkerboard land ownership patterns, most hunters access the area only by permission from the private landowners. Some landowners also have agreements allowing licensed outfitters to use private lands. Without landowner permission, hunters can use BLM administered lands with public access, but they cannot use private land.

Other dispersed recreation in the EIS analysis area includes boating (on Seminoe Reservoir), fishing, driving for pleasure and sight-seeing, horseback riding, target shooting, partying, camping and hiking. Like hunting, dispersed recreational access is limited by the checkerboard land ownership pattern.

Approximately 9 miles of the Seminoe Road (Carbon Country Road 351) passes through the EIS analysis area (see **Figure 1, General Location Map**). The BLM has designated the Seminoe Road from Sinclair to Alcova as a “National Back Country Byway.” The BLM uses this designation to inform the public of roadways that provide visitors and recreationists an opportunity to see historic, scenic or unique natural environments. Travelers on Seminoe Road would have the opportunity to observe wildlife (antelope, mule deer, bighorn sheep, golden eagles and ferruginous hawks). The road crosses the rugged Seminoe Mountains and accesses the Miracle Mile, a blue-ribbon trout fishery on the North Platte River. North of the EIS analysis area, the road passes by huge sand dunes, which are part of the Killpecker Sand Dunes, a dune field which reaches from western Wyoming into Nebraska.

In winter, the area lacks sufficient snow to be desirable for snow-shoeing, cross-country skiing or snowmobiling; however, ice-fishing is a popular activity on Seminoe Reservoir, particularly at Coal

Creek Bay, an arm of Seminoe Reservoir that is within the project area. It is popular for bank and boat fishing, as well.

Developed recreational areas outside of the EIS analysis area include (see **Figure 19, Regional Activity)**:

- Seminoe State Park;
- The Miracle Mile; and,
- Dugway Recreation Site.

Seminoe State Park is a developed park managed by the State of Wyoming, and this park includes Seminoe Reservoir and facilities for camping picnicking, fishing, boating and water skiing. Primitive camping is allowed along the shoreline. The reservoir is approximately 20,300 acres in size with about 180 miles of shoreline.

The Miracle Mile is a 5 ½-mile stretch of blue ribbon trout fishing stream located below the Kortes Dam north of the project site. The Miracle Mile is a popular fishery, where non-locals generally outnumber locals. The Bureau of Reclamation manages the recreation at the Miracle Mile area; however, this agency does not keep daily user visit counts or visitor days. Traffic counts immediately adjacent to the Miracle Mile reveal that 43,400 vehicles passed through this area in 2003, although some of these may not have been recreational visitors.

The Dugway Recreation Site is located on Seminoe Road adjacent to the North Platte River about 3/4 mile southwest of the EIS analysis area boundary. It is available for day and overnight use. Facilities include a campground, a picnic area, a toilet and a water well.

3.12 Transportation

The transportation analysis for the Seminoe Road Project includes I-80, Wyoming State Highway 30, County Road 351 (known locally as the "Seminoe Road"), and the roads within the EIS analysis area. The roads within the region are shown on **Figure 1, General Location Map**.

Traffic loads/traffic counts are identified as average daily traffic (ADT). ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles passing a specific point on a particular road from either direction.

The Wyoming Department of Transportation estimates ADT values based on actual traffic counts made at various locations along federal, state and county roads. See **Table 3.12-1, Traffic Counts for 2003**.

Table 3.12-1, Traffic Counts for 2003[1]

Location[2]	Average Daily Traffic	Estimate (%) of Commercial Trucks (greater than 10,000 lb-gross vehicle weight)
Interstate 80 at Walcott	11,540	54%
Interstate 80 at Sinclair	12,410	53%
Interstate 80 at Rawlins	11,620	54%
Highway 30 (287) at Walcott, just north of Interstate 80	1,200	22%
Highway 130, just south of Interstate 80, connecting to Saratoga	1,390	10%
Highway 72, just north of intersection with Interstate 80 connecting to Hanna	1,560	4%
Highway 72, just south of intersection with Interstate 80 connecting with Elk Mountain	290	14%
County Road 351 (Seminoe Road) at Sinclair	308	4%
County Road 351 at North Platte River (Miracle Mile)	118	Not available

Notes:
1. Traffic counts based on 2003 data obtained from the Wyoming Department of Transportation (WDOT, 2003)
2. See **Figure 1, General Location** Map and **Figure 19, Regional Activity**.

3.12.1 Interstate 80

I-80 is a major U.S. highway that traverses Wyoming from east to west. It serves as a main commercial truck route in the central Rocky Mountain region and over 50% of the traffic on I-80 in Carbon County, Wyoming, is 18-wheelers. See **Table 3.12-1, Traffic Counts for 2003**.

I-80 is an asphalt and concrete, all-weather four-lane highway. In Carbon County, this highway is generally flat. This highway provides exit access to the communities of Rawlins, Sinclair, and Walcott.

3.12.2 Highway 30 (287)

Highway 30 (287) is an asphalt, all-weather two-lane highway. In Carbon County, this road intersects with I-80 at Walcott and generally traverses the county in an east-west direction, passing south of Hanna but through Medicine Bow. Before the construction of I-80, Highway 30 (287) was the primary east-west highway in Carbon County serving commercial, tourist and local traffic. Today, the role of this road as a major commercial routing is greatly reduced; however, during extreme winter conditions (snow storms, ground blizzards), Highway 30 (287) is sometimes used as an alternate for I-80 between Laramie and Walcott.

3.12.3 Highway 72

Highway 72 is an asphalt, all weather two-lane highway. North of I-80, this road connects with Hanna. South of I-80, it connects with Elk Mountain. Highway 72 is principally used by local residential and commercial traffic.

3.12.4 Highway 287

Highway 287 is an asphalt all weather two-lane highway that traverses north-south in Carbon County. The portion of Highway 287 north of Rawlins is a primary route for local and commercial traffic to the communities of Lander, Riverton and Casper. Tourists also utilize this road for access to the Grand Teton and Yellowstone National parks.

3.12.5 Highway 130

Highway 130 is an asphalt, all-weather two-lane highway. In Carbon County, this road intersects I-80 near Walcott and traverses to the south to connect with Saratoga. South and east of Saratoga, Highway 130 passes through the Medicine Bow National Forest, crosses over Snowy Range Pass (at elevation of 10,847 feet), passes through the community of Centennial, and eventually connects to Laramie.

3.12.6 County Road 351 (Seminoe Road)

Carbon County Road 351 (Seminoe Road) originates in Sinclair, bisects the EIS analysis area in a general north-south orientation, and provides access to Seminoe Reservoir and "Miracle Mile" on the North Platte River, then continues to Alcova, where it intersects State Highway 220 (the main road to the city of Casper).

From Sinclair through the EIS analysis area, the Seminoe Road is an asphalt, all-weather two-lane highway. Recent construction and paving have greatly improved the condition of the road within and south of the EIS analysis area. Seminoe Road has been designated a National Back Country Byway by the BLM (see Section 3.11, Recreation).

Approximately 10 miles north of the northern boundary of the EIS analysis area, the asphalt pavement ends, and the Seminoe Road becomes a graveled all-weather road.

3.12.7 Existing Roads Within EIS Analysis Area

An estimated 300 miles of two-track roads currently exist within the EIS analysis area. Most of these roads are unimproved and inaccessible during wet periods and often during winter months. However, of this total, nearly 7 miles of all-weather gravel roads service the existing wells at the Pilot Project, and an estimated 10 miles of improved gravel roads provide access to the area north of the North Platte River in the southwest corner of the EIS analysis area.

Given the “checkerboard” surface land ownership pattern of the EIS analysis area (see **Figure 2, Surface Ownership Map**), the public has limited access to the project area. Although roads on BLM-administered lands are generally open to the public, these roads are typically closed to public access once they cross onto the privately-owned land surface.

3.13 Visual Resources

Broad stretches of moderate to flat topography characterize the majority of the EIS analysis area, although the landscape is periodically interrupted with rock outcroppings and eroded drainage channels. A series of ridges occur in the southern portion of the EIS analysis area, and these ridges obscure the site from I-80. Localized steep topography, including eroded cliff faces, exists in several places along the shoreline of the North Platte River and Seminoe Reservoir, which bisect the EIS analysis area.

The EIS analysis area landscape is vegetated with grasses and shrubs, with only a few scattered cottonwood trees present along the banks of the North Platte River. The dominant colors in the area range from light to moderate greens in the springtime and early summer, to yellows and browns in the summer and the fall with sagebrush being grey-green year-around. The Seminoe Reservoir interrupts the existing landscape with a dominant bluish coloring; however, with recent drought conditions and low water levels, the shoreline of the reservoir presents a stark edging of light brownish coloration.

Five key observation points (KOP) were established within and adjacent to the EIS analysis area to establish the general visual conditions. They do not include every possible viewpoint within the EIS analysis area. However, they provide representative views of the area and several are located at high points along CR 351 where drivers can see a vast expanse of the EIS analysis area. The locations of these KOPs are shown on **Figure 48, Visual Resource Management**, and the photographs taken from these sites are shown as:

- **Figure 49, Key Observation Point #1,**
- **Figure 50, Key Observation Point #2,**
- **Figure 51, Key Observation Point #3,**
- **Figure 52, Key Observation Point #4, and**
- **Figure 53, Key Observation Point #5**.

Two important factors considered in selecting the KOPs were 1) points where the most viewers would see the project and 2) the length of time they would see the project. Most viewers would see the project from Seminoe Road, where they would view portions of the project for approximately 9 miles. In addition, as stated in Section 3.11, Recreation, the Seminoe Road has been designated as a “National Back Country Byway” by the BLM.

3.13.1 Visual Resource Management Classes

BLM uses VRM classes to represent the degree of acceptable visual change within a characteristic landscape. A class is based on the physical and sociological characteristics of any given homogenous area and serves as a management objective. The objectives for the four classes as described in the BLM VRM manual 8432 are described below:

Class I Objective. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. **There are no Class I VRM areas in the EIS analysis area.**

Class II Objective. The objective to this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. Approximately 55% of the EIS analysis area is designated as Class II VRM area. See **Figure 48, Visual Resource Management**.

Class III Objective. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. Approximately 45% of the EIS analysis area is designated as Class III VRM area. See **Figure 48, Visual Resource Management**.

Class IV Objectives. The objective of this class is to provide for management activities, which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements. **There are no Class IV VRM areas in the EIS analysis area.**

Under the existing Great Divide RMP dated November 1990, the EIS analysis area contains both Class II and Class III areas (BLM 1990). See **Figure 48, Visual Resource Management**. Approximately 55% of the EIS analysis area is Class II, while 45% is Class III.

3.14 Socioeconomics

The EIS analysis area is located in Carbon County, which covers nearly 8,000 square miles, making this county the third largest in size in Wyoming. This section provides an overview of the existing socioeconomic conditions of Carbon County, with particular focus on the city of Rawlins where such data is available. Other cities included in this overview are Hanna and Sinclair; information about these two Carbon County towns is included where data are available and pertinent.

3.14.1 Population

As of 2000, Carbon County had an estimated population of 15,639 persons, which was approximately 3.2% of the 2000 Wyoming population. The town of Rawlins, the county seat of Carbon County, had a population of 9,006 persons. Census populations for 1970 through 2000 for Wyoming, Carbon County, Rawlins and other nearby towns are set forth in **Table 3.14-1, Historic Populations**.

Carbon County and the towns of Rawlins, Hanna and Sinclair have experienced declining population since the 1980 census. This is primarily the result of a declining economic environment over the past two decades caused by decreased coal and oil and gas production in the county.

Table 3.14-1, Historic Populations

Place	1970	1980	% Change 1970-80	1990	% Change 1980-90	2000	% Change 1990-2000
Wyoming	332,416	469,557	41%	453,589	(3%)	493,782	9%
Carbon County	13,354	21,896	64%	16,659	(24%)	15,639	(6%)
Rawlins	7,855	11,547	47%	9,380	(19%)	9,006	(4%)
Hanna	460	2,288	397%	1,076	(53%)	873	(19%)
Sinclair	445	586	32%	500	(15%)	423	(15%)
Source: U.S. Department of Commerce, Bureau of the Census ( ) denotes negative decline							

Although Wyoming expects moderate population growth into the future, population in Carbon County is predicted to continue to decline. See **Table 3.14-2, Population Trends**.

Table 3.14-2, Population Trends

Place	2000	2003	2005	2010	% Change 2000-10	2020	% Change 2010-20
Wyoming	493,782	501,242	506,184	519,595	5%	533,534	3%
Carbon County	15,639	15,302	15,047	14,671	(6%)	13,965	(5%)
Rawlins	9,006	8,665	8,539	8,325	(8%)	7,925	(5%)
Hanna	873	874	855	834	(4%)	793	(5%)
Sinclair	423	408	404	394	(7%)	375	(5%)
Sources: 1. U.S. Department of Commerce, Bureau of the Census for year 2000 2. Wyoming Department of Administration and Information, Economic Analysis Division for 2003, 2005, 2010 and 2020 population estimates and forecasts ( ) denotes negative decline							

3.14.2 Housing

The 2000 census provides housing data for Wyoming, Carbon County and towns with the county. See **Table 3.14-3, Housing Profile: 2000**.

Table 3.14-3, Housing Profile: 2000

Housing Units	Wyoming		Carbon County		Rawlins		Hanna		Sinclair	
	Number	%	Number	%	Number	%	Number	%	Number	%
Owner-occupied	135,514	61	4,354	52	2,247	58	273	53	146	69
Renter-occupied	58,094	26	1,775	21	1,073	28	94	18	22	11
Sub-total Occupied	193,608	87	6,129	73	3,320	86	367	71	168	80
Vacant: For Sale or Rent	17,857	8	1,128	14	490	13	132	26	40	19
Seasonal Vacant	12,389	5	1,050	13	50	1	15	3	3	1
Sub-total Vacant	30,246	13	2,178	27	540	14	147	29	43	20
Total	223,854	100	8,307	100	3,860	100	514	100	211	100
Source: Wyoming Department of Administration and Information, Economic Analysis Division										

In 2000, vacant housing units for sale or rent in Carbon County were 6% higher than the average Wyoming statewide rate. In 2000, the town of Hanna had vacant housing rates 18% higher than the Wyoming average.

Owner-occupied housing units in Carbon County were lower in 2000 than the Wyoming statewide average, except in the town of Sinclair, where there were 8% more owner-occupied housing units than the Wyoming statewide average.

In 2000, Carbon County reported an 8% higher seasonal vacancy rate than the Wyoming statewide average. Hanna had a 10% higher rate. These elevated figures represent that certain individuals are maintaining houses until the economy rebounds with new jobs or housing prices increase to a level where the houses can be sold. In addition, there may be vacation houses or trailers located in places like the “Boat Club” at Seminoe Reservoir, or communities such as Saratoga and Encampment.

Household size for owner and renter occupied units are set forth in **Table 3.14-4, Average Household Size: 2000**. Households throughout Wyoming and in Carbon County tend to average between two to three persons.

Table 3.14-4, Average Household Size: 2000

Subject	Wyoming	Carbon County	Rawlins	Hanna	Sinclair
Average household size of owner-occupied units	2.58	2.46	2.58	2.36	2.49
Average household size of renter-occupied units	2.25	2.24	2.16	2.43	2.73
Source: Wyoming Department of Administration and Information, Economic Analysis Division					

Housing values in Carbon County are typically lower than in the rest of Wyoming. See **Table 3.14-5, Housing Values and Costs: 2000**. The median value for a home in Carbon County in 2000 was $76,500 as compared to $96,600 in Wyoming. Hanna had the lowest reported 2000 median housing value in Carbon County at $45,500. Further, for the year 2000, there were no housing values in the towns of Rawlins, Hanna and Sinclair that exceeded values of $300,000, whereas nearly 4% of the houses in Wyoming exceeded that amount.

In 2000, more than 65% of Wyoming homeowners made monthly mortgage payments that averaged $825. In Carbon County, slightly less homeowners (59.2%) than the statewide average made monthly mortgage payments averaging between $515 (Hanna) and $681 (Rawlins). See **Table 3.14-5, Housing Values and Costs: 2000**.

Table 3.14-5, Housing Values and Costs: 2000

Subject	Wyoming	Carbon County	Rawlins	Hanna	Sinclair
HOUSING VALUE (%)					
Less than $50,000	8.3%	20.1	18.1	60.7	31.3
$50,000 to $99,999	45.3%	55.7	60.7	36.9	62.7
$100,000 to $149,999	27.2%	15.6	15.0	--	6.0
$150,000 to $199,999	10.0%	5.1	4.0	2.4	--
$200,000 to $299,999	5.6%	2.6	2.2	--	--
$300,000 to $399,999	2.0	0.4	--	--	--
$500,000 to $999,999	0.9	0.3	--	--	--
More than $1,000,000	0.6	0.3	--	--	--
Median Value (dollars)	$96,600	$76,500	$73,700	$45,500	$68,800
MORTGAGE DATA (%)					
With a mortgage	65.7	59.2	63.9	60.7	58.2
Less than $300	0.6	0.7	0.8	--	--
$300 to $499	6.1	9.0	8.4	28.2	16.4
$500 to $699	15.6	21.8	25.6	24.3	18.7
$700 to $999	23.0	20.0	22.1	8.3	18.7
$1,000 to $1,499	14.9	6.8	6.5	--	4.5
$1,500 to $1,999	3.7	0.5	0.5	--	--
More than $2,000	1.9	0.5	--	--	--
Not mortgaged	34.3	40.8	36.1	39.3	41.8
Median Monthly Mortgage (dollars)	$825	$685	$681	$515	$638
GROSS RENT DATA					
Less than $200	6.4	9.5	12.5	5.0	--
$200 to $299	10.0	13.9	13.9	22.0	16.1
$300 to $499	42.0	43.3	46.8	50.0	67.7
$500 to $749	23.6	14.8	15.7	6.0	16.1
$750 to $999	5.5	1.5	1.8	5.0	--
$1,000 to $1,499	2.0	0.5	0.6	--	--
More than $1,500	0.7	0.4	0.6	--	--
No cash rent	9.8	16.0	8.1.	12.0	--
Median Monthly Gross Rent (dollars)	$437	$377	$369	$390	$363
Source: Wyoming Department of Administration and Information Economic Analysis Division					

Monthly rent in 2000 averaged $437 in Wyoming (statewide) as compared to an average Carbon County monthly rent of $377. Monthly rental payments averaged slightly higher in Hanna ($390), while monthly average rental payments were lower in Rawlins ($365) and Sinclair ($363). See **Table 3.14-5, Housing Values and Costs: 2000**.

3.14.3 Demographic Characteristics

According to the 2000 Wyoming Census, Wyoming and the town of Rawlins had nearly similar median ages of 36 years, although the median age of residents in Hanna and Sinclair was older, averaging over 41 years. In Wyoming and Carbon County, on average, there were more males than females; however, the town of Sinclair had slightly more females than males. See **Table 3.14-6, General Demographic Characteristics: 2000**.

Table 3.14-6, General Demographic Characteristics: 2000

Subject	Wyoming	Carbon County	Rawlins	Hanna	Sinclair
Sex					
Male (%)	50.3	53.6	52.7	51.4	49.4
Female (%)	49.7	46.4	47.3	48.6	50.6
Age					
Under 5 years (%)	6.3	5.7	6.8	4.9	3.5
5 to 9 years (%)	6.9	6.1	6.7	7.9	6.9
10 to 14 years (%)	7.8	7.1	7.2	7.6	10.2
15 to 19 years (%)	8.5	7.9	8.4	6.8	9.7
20 to 24 years (%)	6.8	5.9	7.1	4.5	3.1
25 to 34 years (%)	12.1	11.4	12.3	9.5	8.0
35 to 44 years (%)	16.0	16.9	17.1	14.1	18.0
45 to 54 years (%)	15.0	16.5	15.3	17.4	19.6
55 to 59 years (%)	5.0	5.8	5.3	7.6	4.3
60 to 64 years (%)	4.0	4.4	3.6	5.2	4.0
65 to 74 years (%)	6.3	6.8	5.6	10.1	4.5
75 to 84 years (%)	4.0	4.0	3.7	4.4	5.2
85 years and over (%)	1.4	1.4	1.0	0.2	3.1
Median Age (years)	36.2	38.9	36.1	41.6	41.4
Racial/Ethnic Minorities					
Black/African American (%)	0.8	0.7	0.8	0.2	0.5
American Indian (%)	2.3	1.3	1.5	--	1.4
Hispanic or Latino (%)	6.4	13.8	21.0	5.5	2.6
Asian (%)	0.6	0.7	0.8	0.1	--
Other (%)	4.4	7.4	11.0	4.1	1.8

In addition, according to the 2000 U.S. Census, an estimated 14.5% of Wyoming residents and 23.9% of Carbon County residents represented racial and ethnic minorities. In Rawlins, an estimated 35.1% of the town's residents represented racial and ethnic minorities. Hispanic or Latino residents represented the largest minority/ethnic group, accounting for 6.4% of Wyoming's population, 13.8% of Carbon County population, and 21.0% of Rawlins residents. See **Table 3.14-6, General Demographic Characteristics: 2000**.

According to 2000 data from the U.S. Bureau of Census, nearly 90% of Wyoming's population (25 years and older) had earned a high school degree or higher. This ranked Wyoming third in all 50 states. Approximately 20% of Wyoming residents (25 years and over) have a Bachelor's degree or higher.

Educational information is set forth in **Table 3.14-7, Educational Attainment: 2000**. These statistics show that over 80% of residents in both Carbon County and throughout Wyoming have earned high school degrees; however, on a percentage basis, less people in Carbon County have received high school degrees than in Wyoming statewide. Similarly, the population 25 years and older receiving a Bachelor's degree or higher is slightly lower in Carbon County (17.2%) than in Wyoming (21.9%), with the lowest readings being Hanna (13.4%) and Sinclair (13.5%).

Table 3.14-7, Educational Attainment: 2000

Subject	Wyoming	Carbon County	Rawlins	Hanna	Sinclair
Percent High School Graduate or Higher	87.9	83.5	81.7	85.3	86.5
Percent Bachelor's Degree or Higher	21.9	17.2	15.0	13.4	13.5
Population 25 Years and Over					
Total	315,663	10,508	5,522	552	281
Percentage	100.0	100.0	100.0	100.0	100.0
Less Than 9th Grade					
Total	10,614	541	344	18	7
Percentage	3.4	5.1	6.2	3.3	2.5
9th to 12th Grade No Diploma					
Total	27,703	1,192	664	63	31
Percentage	8.8	11.3	12.0	11.4	11.0
High School Graduate (includes equivalency)					
Total	97,779	3,678	1,971	239	92
Percentage	31.0	35.0	35.7	43.3	32.7
Some College – No Degree					
Total	85,184	2,685	1,391	132	86
Percentage	27.0	25.6	25.2	23.9	30.6
Associate Degree					
Total	25,221	609	323	26	27
Percentage	8.0	5.8	5.8	4.7	9.6
Bachelor's Degree					
Total	47,066	1,254	559	55	31
Percentage	14.9	11.9	10.1	10.0	11.0
Graduate or Professional Degree					
Total	22,096	549	270	19	7
Percentage	7.0	5.2	4.9	34	2.5
Source: Wyoming Department of Administration and Information, Economic Analysis Division					

3.14.4 Employment and Economic Conditions

Total employment in Carbon County decreased from 7,820 persons in 1992 to 7,672 in 2002. During that same period, the Carbon County unemployment rate also dropped from 6% to 4.6%. In 1992, the labor force in Carbon County was 8,318 persons; in 2002, the labor force had declined to 8,038. These figures reveal that persons have left Carbon County and left the labor force.

The services and professional segment accounts for the largest segment of the Carbon County economy, consistently being above the 50% level. The second largest job segment in Carbon County is employment with federal, state and local government. The government segment of the local employment economy remained fairly consistent between 1970 and 2000, averaging around 20%. See **Figure 55, Carbon County Jobs - 1970 and 2000**.

Carbon County employment between 1970 and 2000 is graphically shown on **Figure 54, Carbon County Employment by Industry (1970-2000)**. Coal mining employment peaked in Carbon County in 1981 with over 3,500 jobs. The Carbon County coal mining industry has yet to recover to those early 1980s levels. Even if coal mine production (tonnage) returns to its former peak levels, the mining employment would not replicate the peak job levels of the early 80s. Over the past two decades, the U.S. coal mining industry has undergone a period of economic restructuring and resulting productivity gains. Coal tonnage being produced in America today is accomplished with much lower employment levels.

The composition for employment in Wyoming and Carbon County showed that in 2000 approximately 60% of those who were 16 years and older were in the labor force. See **Table 3.14-8, Employment Status: 2000**. In the town of Sinclair, 73.1% of those 16 years and older were in the labor force; while in Hanna, only 54.4% of those 16 years and older were in the labor force.

Table 3.14-8, Employment Status: 2000

Subject	Wyoming	Carbon County	Rawlins	Hanna	Sinclair
Population 16 Years and Over					
Total	381,912	12,392	6,725	656	320
Percentage	100.0	100.0	100.0	100.0	100.0
Employed Civilian Labor Force					
Total	241,055	7,335	4,087	357	234
Percentage	63.1	59.2	60.8	54.4	73.1
Armed Forces					
Total	3,300	--	--	--	--
Percentage	0.9	--	--	--	--
Unemployed					
Total	13,453	409	233	40	12
Percentage	3.5	3.3	3.5	6.1	3.8
Not in Labor Force					
Total	124,104	4,648	2,405	259	74
Percentage	32.5	37.5	35.8	39.5	23.1
Source: Wyoming Department of Administration and Information, Economic Analysis Division					

In 2002, the unemployment rate in Carbon County was 4.6%, slightly higher than the Wyoming statewide unemployment rate of 4.2%. In 2002, the unemployment rate for the entire United States was 5.8%.

With the exception of a period from 1997 to 2000, Wyoming unemployment rates have consistently been below U.S. unemployment rates since 1990. See **Figure 57, Unemployment Rates**.

3.14.5 Income

In 2000, personal income per capita in Carbon County averaged $23,671, 17% below the $28,463 per person income for Wyoming and 21% below the $29,847 per capita income for the U.S.

Personal income is the amount of income an individual receives annually before taxes. It includes wages, salaries, proprietors' income, other labor income, investment income and transfer payments. Between 1990 and 2000, personal income per capita in Carbon County increased by from $17,234 to $23,671, a 27% increase.

Between 1970 and 2000 total personal income in Carbon County remained relatively stagnant, with the exception of a period between the mid 70s and mid 80s, when mining income peaked (1981) then dramatically dropped (1987). See **Figure 56, Carbon County Personal Income (1970-2000)**.

In 2000, the average wage per worker in Carbon County was $24,825 compared to $26,602 in Wyoming and $36,167 for the U.S. highest-paid wages in Carbon County were in the mining sector (which includes oil and gas workers) where the average worker earned $45,781, almost twice the county and statewide wage average.

Reported income data alone does not necessarily provide a complete picture of economic activity in an area. Residents of rural areas may accept lower incomes than residents of metropolitan areas to obtain amenities such as rural life styles, low crime rates and recreational opportunities.

3.14.6 Community and Public Services

During the EIS process, area community and public service providers were contacted to obtain information regarding current services. This assessment focused on the following providers:

- Education
- Law Enforcement
- Fire Protection
- Ambulance
- Hospital and Medical Services
- Social Services
- Water Supply
- Wastewater Treatment

- Solid Waste
- Electric Utilities

3.14.6.1 Education

Public schools in Rawlins, Hanna and Sinclair are included in Carbon County School District #1. This school district includes four elementary schools with grades K-5, one middle school located in Rawlins, one middle school located in Bairoil and two high schools. School enrollment has decreased over the past 5 years. The total 1999 enrollment equaled 1,951 students, while total enrollment in 2003 dropped to 1,708 students, a decrease of 12%.

Student enrollment and occupancy rates for District #1 high schools are set forth in **Table 3.14-9, School Enrollment**. Most District #1 schools have occupancy rates between 60 and 80%.

Table 3.14-9, School Enrollment

School	Grades	Design Occupancy	Current Occupancy	Student Teacher Ratio
Highland Hills	K-5	361	75%	17.5:1
Mountain View	K-5	209	112%	16.4:1
Pershing	K-5	247	70%	15.7:1
Sinclair	K-5	76	51%	10.9:1
Bairoil	K-5	95	80%	6:1
Rawlins Middle School	6-8	735	78%	17.1:1
Rawlins High School	9-12	882	78%	17.8:1
Cooperative High School	9-12	168	66%	22.5:1
Source: Sanders, Carbon County District 1, 2004				

There are currently no plans for new schools or expansions of existing schools, or school staffing increases (Sanders, personal communication 2004).

Carbon County School District #1 currently employs a total of 284 administrative, teacher and support staff. The teacher/class ratios for the various District #1 schools are set forth in **Table 3.14-9, School Enrollment**.

3.14.6.2 Law Enforcement

The Carbon County Sheriff's and Rawlins's Police Department staffs provide law enforcement services in the area. These two groups cooperate on law enforcement in and around the town of Rawlins. The Carbon County Sheriff's Department provides law enforcement services for the communities of Hanna and Sinclair.

The Rawlins Police Department consists of twenty-one sworn officers, eight dispatchers, and one victim's advocate. There are twenty-one police vehicles assigned to the Rawlins police force. The Rawlins Police Department currently considers themselves slightly under staffed (Chapman, personal communication 2004).

The Carbon County Sheriffs Department employs a sheriff, an under sheriff, seven deputies and two full time dispatchers. There are nine vehicles for this department. Currently, the Sheriff's Department considers itself adequately staffed for the needs of the county.

The Wyoming State Patrol patrols I-80 through Carbon County on a daily basis. In addition to providing law enforcement for the Wyoming interstate and state highway system, the state police also provide assistance to the Carbon County Sheriff's Department and the Rawlins Police Department on an as-needed basis.

In addition, the Wyoming Department of Game & Fish (WDGF) employs wildlife enforcement officers who are responsible for enforcing fish and game regulations in Carbon County.

3.14.6.3 Fire Protection

Fire protection is provided for Carbon County by a countywide fire protection district. The fire protection district includes eleven fire stations, two of which are located in the town of Rawlins. Fire stations are equipped with at least three pieces of fire protection equipment, with eight pieces of equipment permanently located in Rawlins. Fire protection personnel are volunteers. There are a total of 120 volunteer firefighters countywide, with 30 located in the town of Rawlins. Firefighting volunteers are trained for fire control and first aid. The Fire Protection District Manager believes that the district is adequately staffed (France, Carbon County Fire Warden, personal communication 2004).

The BLM provides fire protection coverage for their holdings, and seasonal fire crews and personnel are stationed in Rawlins. The BLM coordinates with local fire districts for initial response, mutual aid and cooperative fire control.

3.14.6.4 Ambulance

Ambulance service is owned and operated by the Rawlins Hospital. The medical director of the ambulance service also serves as the medical director for the Hanna, Wamsutter, and Bairoil ambulance services. This ambulance service provides ground transportation to the Rawlins

Hospital. Air ambulance service is available for Carbon County from hospitals located in Laramie and Cheyenne.

3.14.6.5 Hospital and Medical Services

The Memorial Hospital of Carbon County provides medical care and services for the county. The hospital is licensed as a home health agency and community-based in-home service for Carbon County. The hospital also operates as a pediatric clinic, orthopedic clinic and a medical clinic in Hanna. The hospital maintains thirty-five acute care beds, including medical, surgical, pediatric unit, five intensive care unit beds, three bed and five bassinette obstetric unit, two operating rooms and ambulatory surgical unit and an emergency room.

On average, per month, there are 700 to 800 emergency room visits; eight to ten babies delivered; and 70 to 90 surgeries performed.

The hospital employs 200 people. The staff includes four physicians on active medical time, three family practioners, two family practitioners that also do OB, five emergency room physicians, one general vascular surgeon, one orthopedic surgeon, one radiologist and one pediatrician. In addition, there are sixteen physicians on courtesy medical staff that come to Rawlins to conduct clinics one to two times per month. There are no plans to expand hospital or medical services since they currently meet Carbon County demands (Carter, personal communication 2004).

3.14.6.6 Social Services

Carbon County Social Services provides public assistance to low-income families and the elderly. Overall, caseloads are decreasing, except for assistance to the elderly, which has been increasing. Carbon County non-profit organizations, such as churches, also provide a variety of social service programs.

3.14.6.7 Water Supply

The town of Rawlins maintains a new water treatment facility with a 7 million gallon per day capability. Current water use in Rawlins is less than 5 million gallons per day.

3.14.6.8 Wastewater Treatment

A Rawlins wastewater treatment facility serves the towns of Rawlins and Sinclair. This wastewater treatment plant is designed for twice the current population or roughly 20,000 homes. Since 1999, over $9 million has been invested in improvements on the Rawlins wastewater treatment plant.

3.14.6.9 Solid Waste

A solid waste landfill near Rawlins serves the communities of Rawlins and Sinclair and solid waste pick-up service in these towns is provided by privately-licensed local contractors. The landfill is owned by the town of Rawlins and has a projected life of eight more years. The state of Wyoming is currently assessing the possibility of enlarging the facility to serve the entire county, but, at present, plans are not finalized and no decisions to expand the existing landfill have been made.

3.14.6.10 Electric Utilities

Electrical power for Rawlins and vicinity is provided by Pacific Power and Light Company, which has adequate capabilities to serve customers. Carbon Power and Light Company serves customers in Saratoga and vicinity.

3.14.7 Fiscal Conditions

Oil, gas and coal mining operations generate a significant amount of federal, state and local government revenues. The federal government receives revenue for land and mineral right leases, as well as royalties. The state of Wyoming receives tax revenues primarily from federal royalties, sales, severance, and property taxes. There are no personal or corporate income taxes in Wyoming. Local governmental entities receive property, sales and severance taxes, as well as a share of federal royalties and PILT (payment in lieu of taxes) from the federal government.

Additional governmental revenues are generated from businesses that supply oil and gas operations with goods and services, as well as from employees of oil and gas exploration, development and production. Local purchases made by oil and gas operations generate sales taxes.

Oil and gas workers are also a source of government revenues. Income earned by oil and gas workers are subject to federal income taxes. Household purchases generate sales taxes, and the property owned by oil and gas workers is subject to property taxes.

3.14.7.1 State of Wyoming Revenues

Net state revenue collections totaled over $1.2 billion in 2003, up nearly 10% from 2002 when just under $1.1 billion was collected. Wyoming revenue collections have been increasing steadily over the past 5 years. See **Figure 58, Wyoming State General Revenues (1992-2002)** and **Figure 59, Wyoming General Revenue Source**.

Over 42% of Wyoming revenue collections are from sales and gross receipts. Severance tax, collected from oil, gas and mining operators, accounts for over 36% of Wyoming revenues, and this revenue is redistributed back to local jurisdictions. The various sources of tax collections for Wyoming are shown on **Figure 60, Wyoming State Tax Revenue Collections 2002 and 2003**.

The state of Wyoming also receives “intergovernmental” revenue; this revenue is distributed by the federal government. In 2002, intergovernmental received by Wyoming was approximately $1.2 billion, or slightly more than the $1.1 billion collected within the state of Wyoming.

The state of Wyoming distributes approximately 33% of its total revenues back to county and local government entities. On a statewide expenditure basis (i.e., direct expenditures), the state of Wyoming expends nearly 30% of its direct expenditures on education, nearly 13% on public welfare, and 12% for highways. See **Figure 61, Wyoming State Expenditures - 2002**.

3.14.7.2 Retail Sales and Use Taxes

Wyoming has a statewide 4% sales and use tax. Carbon County collects an additional 2% in sales taxes: 1% as a general purpose county option tax and another 1% as a specific-purpose county option tax. For fiscal year 2001, Carbon County collected a total of $19.8 million in sales and use taxes; this was down approximately 5% from fiscal year 2000, when Carbon County collected about $21 million in sales and use tax.

An estimated 28% (less administrative costs) of statewide sales and use tax collections and all of the local sales and use tax collections (also less administrative costs) are distributed to Carbon County and its incorporated municipalities according to a population-based formula.

3.14.7.3 Property Tax

Wyoming’s total assessed valuation for the 2001 tax year was $10.5 billion, up 33.5% from the 2000 tax year, when assessed valuation was $7.9 billion. Property tax levies increased a corresponding 31.5%, up $167 million from $529 million in 2000 and $696 million in 2001.

Wyoming treats mineral production as personal prop100100100y for Ad Volorem tax purposes; prior year calendar production is included in the state’s current-year tax base. The 2001 taxable value of 2000 production was $6.4 billion, 57% higher than the 2000 taxable value of 1999 production, which was $4.1 billion.

Wyoming residential property increased in value by 12.2%, from $1.8 billion (2000) to nearly $2 billion (2001). Industrial property increased from a 2000 assessed value of $1.36 billion to $1.41 billion in 2001, a 3.9% increase. Commercial property also increased 8.7%, from $534 million (2000) to $580 million (2001). The value of agricultural lands decreased 2.2% from 2000 to 2001, from $146 million to $142 million.

Mineral production is assessed at 100% of value, industrial property at 11.5% and all other property at 9.5% of market value. Agricultural land is assessed at 9.5% of productivity value.

Carbon County experienced a 64% increase in property tax revenues, going from $21.3 million in 2000 to $34.9 million in 2001. The primary reason for this increase in property tax revenues was the increase in oil and gas activity.

3.14.7.4 Severance Tax

Wyoming collects a 6% severance tax on oil and gas. Revenues from severance taxes are distributed to the Wyoming Mineral Trust Fund, General Fund, Water Development Fund, Highway Fund, Budget Reserve Account, and to counties and incorporated cities and towns. In 2003, severance tax collections totaled $441 million, up nearly 32% from the $302 million collected in 2002.

Since 1995, the trend in severance taxes paid in Wyoming generally has been up, but with significant annual variations. See **Figure 62, Wyoming Severance Tax Trends (1992-2003)**.

3.14.7.5 Federal Royalties

The federal government collects a 12.5% royalty on oil, natural gas and surface-mined coal extracted from federal lands. For underground coal mining on federal land, there is an 8% royalty. Fifty percent of federal royalties are retained in the federal treasury, while the other 50% is returned to the state where production occurred to help address impacts from mineral development on federal lands.

In Wyoming, the state's share of federal mineral royalties is distributed to a variety of accounts as follows:

- 50% to the county where production occurred,
- 25% to the State School Fund,
- 15% to the Highway Fund, and
- 10% to the General Fund.

Wyoming also receives federal funds under the Payment In Lieu of Taxes Act, which compensates county governments whose jurisdictions contain tax-exempt federal lands. For fiscal year 2004, Wyoming will receive $14.6 million, of which Carbon County will receive $654,838.

3.14.8 Social Values

The communities of Rawlins, Hanna and Sinclair have a long history with transportation, agriculture, mining and construction. Most households in these communities identify with “making a living from the land,” and these communities continue to obtain economic benefits from the relatively high-wage jobs associated with oil and gas exploration and development. Most residents in these communities tend to value economic opportunity as represented by natural resource activities (agriculture, mining, construction, oil and gas exploration and development) but some also raise concerns about the impacts of such activity on land use and recreation.

As explained in Section 3.14.1, Population, Carbon County has experienced a decrease in population and employment over the past several decades. Unlike other communities in the west, the towns of Rawlins, Hanna and Sinclair have not experienced a migration of newer residents that are less supportive of traditional natural resource activities. Most residents of the region still view mining and oil and gas activities as having a positive effect on the quality of life because of economic stimulus and job opportunities.

Chapter 4 - Environmental Consequences

This EIS chapter examines the anticipated environmental effects associated with the implementation of the action alternatives in comparison to the no action alternative. The environmental analysis for the action alternatives presented in Chapter 4 represents mitigated effects, based on mitigation and reclamation measures discussed in Chapter 2.

For ease of presentation and comparison, the impact analysis discussions in Chapter 4 are grouped by the same technical disciplines as addressed in Chapter 3. This chapter's analyses emphasize those effects related to key issues and concerns identified in Chapter 1. Some effects are expressed in qualitative terms, others in quantitative terms.

Impact descriptions under each resource area are divided into the following categories:

- Effects of the no action alternative;
- Effects common to all action alternatives; and,
- Effects unique to each action alternative.

Impacts are evaluated for the alternatives and are defined as follows.

- **Direct Impacts** – Those effects, which occur at the same time and in the same general location as the activity causing the effects.
- **Indirect Impacts** – Those effects which occur at a different time or different location than the activity to which the effects are related.
- **Cumulative Impacts** – Those effects which result from the incremental impact of the action when added to other past, present and reasonably foreseeable actions.

4.1 Air Quality/Climate

Air Quality/Climate Impact Significance Criteria: *Potential impacts considered significant if:*

- *Potential total near-field concentrations are greater than WAAQS and NAAQS;*
- *Potential total far-field concentrations are greater than WAAQS and NAAQS;*

- *Potential cumulative near-field concentrations are greater than PSD Class II increments;*
- *Potential cumulative far-field concentrations in parks and Wilderness Areas in the region are greater than PSD Class I increments;*
- *Potential decrease in visibility in parks and Wilderness Areas in the regions are greater than FLAG. Potential visibility impacts as compared to established Forest Service and Park Service thresholds (See **Appendix H, Air Quality Information**);*
- *Potential decrease in ANC in sensitive lakes in the region are greater than levels of acceptable change;*
- *Potential total deposition from the proposed project as compared to deposition analysis thresholds (See **Appendix H, Air Quality Information**).*

Fugitive dust and gaseous emissions would occur during the construction, production, and final reclamation phases of all action alternatives. However, no adverse direct, indirect or cumulative impacts to air quality from the project alone are0 anticipated. Further, no long-term air quality impacts would occur from the project because disturbed areas would be stabilized and reclaimed upon project closure.

A comprehensive air quality analysis was conducted to assess potential direct and indirect near-field criteria air pollutant impacts, hazardous air pollutant (HAP) impacts, and far-field (cumulative) impacts on ambient air pollutant concentrations, visibility, and atmospheric deposition (acid rain) that would most likely occur from the project (TRC 2004). Air quality specialists from the BLM, EPA, Wyoming DEQ Air Quality Division, U.S. Forest Service, and the National Park Service jointly participated in the development of a protocol that was applied to this analysis. A discussion of the modeling assumptions and protocol, along with an overview of the process that led to the completion of the Seminoe Road Project's air quality analysis is set forth in **Appendix H, Air Quality Information**.

The air quality impact analysis results presented in this EIS should be used to compare the relative impacts from various activities, alternatives and sources. Wyoming state law requires that the Wyoming DEQ, Air Quality Division ultimately determine whether this project would cause or contribute to any violation of ambient air quality standards and conforms to other regulatory requirements prior to approving an Air Quality Construction Permit. See **Appendix D, Agency Jurisdictions (Permits and Approvals)**. The Wyoming DEQ, Air Quality Division would make the final determination in their permitting processes even though the results of the air quality analysis presented herein demonstrate compliance with these requirements.

4.1.1 Effects of Alternative A (No Action)

The Pilot Project operations could continue under the no action alternative. The BLM has previously assessed Pilot Project air quality impacts in a 2001 EA (WY-030-EA00-288), and the Wyoming DEQ Air Quality Division has issued the appropriate construction permits for this project. Fugitive dust and gaseous emissions do occur from the Pilot Project, but these emissions are localized and minimal. There have been no violations of state or federal air quality regulations or standards as a result of the Pilot Project.

Air quality of the EIS analysis and surrounding areas would remain under the influence of existing cumulative sources and land use trends. Current land use trends in south-central Wyoming would continue, including increased oil and gas exploration and development, continued coal mining, increased truck and other vehicular traffic on I-80 and other highways, and increased recreational use including hunting, camping, off-road vehicle (ORV) traffic, boating and fishing activity on Seminoe Reservoir, fishing on the Miracle Mile, and other dispersed and developed recreation. Increased emissions in this region could cause incremental and localized degradation of air quality over time, although this increase may not be measurable unless the density of development increases significantly.

The EIS analysis and surrounding areas are currently classified as being in attainment with existing EPA AAQS for all pollutants. With current and anticipated land use trends, the area is expected to continue to be classified as being in attainment with existing standards.

4.1.2 Effects Common to All Action Alternatives

Emission sources would include vehicular traffic, well pad and access road construction, drilling, and compressor facilities under all action alternatives. Air pollutant emissions from these sources and activities would include fugitive dust, oxides of nitrogen (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), volatile organic compounds (VOC), and federally listed HAP that may include benzene, toluene, ethylbenzene, and xylenes (collectively called BTEX), and formaldehyde (TRC 2004).

4.1.2.1 Fugitive Dust Emissions

Fugitive dust emissions would occur during construction and drilling activities within the EIS analysis area. Airborne dust is classified as PM_{10} and $PM_{2.5}$, which are particulate matter with an aerodynamic diameter of less than 10 and 2.5 microns, respectively. Particulate emissions would occur during construction of access roads, well pads, compressor sites, utilities and pipeline installations, traffic on unpaved roads, and from wind erosion in areas of soil disturbance and topsoil stockpiling. These fugitive emissions would continue from traffic associated with drilling activities, long-term gas production operations, and project decommissioning and final reclamation.

Maximum localized particulate matter impacts would result from well pad and road construction activities. A most-likely modeling scenario consisting of a well pad and a 2-mile access road was evaluated to predict particulate impacts. The EPA dispersion model AERMOD was utilized to model this configuration along with meteorological data collected at the Rock Springs airport during 2003. Representative background concentrations summarized in **Table 3.1-2, Representative Background Ambient Air Concentrations** (presented in Chapter 3), are added to model results to yield predicted ambient concentrations.

Fugitive dust emissions generated by activities within the EIS analysis area are not predicted to have any significant effects on air quality. No violation of applicable state and federal PM_{10} and $PM_{2.5}$ standards is expected to occur. Near-field particulate matter modeling results are summarized in **Table 4.1-1, Maximum Modeled PM_{10} and $PM_{2.5}$ Impacts**.

Table 4.1-1, Maximum Modeled PM_{10} and $PM_{2.5}$ Impacts

Pollutant	Averaging Time	Direct Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Predicted ($\mu g/m^3$)	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	20.4	33	53.4	150	150
	Annual	3.5	16	19.5	50	50
$PM_{2.5}$	24-hour	7.1	13	20.1	65	65
	Annual	1.0	5	6.0	15	15

4.1.2.2 Gaseous Criteria Pollutant Emissions

Gaseous emissions would result from the construction equipment used to build access roads and well pads, as well as from drill rig engines. In addition, work crew, management and supply vehicles commuting to and from the work sites would emit gaseous constituents.

Compressor units and well “down-hole” pumps would be powered by electricity as a result of the Proponent’s plans to electrify the field; this would essentially eliminate gaseous emissions from these production components. Proposed build-out plans provide for a few wells to be drilled in outlying areas in advance of full development of particular drilling phases; these wells would require temporary powered engines to drive down-hole well pumps until electric utility lines are installed (buried) to reach those wells. Therefore, the electrified alternative assessment would include very minor gaseous emissions.

Gaseous emissions for a field-wide gas powered compressor and down-hole well pump scenario were modeled for comparison with the electrified scenario. This scenario would obviously produce greater NO_2 and CO ambient concentrations than the electrified proposed action alternative. Maximum model NO_2 and CO impacts are discussed in Section 4.1.5, Effects of Alternative C (Pipeline to Reservoir).

The majority of SO_2 ambient concentrations for any of the action alternatives would occur from construction drilling emissions. The modeling scenario developed to predict these impacts included a drilling rig at a well pad. The AERMOD model was utilized, and maximum predicted concentrations are provided in **Table 4.1-2, Maximum Modeled SO_2 Impacts**.

Table 4.1-2, Maximum Modeled SO_2 Impacts

Pollutant	Averaging Time	Direct Modeled (μg/m³)	Background (μg/m³)	Total Predicted (μg/m³)	WAAQS (μg/m³)	NAAQS (μg/m³)
SO_{10}	3-hour	15.4	132	147.4	1,300	1,300
	24-hour	7.6	43	50.6	260	365
	Annual	2.8	9	11.8	60	80

Ozone is a criteria pollutant that would not be directly emitted from project activities but is formed in the atmosphere as a result of photochemical reactions that involve ambient concentrations of NO_2 and VOC. Compliance with ambient air quality standards cannot be determined with conventional dispersion models because of the complex photochemical reactions that form ozone. As such, a nomograph developed from the Reactive Plume Model (Scheffe 1988) was utilized to predict maximum ozone impacts.

Maximum ozone concentrations would result during periods when NO_X and VOC emissions are at their highest, which would occur during production activities. The scenario developed to evaluate ozone concentrations consisted of 26 gas-powered, down-hole well pumps and a compressor station. This arrangement represents the maximum number of wells anticipated to operate outside of the electrified region, combined with emissions from a single compressor station. The ozone 1-hour ambient impact predicted to occur from the NO_X and VOC emissions estimated for this configuration was 21.0 μg/m^3, and an 8-hour average ozone impact was estimated to be 14.7 μg/m^3. These impacts combined with background concentrations are compared to the Ozone AAQS in **Table 4.1-3, Maximum Modeled O_3 Impacts**.

Table 4.1-3, Maximum Modeled O_3 Impacts

Pollutant	Averaging Time	Direct Modeled (μg/m^3)	RPM Background (μg/m^3)	Total Predicted (μg/m^3)	WAAQS (μg/m^3)	NAAQS (μg/m^3)
Ozone	1-hour	21.0	62.6	83.6	235	235
	8-hourl	14.7	62.6	77.3	157	157

4.1.2.3 Hazardous Air Pollutant Emissions

HAP can be subject to “Maximum Available Control Technology” (MACT) if they qualify as major or area sources. Major sources are defined as those sources having the potential to emit 10 tons per year of any individual HAP or 25 tons per year of any combination of HAP. All other sources of HAP are referred to as area sources.

The only expected HAP for the Seminoe Road Project would be formaldehyde. Very low levels of formaldehyde would be emitted during the production phase of the project from gas-powered engines used to power certain individual down-hole well pumps; however, these emissions would not qualify as a major or area source, and therefore would not be subject to MACT standards. Formaldehyde emissions from the project would not have any adverse effects on regional air quality, nor cause any short-term or long-term human health issues.

4.1.2.4 Visibility

Visibility impacts are predicted utilizing far-field models. This modeling is discussed in more detail in Section 4.1.3, Cumulative Impacts, particularly as it relates to individual project contribution to periods of cumulative visibility impairment.

4.1.2.5 Indirect Impacts

Indirect air quality impacts associated with the Seminoe Road Project would be negligible and primarily associated with vehicular traffic of employees and their families that would move into the region. Such traffic would probably be focused in the town of Rawlins and would not be concentrated in the vicinity of the EIS analysis area.

4.1.3 Cumulative Impacts

Given the relative remoteness of the Seminoe Road Project and the expected low project emissions, no cumulative air quality impacts are expected for the near-field that would cause effects on the human environment based on ambient air quality standards.

The nearest industrial source to this project is the Sinclair Refinery that is located approximately 15 miles southwest of the EIS analysis area.

Cumulative impacts were analyzed because each site-specific increase in pollutant emissions, including those from the Seminoe Road Project, adds to cumulative air quality impacts within south-central Wyoming. Currently expanding oil and gas exploration and development activities continue to contribute to cumulative effects on regional air quality.

Possible impacts to Class I and sensitive Class II areas were analyzed for the Seminoe Road Project using the CALMET/CALPUFF modeling system (TRC 2004). This modeling system is approved by the EPA for use in conducting far-field air quality analyses. As shown on **Figure 20, Air Quality Modeling Domain**, the modeling domain included the following Class I and sensitive Class II areas existing in southwestern Wyoming and portions of eastern Idaho, northeastern Utah and northern Colorado:

Class I Areas	**Class II Areas**
Bridger Wilderness Area	Popo Agie Wilderness Area
Fitzpatrick Wilderness Area	Wind River Roadless Area
Mt. Zirkel Wilderness Area	
Rawah Wilderness Area	
Savage Run Wilderness Area (Federal Class II, Designated as Class I by Wyoming)	
Dinosaur National Monument (Federal Class II, Designated as Class I by Colorado)	

Predicted pollutant ambient concentrations at these sensitive areas were compared to applicable air quality standards and to the Class I and Class II ambient air increments, as well as to assess impacts to Air Quality Related Values (AQRV). The AQRV analyzed included visibility/regional haze and atmospheric deposition. Potential lake acidification from atmospheric deposition impacts was analyzed for the following lakes designated as acid sensitive:

Lake	Area
Deep Lake	Bridger Wilderness Area
Black Joe Lake	Bridger Wilderness Area
Hopps Lake	Bridger Wilderness Area
Upper Frozen Lake	Bridger Wilderness Area
Lazy Boy Lake	Bridger Wilderness Area
Ross Lake	Popo Agie Wilderness Area
Lower Saddlebag Lake	Glacier Lakes Ecosystem Experiments Site
West Glacier Lake	Mt. Zirkel Wilderness Area
Lake Elbert	Mt. Zirkel Wilderness Area
Seven Lakes	Mt. Zirkel Wilderness Area
Summit Lake	Mt. Zirkel Wilderness Area
Island Lake	Rawah Wilderness Area
Kelly Lake	Rawah Wilderness Area
Rawah Lake #4	Rawah Wilderness Area

A regional emissions inventory of industrial sources located within the far-field modeling domain was used in the cumulative impact analysis. Oil and gas wells permitted and approved between January 1, 2001 and March 31, 2004 were included in this inventory. Impacts from sources in operation prior to this date were assumed to be included in regional background concentrations. Potential sources currently being analyzed in Wyoming under BLM and Forest Service EIS processes were also included in the regional emissions inventory, providing that such sources had been defined and analyzed sufficiently to yield a project emission inventory by March 31, 2004.

Modeled impacts were compared to applicable Class I and Class II increments, and to the AAQS when background pollutant concentrations were added. When all pollutants were analyzed, the Bridger Wilderness Area proved to be the most sensitive area with regards to potential impacts. However, the modeled impacts were well below their respective ambient air increment concentrations although an expansion of annual SO_2 increment was predicted. Predicted total ambient concentrations (background concentrations added to modeled impact) were also below the respective state AAQS for each sensitive receptor modeled.

Annual deposition fluxes of sulfur and nitrogen at sensitive lake receptors predicted by the far-field model were used to estimate the change in ANC. A Forest Service screening methodology (Fox 1989) was used for this estimate, which indicated that cumulative emissions would cause less than a 0.23% change in ANC with the exception of Upper Frozen Lake located in the Bridger Wilderness Area, where the predicted ANC change was 2.41%. However, the model indicted that the Seminoe Road Project would not contribute to the cumulative ANC change for any analyzed sensitive lake.

Impacts to visibility (regional haze) at Class I and sensitive Class II areas were analyzed using the CALPUFF modeling system (TRC 2004). This model predicted concentrations of PM_{10}, $PM_{2.5}$, SO_4 and NO_3, which, in turn, were used to calculate the change in atmospheric light extinction. Change in atmospheric light extinction relative to background conditions is used to assess regional haze. Natural background visibility conditions were obtained from FLAG (TRC 2004), a federal land managers' report on air quality related values, and data measured at the Bridger Wilderness (Wyoming), Mount Zirkel Wilderness area (Colorado), and Rocky Mountain National Park (Colorado).

Analysis thresholds for atmospheric light extinction are set forth in FLAG (TRC 2004) at 5% and 10% of the reference background visibility or 0.5 and 1.0 deciview (dv) for project sources alone and cumulative impacts, respectively. There are no applicable local, state, tribal or federal regulatory visibility standards; however, the BLM does consider a 1.0 dv change to be a significant adverse impact.

The far-field modeling analysis predicted that the Seminoe Road Project would not contribute to any visibility impairment at Class I and sensitive Class II areas.

FLAG and IMPROVE background visibility data were used to analyze visibility impacts at each Class I and sensitive Class II area. Direct visibility impacts from the Seminoe Road Project alone were predicted to be below the 0.5-dv threshold at all Class I and sensitive Class II areas.

Although the cumulative visibility analysis for all regional sources (including the Seminoe Road Project) revealed that there could be 4 days per year (IMPROVE) and 1 day per year (FLAG) when visibility impacts were greater than the 1.0-dv threshold for the Bridger and Popo Agie Wilderness areas in western Wyoming, it was determined that the Seminoe Road Project would not be a major contributor to these few visibility exceedances. Impacts from the Seminoe Road

Project were predicted to be below the 0.04 dv visibility significance threshold for all days where the cumulative visibility impacts were estimated to be 1.0 dv or greater (TRC 2004).

4.1.4 Effects of Alternative B (Proposed Action)

The air quality effects of Alternative B would be the same as addressed in Section 4.1.2, Effects Common to All Action Alternatives, and Section 4.1.3, Cumulative Impacts.

4.1.5 Effects of Alternative C (Pipeline to Reservoir)

Under Alternative C, as a means to compare emissions to the electrified scenario set forth in Alternative B, the compressors and the down-hole pumps would be gas powered. Emissions for down-hole pump engines, vehicle diesel engines, and gas-fired compressor engines were modeled utilizing AERMOD, and, as expected, emissions of NO_x, CO and formaldehyde would be greater for Alternative C than for Alternative B. See **Table 4.1-4, Maximum Modeled NO_2 and CO Impacts – Alternative C**.

Table 4.1-4, Maximum Modeled NO_2 and CO Impacts – Alternative C

Pollutant	Averaging Time	Direct Modeled ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Predicted ($\mu g/m^3$)	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	11.1	25	3.4	14.5	100	100
CO	1-hour	101.7	None	3,336	3,438	40,000	40,000
	8-hour	46.6	None	1,381	1,428	10,000	10,000

Potential formaldehyde emissions from compressor engines, down-hole well pumps and diesel truck emissions were also modeled. Short-term impacts were compared to Reference Exposure Levels (REL) developed by the National Institute for Occupational Safety and Health. Long-term impacts of formaldehyde are compared to the EPA Reference Concentrations for Chronic Inhalation (RfC). **Table 4.1-5 Maximum Modeled Formaldehyde Impacts**.

Table 4.1-5, Maximum Modeled Formaldehyde Impacts

Averaging Time	Modeled Concentration ($\mu g/m^3$)	Comparison Threshold ($\mu g/m^3$)
1-hour	4.07	94 REL
Annual	0.027	9.8 RfC

Because formaldehyde is a suspected carcinogen and long-term exposures to this constituent can increase latent cancer risk over a 70-year lifetime, possible exposure impacts to the residence nearest the EIS analysis area (located in NW1/4, Section 12, T22N, R85W) were evaluated. EPA's Unit Risk Factors (RF) were used to analyze cancer risk (TRC 2004). Results of this analysis are set forth in **Table 4.1-6, Long-term Formaldehyde Cancer Risk Analysis**, and the results indicate an extremely low cancer risk, nearly less than a one-in-a billion risk.

Table 4.1-6, Long-term Formaldehyde Cancer Risk Analysis

Analysis	HAP Constituent	Modeled Concentration ($\mu g/m^3$)	Unit Risk Factor $1/(\mu g/m^3)$	Exposure Adjustment Factor	Cancer Risk
MLE	Formaldehyde	0.027	1.3×10^{-5}	0.0949	3.31×10^{-8}

Even with gas-powered compressors and down-hole well pumps, the cumulative air quality effects of Alternative C would essentially be the same as discussed in Section 4.1.3, Cumulative Impacts. There would be no visibility impairment at Class I and sensitive Class II areas as a result of the Seminoe Road Project, Alternative C.

4.1.6 Effects of Alternative D (Underground Injection)

The air quality effects of Alternative D would be the same as addressed in Section 4.1.2, Effects Common to All Action Alternatives, and Section 4.1.3, Cumulative Impacts.

4.1.7 Potential Monitoring and Mitigation

No site specific monitoring is proposed for the Seminoe Road Project. The mitigation measures addressed in Section 2.8.9, Air Quality, should be sufficient for the project.

Predicting cumulative air quality impacts for future oil and gas development in Wyoming continues to be problematic for the BLM. Past EIS analyses often over-predict cumulative impacts because recent and spatially relevant air quality and meteorological data is lacking. BLM and state of Wyoming land managers should consider installing a statewide network of PM_{10} meteorological stations, particularly in regions of high oil and gas development. The data from these new monitoring stations would be effective to improve future air quality analyses and permitting efforts in Wyoming.

4.2 Soils

Soils Impact Significance Criteria: *Soils impacts would be considered significant if the Proponent failed to salvage available quantities of soil for reclamation and soil disturbance caused a loss of soil productivity and/or created a sustained increase in erosion above normal conditions such that excessive sediments entered Seminoe Reservoir or North Platte River.*

4.2.1 Effects of Alternative A (No Action)

Under the no action alternative, the EIS analysis area would essentially remain in its endemic state supporting current land uses. The Pilot Project operations could continue under the no action alternative.

4.2.2 Effects Common to All Action Alternatives

Table 4.2-1, Soil Impacts by Alternative depicts the acreages of disturbances to sensitive soils (saline/sodic soils, shallow soils and erodible soils) associated with each action alternative.

Table 4.2-1, Soil Impacts by Alternative

Soil Category[1]	Area Within EIS Analysis Area (acres)	Portion of EIS Analysis Area (%)	Area Disturbed Alternative B (acres)	Area Disturbed Alternative C (acres)	Area Disturbed Alternative D (acres)
Shallow Soils[2]	49,280	36	2,460	2,530	2,460
Saline/Sodic Soils[3]	38,720	28	1,940	2,010	1,940
Erodible Soils[4]	25,920	19	1,300	1,340	1,300
Overlap of the Above Three Soil Cagegories[5]	6,400	5	320	350	320

Notes:

1. These soil categories occur throughout the EIS analysis area; they are not additive as they overlap on each other in many areas.
2. **See Figure 23, Saline and Sodic Soils**.
3. **See Figure 25, Shallow Soils**.
4. **See Figure 26, Erodible Soils**.
5. **See Figure 27, Areas of Sensitive Soils Concentrations.**

It is assumed that no soils would be disturbed under Alternative A beyond those disturbed under the previously-approved Pilot Project and gas pipeline to Walcott.

During the construction phase, facility and utility sites would be cleared of vegetation, graded or excavated to specifications, and the construction/burial of facilities and utilities completed. Surface soils would be salvaged and windrowed/stockpiled along the borders of all proposed disturbed sites. Subsoils and other subgrade materials would remain in place for the life of the project, excepting for utility line burial disturbances where the subsoils would be excavated and replaced within a relatively short time span. Erosion and sediment control features would be constructed as required. The construction phase of the project would be completed with the implementation of an interim reclamation plan applied to those areas not required for the production phase of this project. This acreage includes all of the disturbed areas associated with utility line burial and the majority of the acreage disturbed in association with well pad and access road construction. Soil reapplication would occur during the same year as construction to be followed by revegetation at the beginning of the next recognized planting season.

The operations phase of this project would involve the extraction of natural gas from well pad facilities, the use of access roads, and the operation of compressor facilities. At the close of operations, aboveground facilities would be removed, disturbed sites regraded to the desired contours, stockpiled soil replaced, and revegetation completed. Erosion and sediment features would remain in place until no longer needed.

The linear nature of the proposed project, coupled with surficial limitations of many proposed disturbances leaving a relatively intact subsurface soil profile, would increase the potential for overall reclamation as compared to broader-type disturbances. Desirable plant species invasion from adjacent undisturbed areas would be enhanced and the time required to achieve successful reclamation potentially shortened.

Impacts to the soil resource resulting from these proposed disturbances include those that would affect the chemical, physical, and microbial nature of the endemic soils as well as the volumes available for reclamation. Soil chemical parameters would be permanently modified as a result of the proposed soil salvage program. Soil surface horizons would be mixed during salvage resulting in a blending of characteristics as compared to the soils in their natural state. Such characteristics include pH, salinity, and fertility. Soil chemistry would also be modified through soil stockpiling as anaerobic conditions within the stockpiles develop, depending on stockpile size, depth, and longevity. A number of soil physical characteristics such as structure, texture, and rock fragment content would be permanently modified through blending during surface soil salvage and replacement operations. Given that only surface soils would be salvaged/stockpiled, individual disturbances would be comparatively small in any one area, and that little mixing of divergent soil types would likely occur, the impacts to soils associated with salvage and replacement activities are considered to be limited in duration and intensity. The surface soil horizons that would be mixed at any one site would likely be similar in terms of both chemical and physical characteristics and, given the site-specific soil volumes involved, would not likely result in a negative impact in terms of reclamation potential. Revegetation plans prepared on a site-specific basis should adequately address these soil chemical and physical concerns and limit the impacts of soil salvage and replacement to the short-term following soil reapplication on disturbed surfaces.

Isolated spill accidents, should they occur, would result in minor soil contamination from oils, solvents, etc. (See Section 4.15, Accidents and Spills) Spills would normally result in soils deemed unsuitable for reclamation. Soils impacted by chemical spills would be excavated and disposed of in a licensed landfill facility approved by the BLM. The volume of soil subject to spills should be limited, however, given the plan to salvage suitable soils prior to operational disturbances and the proposed implementation of a SPCC Plan. No impact to the revegetation potential of the soil resource is anticipated.

Compaction, particularly along access road disturbances, would likely reduce the aeration, permeability, and water-holding capacity of impacted soils from construction through the operations phase of this project. Ripping and similar surface manipulations are proposed as a part of the reclamation plan to address compaction concerns. The effects of compaction can be reduced once these techniques are properly applied.

Soil microbial populations would likely change with a potential overall loss of nitrifying-type species as surface soils are salvaged and placed in stockpiles. This impact would be most notable in larger stockpiles where surface soils supporting microbial populations are buried to depths dominated by anaerobic conditions. The loss of such species would be less notable in smaller stockpiles windrowed along access roads or well pad boundaries where aerobic conditions dominate. Impacted soil microbial populations should reestablish readily over time following soil reapplication through natural invasion from adjacent undisturbed soils given the small acreage impacted in any one area and/or the linear nature of the road and utility corridor disturbances. The reclamation techniques to be applied would also aid in reestablishing soil microbial populations as reclaimed plant communities develop. This is a generally accepted premise based on observations of reclaimed mine areas in the Northern Great Plains where stockpiled soil has been respread and revegetation has been successful. This is considered to be a short-term, mitigable impact.

4.2.2.1 Saline/Sodic Soils

Impacts to saline and/or sodic soils (**Figure 23, Saline and Sodic Soils**) center around the suitability of these soils for reclamation and the availability of sufficient quantities of soil material for salvage and reapplication. As noted previously, these soils often exhibit droughty profiles due to high salinity levels and may also be subject to decreased soil aeration, infiltration, and permeability under high sodium levels when coupled with clayey soil textures. Soil stockpile stabilization and revegetation plantings can be hindered in the face of such edaphic characteristics resulting in reduced seed germination, plant establishment, and growth. The low average annual rainfall characteristic of this region further exacerbates this condition. However, the soils exhibiting these constraints, for the most part, readily support adapted, native vegetation communities on site. It can be assumed that with sufficient soil depths, efficient soil handling, and the planting of adapted species, reclamation of these disturbances can be achieved in the short-term.

Where saline and/or sodic soil constraints are coupled with a shallow soil condition, reclamation goals would be more difficult to achieve in the short-term. Soil handling efficiencies should not be affected given dominant slope angles. However, a shallow soil depth replaced over bedrock, or less weatherable parent material, would likely enhance a droughty soil profile already constrained by soil chemistry and regional climatic influences. These soil conditions do, however, support salt- and drought-tolerant plant communities on site so it is assumed that the reclamation of disturbances characterized by these conditions can be achieved through time.

These soils are only rarely found on slopes exceeding 25%.

4.2.2.2 Soils Overlying Steep Slopes

Soil map units overlying steep slopes are characterized, all or in part, by water erosion constraints. Shallow soils are also common while few steep slope soils exhibit saline or sodic profiles. A primary concern with respect to impacts to steep slope soils (**Figure 24, Steep Slope Soils**) is construction and reclamation equipment efficiencies as related to soil handling. Soil salvage and handling efficiencies on slopes up to and including 25% are not typically constrained to a great degree unless influenced by shallow soil conditions, extreme topographic variations, or high surface coarse fragment cover. The majority of slopes proposed for disturbance are less than 25%. Conversely and depending upon slope gradient, equipment efficiencies can be curtailed on slopes greater than 25%. A reduction in efficiencies can, in turn, result in a displacement of soil materials rendering them unavailable for salvage and, in a disturbed state, subject to increased water and wind erosion. Stockpiled soils and soils respread over regraded disturbances on steep slopes are also subject to increased runoff and higher erosion potentials until soil stabilization goals have been met. Mulching may be required to successfully stabilize these disturbed soils and to meet vegetation establishment goals.

Impacts to steep slope soils are considered to be mitigable and short-term, assuming that proper soil handling and revegetation techniques are employed. It is likely, however, that steep slope disturbance footprints would be visible for some years beyond the point when they are successfully stabilized and vegetation productivity is restored.

4.2.2.3 Shallow Soils

Shallow soils (**Figure 25, Shallow Soils**) are more susceptible to the negative affects of increased erosion due to the limited soil material initially available and capable of supporting vegetation. Soil salvage and reapplication operations occurring on more gentle slopes could be conducted in shallow soil situations with adequate efficiencies. Conversely, salvage/reapplication operations conducted under steep slope conditions would potentially be less efficient. Soil stockpile stabilization would be critical for disturbances located in shallow soil situations to ensure that sufficient soil material is stockpiled and available for reapplication. Similarly, surface stabilization following soil reapplication would be important to be certain that a sufficient depth of soil remains over disturbed sites to achieve site stabilization and plant establishment goals. Shallow soils rarely exhibit saline or sodic profiles.

Impacts to shallow soils, where soil salvage/replacement and revegetation techniques can be applied efficiently, are considered to be short-term and mitigable. Impacts to shallow soils where soils could not be salvaged or replaced due to equipment inefficiencies would be viewed as a long-term, negative impact.

4.2.2.4 Highly Erodible Soils

Soil map units characterized by slight to severe and severe water erosion potentials are common across the project area (**Figure 26, Erodible Soils**). The vast majority of soils overlying steep slopes are included in either one of these classifications as are units on more gentle slopes subject to high runoff potentials. These soils may also be shallow and/or saline/sodic. Soil map units characterized by slight to severe or severe wind erosion potentials are not common on site. Soils subject to this hazard typically exhibit sandy surface soil textures and may support a comparatively sparse vegetation community.

Water or wind erosion left unchecked can result in a loss of stockpiled soils suitable for reapplication that, in turn, can reduce the revegetation success potential of any disturbed site. Soil erosion occurring on recently planted or establishing vegetation communities can also have detrimental affects on revegetation success, particularly on steeply sloping sites. Erosion potentials are typically highest during the construction phase of this type of project, falling in severity as interim revegetation, soil stockpile, and erosion control activities are completed. Hazards would again rise at specific sites as the project is terminated and regrading/resoiling operations are initiated. Erosion hazard potentials would then again fall as the reapplied soils are stabilized and vegetation communities become established.

The Proponent has committed to a number of site management and construction techniques, in addition to soil salvage and concurrent reclamation that would serve to reduce the erosion hazards. These activities include using existing roads for access purposes to the degree possible, applying BLM “best management practices” during construction and revegetation activities, minimizing new disturbances to the acreage necessary to complete construction and operations, and employing road surfacing as a part of overall road maintenance.

Overall, impacts to highly erodible soils on more gentle slopes are mitigable and short-term assuming the application of the appropriate construction and reclamation techniques. The confounding factors of salinity/sodicity, steep slopes, and/or shallow soil depths added to high erosion hazards would inhibit reclamation potentials to varying degrees and increase the time required to achieve site stabilization and reclamation objectives.

4.2.2.5 Indirect Effects Common to All Action Alternatives

There are no indirect effects associated with the Seminoe Road Project for soils.

4.2.3 Effects of Alternative B (Proposed Action)

Impacts to soils of the development area under Alternative B would include those common to all action alternatives plus those associated with the release of process water down project area drainages. Points of discharge are shown on **Figure 12, Produced Water Discharge Points – Alternative B**. Process water contains varying levels of salts and sodium that would be introduced into existing soil profiles over and above those levels existing normally. As noted in Section 4.4, Surface Water, the approximate average concentration for sodium (371 mg/l) in the produced water is higher than the concentration in the North Platte River and Seminoe Reservoir (42 mg/l). The introduction of salts and sodium, as well as the additional water itself, would give rise to a soil continuum having the potential for supporting a different array of plant species than is normal for the drainages proposed to be affected. This would probably also be true for the playa areas where produced water would be discharged and allowed to infiltrate and evaporate. This can also currently be seen on site where process water has been released into Pool Table Draw. The soils exhibit, at least temporarily, an enhanced soil moisture regime supporting a fairly diverse array of wetland-classed plant species. Saltmarsh bulrush (*Boboschoenus maritimus*) is occasionally present indicating, where this species exists, a potentially saline soil condition though there is no direct evidence of salinity increases in the soil materials present which have been subject to produced water discharges since 2001. It can be assumed that, with the release of process water down the drainages during operations, soil moisture regime characteristics as well as soil salt and sodium levels would be enhanced. With the close of operations, process water releases would be terminated. It is likely that soil moisture regimes would return to pre-disturbance conditions. However, any increase in salt or sodium levels would remain. The potential increase in soil salinity and sodicity that could result cannot be accurately calculated. See Section 4.6.3, Effects of Alternative B (Proposed Action) for a summary of such impacts to the vegetation resource.

The drainages to be affected may also experience increased erosion of the channel bottoms and side slopes. The degree of erosion would depend, typically, on the amount, velocity, and timing of discharges as well as the condition of the channels. Where such channels are now vegetated or are overlain by a gravel/cobble surface, all or in part, erosion would be curtailed.

4.2.4 Effects of Alternative C (Pipeline to Reservoir)

Impacts to soils across the EIS analysis area, as a whole, would be identical to those described for Alternative B (Proposed Action) under this alternative. Impacts to drainage-way soils not affected to date, conversely, would be eliminated since produced water would be conveyed to Seminoe Reservoir via a buried pipeline (see **Figure 14, Direct Discharge into Seminoe Reservoir – Alternative C**). Revegetation of these disturbances would occur following construction and be completed during the first appropriate planting season. Assuming the proper vegetation techniques are applied, this impact to soils would compare to that associated with the interim reclamation of other utility lines to be constructed.

Although the water conveyance pipeline would be designed and installed to prevent leaks, there remains a possibility, albeit remote, that any pipeline constructed to convey water to the reservoir could develop leaks resulting in process water entering the soils surrounding this utility. Although produced water is slightly saline and sodic, no impact to soils would be expected in terms of the soil's capability to support native plant communities if a leak is quickly prepared. If the pipeline is surface-laid, any leaks could be readily identified and repaired. Leaks in buried water pipelines are more difficult to detect, and repairs would be made by excavating to the pipeline, thus disturbing ground at and surrounding the area of the leak. This short-term impact would be considered to be of limited magnitude and duration assuming the leak is repaired and the construction area revegetated with the appropriate plant species in a timely manner.

4.2.5 Effects of Alternative D (Underground Injection)

The surface disturbances proposed under this alternative, and the potential impacts to the soil resource, are the same as for Alternative B (Proposed Action) with one exception. Since produced water would be injected underground, soils overlying drainage-ways not affected to date would not be subject to potential impacts from produced water. Injection wells would be located in areas already affected by produced water treatment facilities (see **Figure 16, Underground Injection of Produced Water – Alternative D**). The physical and chemical characteristics of these soils would remain at baseline levels.

4.2.6 Cumulative Impacts

In the past, soil resources in the EIS analysis area has been impacted through road building, electrical transmission line construction, mining, and pipeline installation. The implementation of any of the proposed action alternatives could result in a loss of soil productivity and the potential for increased soil erosion. The potential for soil erosion from the project disturbance is not expected to result in any major increases in sedimentation of area drainages. The contribution by the Seminoe Road Project disturbances to overall soil erosion within the various watersheds would be small given erosion/sediment control techniques and revegetation activities to be employed and the relatively minor total project disturbance (less than 5% of the EIS analysis area) proposed.

4.2.7 Potential Monitoring and Mitigation

When considering natural gas production requirements, the location of proposed facilities would be sited to avoid or minimize, to the degree possible, disturbances to sensitive soils, including cryptobiotic soils. While it is not possible to avoid sensitive soils entirely given their occurrence over the project area, a minimization approach would serve to decrease the potential for erosion and increase the potential for successful and timely reclamation. Minor siting modifications in sensitive soil areas targeting lesser slope angles or higher quality soils would result in lesser and more manageable impacts to the soil resource.

4.3 Geology

Geology Impact Significance Criteria: *Geology impacts would be significant if the project resulted in landslides or subsidence.*

4.3.1 Effects of Alternative A (No Action)

Under the no action alternative, the Pilot Project could continue; however, natural gas would not be extracted from the remainder of the EIS analysis area. The potential to recover the natural gas resource at some point in the future would remain.

4.3.2 Effects Common to All Action Alternatives

There would be negligible effect to the geologic resources as a result of drilling activities and extraction of natural gas. Although the gas resource would be extracted, the existing geologic structure and lithology in the area would not be altered. The potential recoverability of any oil and gas resources present in the geologic formations below the targeted coal seams would also be unaltered. In addition, there would also be no indirect effects to the geologic resources for any of the alternatives.

The potential of the project to create landslides is unlikely. If an earthquake of the typical historic intensity (2.0 to 4.1 magnitude) occurs in the vicinity of the Seminoe Road Project, no property or equipment destruction is expected.

In addition, dewatering activities would not cause aquifer compression or ground subsidence as the production coal formations (Medicine Bow/Fox Hills and Mesaverde formations) would continue to exist under confined hydraulic conditions, where the potentiometric surface (pressure head of the ground water) would remain above the top of the formations. Although the pressure head in the coals would be reduced during dewatering activities to promote release of natural gas, the formations would remain saturated, albeit under less hydraulic pressure. Therefore, aquifer compression and ground subsidence would not occur.

Given projected depths of gas extraction at the Seminoe Road Project, the continued pressure head on the target coal zones, and the drilling and well completion techniques, the potential for fugitive natural gas seepage to reach surface outcrops or affect local wells is expected to be low.

The potential of the Seminoe Road Project activities to disturb or damage paleontological resources is low as there are no known significant fossil-bearing localities in the area.

On the eastern side of the EIS analysis area, or in undeveloped isolated leases within the analysis area, it is possible that natural gas production could drain gas resources from outside the active extraction area; however, given the planned 160-acre well spacing and with proper well connection techniques, the well drainage is expected to be negligible. In addition, the BLM and WOGCC would monitor drilling activities

4.3.3 Effects of Alternative B (Proposed Action)

The effects of Alternative B would be the same as those described in Section 4.3.2, Effects Common to All Action Alternatives.

4.3.4 Effects of Alternative C (Pipeline to Reservoir)

The effects of Alternative C would be the same as those described in Section 4.3.2, Effects Common to All Action Alternatives.

4.3.5 Effects of Alternative D (Underground Injection)

Effects of Alternative D on geologic resources would be similar to that of Alternatives B and C, except that underground injection would be used for disposal of produced water. Underground injection would need to be permitted in accordance with federal and state regulations, and pressure buildup in injected geologic zones could cause seismic activity to occur. However, any impact from such seismic activity is expected to be low, even negligible.

4.3.6 Cumulative Impacts

As explained in **Appendix E, Regional Activity**, underground and surface coal mining activities have occurred in the Hanna Basin over the past century. The targeted coal zones for mining activities were the sub-bituminous and bituminous coals occurring in the Tertiary age Hanna Formation; the Hanna Formation is located stratigraphically well above the targeted Medicine Bow/Fox Hills and Mesaverde coals, which are the extraction zones for the Seminoe Road Project. See **Figure 29, General Stratigraphic Column and Geologic Cross-Section A-A'**.

Historic attempts to develop oil resources within and surrounding the EIS analysis area have not been successful. Although numerous exploration wells have been drilled, no economic oil reserves were discovered. There are no existing oil wells within the EIS analysis area that would be disturbed by the planned Seminoe Road Project. North of the Seminoe Road Project, on a topographic feature known as "Windy Ridge," a single gas well, which was reported to have been productive, is currently capped (BLM, personal communication, 2004). Activities at the Seminoe Road Project should have no impact to this "Windy Ridge" capped gas well.

4.3.7 Potential Monitoring and Mitigation

If any paleontological resources are discovered during construction activity at the Seminoe Road Project, further operations would be stopped within the area of the discovery, and the BLM authorized officer would be notified to ensure that appropriate protection and/or mitigation could be implemented.

4.4 Surface Water

***Surface Water Impact Significance Criteria**: Impacts to surface water would be considered significant if:*

- *Produced water discharge or surface disturbance negatively affects the beneficial uses in North Platte River, Seminoe Reservoir or downstream of Seminoe Reservoir;*
- *Produced water discharge results in violation of Wyoming Pollutant Discharge Elimination System (WYPDES) permit conditions;*
- *Produced water discharges degrade Class I waters in the Miracle Mile such that the beneficial use (blue ribbon trout fisheries) is negatively affected;*
- *Surface disturbance or erosion from project actions causes grazing allotments within the project area to fail standards for healthy rangelands for public lands (BLM 1997);*
- *Surface disturbance from roads and construction activities and/or from project discharges increase sediment loads into Seminoe Reservoir above background conditions; and*
- *Produced water discharge causes erosion in the ephemeral and intermittent drainages in the EIS analysis area beyond the erosion expected to occur under natural conditions.*

A surface water-quality mixing model (mixing model) was prepared to assess potential water quality impacts to the Seminoe Reservoir and the North Platte River both upstream and downstream of the Seminoe Reservoir (HydroGeo 2003b). This mixing model was adapted from an EPA model developed for the Powder River Basin in northeast Wyoming and was altered to fit the site-specific conditions of the Seminoe Road Project. A discussion of the mixing model assumptions and general protocol is set forth in **Appendix J, Overview of Surface Water Mixing Model**. The surface water impact analysis results presented from this model were used to compare the relative impacts from various activities under the identified alternatives. WDEQ, Water Quality Division, issues permits for surface discharge and determines conditions governing timing, potential treatment or other conditions designed to protect Wyoming waters (i.e. NPDES permits, the name was recently changed to WYPDES permits). See **Appendix D, Agency Jurisdictions (Permits and Approvals)**.

In addition to the surface water quality model, baseline data were collected in the Seminoe Road Project area for water quality, vegetation, channel stability and other factors that may be influenced by Seminoe Road Project actions. This information was presented in Chapter 3, Affected Environment, and reports referenced throughout this document. The Pilot Project contains many of the elements that are proposed in the alternatives, most notably road/pad construction, interim and final reclamation, surface water discharge, produced water quality, treatment systems, a reconstructed stock pond that collects project and runoff waters, and water quality and flow data collected by the Proponent and the BLM. Information and data from the Pilot Project are presented throughout this section to aid in the analysis of project alternatives.

4.4.1 Effects of Alternative A (No-Action)

Pilot Project operations would continue under the no action alternative, with produced water being discharged into Pool Table Draw under the terms and conditions of a NPDES permit issued by the WDEQ Water Quality Division. See **Table 4.4-1, Pilot Project NPDES Limits**. The Pilot Project has not caused any measurable water quality effects to the Seminoe Reservoir or to the Miracle Mile stretch of the North Platte River; however, it has increased in-channel erosion in Pool Table Draw.

Table 4.4-1, Pilot Project NPDES Limits

Daily Discharge at any Discharge Point	1.5 cfs
Chloride	46 mg/l
Dissolved Iron	0.2 mg/l
Dissolved Manganese	0.621 mg/l
Specific Conductance	2,000 µmhos/cm
Sulfate	3,000 mg/l
Total Arsenic	0.0014 mg/l
Total Barium	1.8 mg/l
Total Dissolved Solids	5,000 mg/l
Total Petroleum Hydrocarbons	10 mg/l
Total Radium	1.0 pCi/l

Recently completed acute Whole Effluent Toxicity tests (WET tests) show no impacts of produced water on aquatic organisms; all mortality is insignificant as compared to a laboratory standard or to other sampling points. WET testing was performed by Energy Laboratories, Billings, Montana. Samples were collected from five locations by HydroGeo. The locations tested were:

- DS-3 Discharge, pre-aeration, pre-treatment
- DS-3 Discharge at bubbler, post-treatment
- AMP-4 (old POC), mouth of Pool Table Draw
- AMP-2, Seminoe Reservoir, Coal Creek Arm
- North Platte River, Miracle Mile at Bridge

After discharge, de-gassing of project-produced water causes a 5-10% increase in the produced water's pH. In addition, upon being discharged into drainage channels, the quality of the produced water can be influenced by the channel sediments over and through which the water flows; the degree of this influence is seasonally variable (See **Appendix I, Monitoring Results for Seminoe Road Pilot Project**). In general, during warmer months, produced water flowing in Pool Table Draw has experienced concentration increases in TDS (15 to 20%), iron (200 to 400%) and conductivity (15 to 20%), while sustaining a 10 to 15% reduction in SAR values. (HydroGeo 2004)

Although Pilot Project produced water is subject to energy dissipation measures before being released to the surface (See **Figure 11, Water Treatment Facilities Layout**), constant downstream flow tends to saturate channel soils and sediments, which creates conditions more conducive to erosion than dry soils and sediments. Where the drainage gradient increases, surface roughness changes and/or soils have less structure; drainage channels are subject to downward cutting or bank erosion as the drainage system seeks equilibrium.

Pool Table Draw, like other drainages in the EIS analysis area, has erosion features along portions of the drainage, such as headcuts and bank erosion. See **Figure 38, Pool Table Draw Photographs**. These features in the lower portion of Pool Table Draw include a deep gulley in the high pool of the reservoir, a narrow incised headcut dropping 3-5 feet and a number of small nick points as the channel drops to the elevation of the headcut (see **Appendix I, Monitoring Results for Seminoe Road Pilot Project**). The constant flow of Pilot Project produced water has exacerbated and, in several places, accelerated the natural erosion processes. Heavy runoff from thunderstorms, including one in August 2003, intensified the erosion, especially the downcutting and bank erosion in the drainage. See **Figures 35 and 36, Hydrologic Process and Geomorphic Cycle (Parts I and II)**.

For several years, given drought conditions and fluctuating (downward trending) water levels, Seminoe Reservoir has been below its full pool level. Immediately downstream of the area where the Pool Table Draw drainage channel intersects with the full pool level of the Seminoe Reservoir, headcutting and gully formation is more prevalent. See **Figure 38, Pool Table Draw Photographs** and **Figures 35 and 36, Hydrologic Process and Geomorphic Cycle (Parts I and II)**.

The Pilot Project ROD, issued in 2001 by the BLM, requires mitigation to minimize project related channel erosion impacts (BLM 2001b). In-channel mitigation is expected to require at least one major drop structure and at least 5 small armoring structures for nick points (small vertical drops in the channel elevation) to stabilize the system; this may change as the plans are finalized. These major drop structures can be built using sheet piling (interlocking corrugated sheet metal), rock gabion structures (metal wire reinforced baskets for rock aggregate), large rock placement without gabions to form vortex weirs, and/or concrete weirs. These structures require heavy equipment such as bulldozers, backhoes, front-end loaders, haul trucks etc. and would need the construction of temporary roads or the upgrade of existing two tracks to access construction sites and haul material such as rock used for rip-rap. The small armoring structures would include the installation of fabric anchored into the drainage sides and rock rip-rap to reduce channel energy.

4.4.2 Effects Common to All Action Alternatives

All action alternatives would produce approximately 101,000 acre-feet of water from coal seams over the life of the project. Water production would begin in year 1 and conclude in year 30, with maximum water production in year 7. See **Figure 41, Project Water Production Schedule**. The actual effects of produced water disposal would vary amongst the action alternatives.

Erosion and sedimentation would be the predominant common effect to all action alternatives; however, the amount and extent of such erosion and sedimentation would vary with each alternative, as each action alternative has a different level of disturbance and a different means of produced water disposal.

Development and construction activities (well pads, roads, utility installations) are potential sources of soil erosion and increased sediment loading to area drainages. The potential for erosion and sediment loading below disturbed areas would be the greatest during the initial construction phase. During production operations, potential erosion would decrease due to less surface disturbance and the implementation of interim reclamation activities.

As described in Section 2.4, Alternative B – Proposed Action, the Proponent has proposed that approximately 60% of the original construction disturbance would be reclaimed; this is called interim reclamation. See **Table 2-1, Preliminary Estimate of Surface Area Disturbance**. Road and well pads used for production purposes would be graveled. Sediment control measures are set forth in Section 2.8.12, Water Resources, and reclamation techniques and measures are discussed in Section 2.7, Proponent Committed Reclamation Measures, and **Appendix F, Reclamation Plan**.

The proposed interim reclamation (and final reclamation) would help protect surface water resources from additional sedimentation. The type and extent of sediment control measures employed and used would depend on the area disturbed, weather conditions, and the potential for sediment to be delivered to surface drainages using Best Management Practices (BMPs) and following the reclamation plan (see **Appendix F, Reclamation Plan**). Areas of particular emphasis with regard to potential erosion and sedimentation would be those sites where roads, utility corridors, and other project related activities cross or disturb drainage areas.

All action alternatives and even with the implementation of BMPs would produce erosion rates above background conditions in the uplands (hillslopes above the stream channels). Intense rainfall (which implies heavy runoff) would increase the potential for sediment loading during severe thunderstorms common in the project area. The reduction of infiltration and concentration of flows from roads and pads would result in localized erosion and deposition, especially during the construction phase. For the most part, this sediment would be stored in the uplands and in ephemeral channels, but a portion would be transported to Seminoe Reservoir during storm events. However, a portion of this sediment would make it into surface waters under all action alternatives. The amount of this sediment would depend largely on the effectiveness of the erosion control practices.

If accidental spills of project related materials were to occur, impacts to surface water would be common to all alternatives. Surface water quality impacts from spills could occur as a result of an accident during transportation, storage or use of site materials, such as diesel fuel. See also Section 4.12, Transportation, and Section 4.15, Accidents and Spills.

4.4.3 Effects of Alternative B (Proposed Action)

Alternative B contemplates a phased implementation of 17 individual produced water discharge points emptying into 13 ephemeral drainages, one intermittent drainage, and three playa basins. See **Figure 12, Produced Water Discharge Points – Alternative B**.

Table **4.4-2, Summary of Potential Discharge Locations**, summarizes the proposed discharge site information. With data collected from Pool Table Draw, an estimated seven percent of the produced water discharged into the ephemeral and intermittent drainages would be lost to infiltration and evaporation before entering the North Platte River and Seminoe Reservoir, while the produced water discharged to the playa basins would temporarily pool before infiltrating back into the ground or evaporating.

Table 4.4-2, Summary of Potential Discharge Locations

Discharge Point [1]	Watershed	Drainage Type	Number of Production Wells Feeding Discharge	Estimated Average Discharge (cfs)	Estimated Maximum Discharge (cfs)	Estimated Avg Volume Reaching North Platte River System (cfs)	Estimated Max Volume Reaching North Platte River System (cfs)
DS-02	W. Fork Pool Table Draw	Ephemeral	31	0.2	1.1	0.12	0.75
DS-03	E. Fork Pool Table Draw	Ephemeral	72	0.4	2.4	0.36	2.24
DS-04	Ayers Draw	Ephemeral	88	0.5	2.3	0.45	2.25
DS-05	Dry Ditch	Ephemeral	146	0.8	2.7	0.73	2.59
DS-06	Upper Dirtyman Draw	Ephemeral	74	0.4	2.6	0.35	2.04
DS-07	Lower Dirtyman Draw	Ephemeral	67	0.4	3.2	0.36	2.78
DS-08	Longhart Draw	Ephemeral	76	0.4	1.9	0.35	1.68
DS-09	Unnamed Drainage #2	Ephemeral	50	0.3	1.5	0.24	1.40
DS-10	Upper West Fork Pool Table Draw	Ephemeral	61	0.4	3.2	0.31	2.37
DS-11	O'Brien Crk.	Intermittent	45	0.4	1.8	0.31	1.49
DS-12	Unnamed Drainage #1	Ephemeral	72	0.3	1.7	0.28	1.62

DS-13	Mountain Lion Draw	Ephemeral	26	0.2	1.4	0.20	1.40
DS-14	St. Mary's Ditch	Ephemeral	92	0.4	3.1	0.40	3.00
DS-18	Unnamed Drainage #3	Ephemeral	43	0.2	1.5	0.20	1.42
Notes: 1. Flows from Pilot Project DS-1 would be re-routed to DS-2 for the full development phase of the Seminoe Road Project.							

Produced water is expected to be of similar quality to Pilot Project produced water for the proposed full project "build-out" and is expected to meet primary and secondary drinking and livestock standards.

4.4.3.1 Effects to Ephemeral Drainages Within the EIS Analysis Area

Ephemeral drainage channels would likely adjust vertically and laterally in response to continuous water discharges from the Seminoe Road Project and storm events would accelerate or compound these effects. The extent of the erosion in ephemeral drainages would vary depending on the produced water flow volume, the drainage channel gradient and morphology, geology, and vegetative cover. However, in ephemeral drainages below where produced water is discharged, erosion can be expected to be above undisturbed conditions and would lead to increases in sediment loads into Seminoe Reservoir beyond background conditions.

Based on experience from the Pilot Project, sections of ephemeral drainages would be expected to sustain substantial erosion (channel headcutting and bank erosion) downstream of where produced water is discharged. Pool Table Draw was listed as minor for erosion potential and yet experienced substantial erosion in portions of the channels, especially near the confluence with O'Brien Creek. The rest of the proposed drainages have a moderate to high rating for erosion potential, and are expected to have substantial erosion in portions of the drainage under this alternative. See **Table 4.4-3, Erosion Potential of Proposed Discharge Drainages**.

As described earlier, produced water flowing continuously in ephemeral drainages would cause channels to form in areas with broad swells (low gradient drainage bottoms with no defined channel, typically moist with good grass production) and cause channels to adjust vertically and laterally. Due to these impacts to ephemeral channels, allotments may fail standards and guides assessments in the future, since forage production would be reduced in the channel bottoms (Standard 1) and riparian vegetation in channels bottoms would be less able to withstand storm events due to increased erosion (Standard 2) (BLM 1997). These impacts are expected even with

Table 4.4-3, Erosion Potential of Proposed Discharge Drainages

Drainage	Drainage Type	Erosion Potential [1]
Pool Table Draw	Ephemeral	Minor
Ayers Draw	Ephemeral	Moderate
Dry Ditch	Ephemeral	Moderate
Dirtyman Draw	Ephemeral	High
Longhart Draw	Ephemeral	Moderate
Unnamed Drainage #2	Ephemeral	Moderate
O'Brien Creek	Intermittent	Minor
Unnamed Drainage #1	Ephemeral	Moderate
Mountain Lion Draw	Ephemeral	High
St. Mary's Ditch	Ephemeral	Moderate to High
Unnamed Drainage #3	Ephemeral	Moderate to High

Notes:
1. Erosion potential based on observations made during the baseline drainage surveys (HydroGeo 2001, 2003a, and 2003b). Location of drainages shown on **Figure 37, Watershed Map**.

the intensive management of ephemeral drainages; however, they would be reduced somewhat through intensive management in drainage channels.

Standards 1 and 2 for healthy rangelands are (BLM 1997):

- Standard 1 – Watershed Health: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
- Standard 2 – Riparian/Wetland Health: Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel succession and is resilient and cable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.

Ephemeral channel sediments, over and through which produced water would flow, would influence the quality of the produced water. Similar to the current situation in Pool Table Draw, downstream of where Pilot Project produced water is being discharged, it is expected that produced water flowing in ephemeral drainages would experience concentration increases in pH (5 to 10%), TDS (15 to 20%), iron (200 to 400%) and conductivity (15 to 20%), but sustain a 10 to 15% reduction in SAR values.

4.4.3.2 Effects From Intensive Erosion Management of Ephemeral Drainage Channels

The Pilot Project has shown that continuous discharge of water into ephemeral channels results in channel incision and lateral adjustment producing channel erosion substantially above undisturbed conditions. Although intense erosion management in ephemeral drainge channels has not been proposed by the Proponent, the BLM feels that such action would be necessary as a mitigation measure to reduce the energy of discharged water by increasing channel length and controlling vertical drops in the channel. This would be done with engineered channels, armoring small vertical drops fabric and rock, and building large vertical drop structures using Gabion basket structures (metal wire reinforced baskets for rock aggregate), large rock placements, sheet piling, and/or concrete weirs. These intensive erosion management actions would occur before surface discharge of project water begins to reduce in channel erosion from project actions. Under this alternative, detailed water management plans would be prepared for each phase of the development, techniques would be designed for each drainage channel impacted, and structures and/or engineered channels described above would be placed using heavy equipment before surface water discharges.

Large vertical drop structures would be placed in areas with greater than 3 feet vertical incision and would need to be anchored into stable soils in the sides of drainages. According to the drainage survey, there would be about 20 large vertical drop structures. These drop structures as mentioned above can be built using sheet piling (interlocking corrugated sheet metal), large rock placements, rock Gabions, and/or concrete. These structures require heavy equipment and would need the construction of temporary roads to access construction sites and haul material. Engineered channels would require the disturbance of vegetation within drainages using heavy equipment, would require revegetation efforts, and could be subject to long term maintenance needs especially after storm events. Smaller structures would require temporary haul roads to place rip-rap (angular rock) and other materials, and would also require maintenance.

Experience from the Pilot Project indicates that to intensively manage Pool Table Draw (listed as having minor erosion potential during baseline surveys) to handle current volumes of water (less than 1.5 cfs) without severe erosion or deposition would require at least one major drop structure, at least five small armoring structures for nick points. Additional well sites planned in the proposed action would use Pool Table Draw for water disposal and could result in at least 5.4 cfs of water discharge in the next few years and would require about three large structures. This additional discharge could require different efforts to intensively manage the Pool Table Draw. The water management plan for the first phase of the project build-out would include the design of the structures needed. Assuming these estimates are accurate, at least three temporary construction roads would need to be built, and maybe five additional haul roads. This would be in addition to the rest of the project disturbance needed to access and produce well sites in the watershed for Pool Table Draw.

The design of effective, stable, naturally regulating, open channels that are not subject to severe erosion and/or deposition is a very difficult engineering problem. Even with the proper design of in-channel structures, the variability of natural conditions such as severe storm events, local conditions such as soil types, would require active management of these structures over the life of the project. A substantial reclamation effort at the end of the project would also be needed to redesign the structures for natural precipitation regimes. Also, unless the entire channel is treated, there would most likely be substantial erosion and deposition even with these efforts due to natural channel adjustment to project induced flows.

Intensively managing these ephemeral systems (all additional channels were rated as moderate to high for erosion potential) would require a tremendous planning effort (at least 20 large structures and maybe 100 smaller grade control structures), construction with heavy equipment in channel bottoms, construction of temporary roads, hauling material for construction, revegetation efforts, long-term intensive management, and extensive reclamation efforts. New structures beyond original plans could be anticipated and secondary impacts from surface disturbance could be substantial. All of these efforts would be difficult to anticipate and would most likely not reduce overall channel erosion below undisturbed conditions.

4.4.3.3 Effects to Intermittent Drainages Within the EIS Analysis Area

Sections of O’Brien Creek, the only intermittent drainage within the EIS analysis area, would be expected to sustain minor erosion (channel headcutting and side cutting) downstream of where produced water is discharged. See **Table 4.5-3, Erosion Potential of Proposed Discharge Drainages**. Similar to the effects expected for ephemeral drainages, the extent of the erosion in O’Brien Creek would vary depending on the produced water flow volume and the drainage channel gradient, morphology, geology and vegetative cover.

O’Brien Creek water quality, including conductivity (salinity), is very similar to the water quality to be produced from the Seminoe Road Project coalbed natural gas wells (HydroGeo 2003a). As a result, no negative water quality impacts are expected from produced water being discharged into O’Brien Creek.

4.4.3.4 Effects to Playas Within the EIS Analysis Area

Under Alternative B, approximately one-fourth of the produced water (25,000 acre feet of water for the 30 year project life) would be discharged from discharge points DS-15, DS-16 and DS-17, and routed into three closed playa basins: Ferris Lake, Alkali Flats and St. Mary's Anticline. See **Figure 12, Produced Water Discharge Points – Alternative B**.

Playas within the EIS analysis area are typically dry but periodically flood in the spring with winter snowmelt and following periods of high precipitation. The estimated amount and volume of coalbed natural gas produced water to be discharged annually into the three EIS analysis area playas are set forth in **Table 4.4-4, Estimates of Produced Water Discharge into Playas**. Discharge to these playas (which are closed basins) would begin in year 4 or 5 and conclude at the end of project operations.

Table 4.4-4, Estimates of Produced Water Discharge Into Playas

Discharge Point	DS-15	DS-16	DS-1
Playa	Ferris Lake	Alkali Flats	St. Mary's Anticline Flats
Area of Closed Basin Watershed (acres)	4,491	12,094	11,002
Number of Coalbed Natural Gas Wells Feeding Discharge	67	181	47
Estimated Average Discharge (cfs)	0.4	0.9	0.3
Estimated Average Annual Discharge to Playa (acre-feet)	290	652	217
Estimated Maximum Discharge (cfs)	1.8	5.0	2.3
Estimated Maximum Annual Discharge to Playa (acre-feet)	1,303	3,620	1,665
Estimated natural Inundated Area (acres)	20 - 25	50 - 60	10 - 50
Maximum Inundated Area With Project Discharges (acres)	100 – 150	350 - 400	100 - 150

Any water discharged into playa lakes in the closed basins would be subject to both infiltration and evaporation. Infiltration in the playas would be estimated to range from 10 to 20%. The annual evaporation for this part of south central Wyoming is estimated to be approximately 36 inches (3 feet). Monthly evaporation is lowest during the winter and highest during the summer.

During project operations, produced water is expected to pool in the three playas. The water levels would vary throughout the life of the project, depending on the amount of water discharged. Typically, because of varying evaporation rates throughout the year, playa lakes would cover the greatest area during the late winter and spring, then shrink in size during the summer.

The barren lake bottom of the Ferris Lake playa covers an area of approximately 20 to 25 acres in size. During the years of maximum produced water discharge from discharge point DS-15 (years 5 to 8), water in the Ferris Lake playa would expand to approximately 100 to 150 acres during the spring of that year (with a maximum depth of approximately 2 to 3 feet). During the summer months, with high evaporation rates, this playa lake would shrink to about 40 to 50 acres. During other years of the project, the water levels in the Ferris Lake would be less than the maximum pumping rate years.

The Alkali Flats playa covers a broad area of approximately 1,000 acres, with a barren lake bottom zone of approximately 50 to 60 acres in size. During the years of maximum produced water discharge from discharge point DS-16 (years 6 to 9), water in the Alkali Flats playa would expand to approximately 350 to 400 acres during the spring of that year (with a maximum depth of approximately 4 to 5 feet). During the summer months, with high evaporation rates, this playa lake would shrink to about 100 to 150 acres. During other years of the project, the water levels in the Alkali Flats playa would be less than the maximum pumping rate years.

The barren lake bottom of St. Mary's Anticline Flats playa lake covers an area of approximately 10 acres in size. During the years of maximum produced water discharge from discharge point DS-17 (years 6 to 9), water in the St. Mary's Anticline Flats Lake playa would expand to approximately 100 to 150 acres during the spring of that year (with a maximum depth of approximately 2 to 3 feet). During the summer months, with high evaporation rates, this playa lake would shrink to about 40 to 50 acres. During other years of the project, the water levels in the St. Mary's Anticline Flats playa lake would be less than the maximum pumping rate year.

Proposed water discharges into these playas would inundate areas greater than their maximum natural extent. The inundated vegetation in the areas outside the current lake beds would be replaced by salt and water tolerant plants. Since the inundated area is expected to change seasonally and over the life of the project, at times the vegetation may not meet Standard 3 for rangeland management (BLM 1997).

Water that currently collects in playa lakes as well as project produced water would be affected by evaporation and chemical interaction with the poor quality playa soils. As a result, the playa lake water quality would be expected to have higher concentrations of trace constituents and salinity than produced water.

4.4.3.5 Effects to North Platte River Upstream of Seminoe Reservoir

There would be very small flow increases to the North Platte River upstream of Seminoe Reservoir as a result of produced water discharge into Dirtyman Draw (DS-6 and DS-7) and Unnamed Drainage #3 (DS-18). **See Figure 12, Produced Water Discharge Points –**

Alternative B. An estimated 0.9 cfs from Dirtyman Draw (DS-6 and DS-7) and 0.9 cfs from Unnamed Drainage #3 (DS-18) would empty into the North Platte River upstream of Seminoe Reservoir. These flows combined would represent less than one percent of the average historic monthly flows in the North Platte River in this area. Historical flows in the North Platte have ranged from 300 to 4,100 cfs as measured at USGS gauging station #0663000.

Likewise, there would be no adverse water quality effects to the North Platte River upstream of the Seminoe Reservoir as a result of produced water discharge. With the exception of conductivity (a measure of salinity), the water quality of produced water and the North Platte River are similar. Although the produced water has a higher average conductivity (1,580 µmhos/cm) than water in the North Platte River (historic range of 140 to 720 µmhos/cm), the disproportionate mixture of the two water volumes would result in negligible water quality changes to the North Platte River. For example, during the low flow period (October through March) of project year 7, (which is the estimated year of maximum project pumping), the mixing model (see **Appendix J, Overview of Surface Water Mixing Model**) predicts that salinity in the North Platte River above Seminoe Reservoir could increase approximately 3% (HydroGeo 2004b). The modeling effort reveals that this calculated maximum salinity would be well within the natural variation of the water quality within the river. Therefore, the discharge of produced water into the North Platte River above Seminoe Reservoir would not affect beneficial uses of the water.

4.4.3.6 Effects to Seminoe Reservoir

An estimated daily average of 10 to 11 acre-feet of produced water would empty into the Seminoe Reservoir during project operations contemplated under Alternative B. During project year 7, pumping would peak such that a maximum daily rate of around 35 acre-feet of produced water would be discharged into the Seminoe Reservoir. See **Figure 41, Project Water Production Schedule**. These daily volumes are negligible when compared to the capacity of the Seminoe Reservoir, which has the potential to contain an estimated 1,017,000 acre-feet.

Even given the recent low water levels in Seminoe Reservoir, which have ranged between approximately 435,000 and 770,000 acre-feet over the past few years, the maximum yearly volume of produced water (12,800 acre-feet) predicted to enter the Seminoe Reservoir in year 7 of the project only represents 3% of the above low volume. On average, the project would discharge 3,600 to 4,100 acre feet of water per year into the reservoir; these volumes represent less than 1% of the reservoir's total capacity.

In the year 2000, an estimated 62,800 acre-feet of water evaporated from the Seminoe Reservoir (USDI Bureau of Reclamation 2000). The projected average monthly discharge of around 330 acre feet of produced water into the Seminoe Reservoir would be much less than the monthly evaporation off the reservoir, which ranged from 1,100 acre feet in February to 11,100 acre feet in July (USDI Bureau of Reclamation 2000).

With the exception of conductivity (a measure of salinity), the water quality of produced water and the North Platte River are similar. Although the produced water has a higher average conductivity (1,580 µmhos/cm) than water in the Seminoe Reservoir, which ranges from around 500 to 600 µmhos/cm near the Seminoe dam, the disproportionate mixture of the two water volumes would result in negligible salinity changes in the Seminoe Reservoir. During project year 7 (which is year of maximum project pumping), the mixing model (see **Appendix J, Overview of Surface Water Mixing Model**) predicts that salinity in the Seminoe Reservoir could increase approximately 3%. For example, a natural conductivity of 600 µmhos/cm could potential increase to 620 µmhos/cm.

Reservoir arms that lack mixing from tributary inputs and could have locally higher increases in salinity; however, these amounts would still be less than what would likely impact beneficial uses such as trout fisheries (See Section 4.7.2.13, Fisheries). Acute WET tests described in the impacts for Alternative A show the produced water is not toxic to common aquatic organisms (Fathead Minnows and Daphnia Magna).

4.4.3.7 Effects to "Miracle Mile"

Produced water discharge would not affect flows in the stretch of the North Platte River known as the "Miracle Mile." The federal government has mandated that discharge from Kortes Reservoir, which is located immediately downstream of Seminoe Reservoir, must maintain a discharge rate of 500 cfs into the Miracle Mile.

Likewise, there would be no adverse water quality effects to the Miracle Mile as a result of produced water discharge. With the exception of conductivity (a measure of salinity), the water quality of produced water and the Miracle Mile are very similar. Although the produced water has a higher average conductivity (1,580 µmhos/cm) than water in the Miracle Mile (historic range of 300 to 660 µmhos/cm as measured at USGS gauging station 06636000), the disproportionate mixture of the two water volumes would result in negligible water quality changes to the North Platte River. During the low flow period (October through March) of project year 7 (which is year of maximum project pumping), the mixing model (see **Appendix J, Overview of Surface Water Mixing Model**) predicts that salinity in the North Platte River above Seminoe Reservoir could increase approximately 3%. For example, a natural conductivity of 600 µmhos/cm could potentially increase to 620 µmhos/cm. The modeling effort reveals that this calculated maximum salinity would be within the natural variation of the water quality within the river and the discharge of Project produced water is not expected to affect beneficial uses of the Miracle Mile water, particularly the blue ribbon trout fishery (see Section 4.7.2.13, Fisheries).

4.4.3.8 Effects to North Platte River Downstream of Pathfinder Reservoir

There would be no adverse water quality effects to the North Platte River downstream of Pathfinder Reservoir as a result of produced water discharge.

The theoretical annual average TDS load to the North Platte System from the Seminoe Road Project was calculated to be about 7,000 tons per year. To put this number in context, the TDS load from the North Platte River above Seminoe Reservoir is about 250,000 tons per year.

4.4.4 Effects of Alternative C (Pipeline to Reservoir)

Under Alternative C, produced water would be piped and directly discharged into either the Seminoe Reservoir or a stretch of the North Platte River just upstream of Seminoe Reservoir. See **Figure 14, Direct Discharge into Seminoe Reservoir – Alternative C**.

Produced water from the proposed full project “build-out” would meet primary and secondary drinking and livestock standards, and is expected to be of similar quality to Pilot Project produced water. As discussed in Section 4.5.1, Effects of Alternative A – No Action, Pilot Project produced water has met conditions and water quality standards imposed by the WDEQ NPDES permit. The watersheds and playas within the EIS analysis area would not be subjected to produced water discharge.

This alternative would result in surface disturbance and potential increased sedimentation in drainages where reservoirs are constructed to store and cool project produced water before it is piped directly to perennial waters in the North Platte River and Seminoe Reservoir. Surface disturbance from construction of pipeline corridors and ancillary facilities could also result in some increase of sedimentation to drainages. However, BMP’s to control erosion and sedimentation would be implemented to mitigate and minimize adverse affects. These reservoirs would have a similar design to the stock pond in Pool Table Draw (see **Figure 15, Design Concepts for Direct Discharge – Alternative C**).

There would be negligible flow increases to the North Platte River upstream of Seminoe Reservoir, and these would be the same as described for Alternative B. Likewise, under Alternative C, no adverse water quality effects are expected to the Seminoe Reservoir and the North Platte River, both upstream and downstream (Miracle Mile) of the reservoir. There is expected to be a slight increase in conductivity in the Miracle Mile, but would not effect the beneficial uses of this blue ribbon trout fishery. Salt loading is expected to be similar as those described in Alternative B, about 3% per year during maximum discharges of produced water. Surface water quality effects would be similar to those for Alternative B. See Section 4.5.3, Effects to Alternative B (Proposed Action).

4.4.5 Effects of Alternative D (Underground Injection)

Under Alternative D, produced water would be routed to collection points then injected underground into the Dad Sandstone. See **Figure 16, Underground Injection of Produced Water – Alternative D**.

With underground injection of produced water, there would be no effects to the flows and water quality in the North Platte River system. The entire estimated 101,000 acre feet of produced water would be re-injected underground and not available to downstream flows. The drainages and playas within the EIS analysis area would not be subjected to produced water discharge.

4.4.6 Indirect Effects

Potential impacts could result from off-site spills or releases, but the potential for such impacts are low. See also Section 4.12, Transportation, and Section 4.15, Accidents and Spills.

4.4.7 Cumulative Impacts

Downstream demands for water in the Platte River drainage would continue to influence the operations of North Platte River reservoirs, and water levels in these reservoirs (particularly in Seminoe Reservoir) are expected to fluctuate into the future. In addition, regional surface water quality would continue to be influenced by local and regional land use trends and activities, which include ranching and farming, oil and gas exploration and development, coal mining (albeit reduced from historic levels), and recreational use.

Because regional coal mining activities are greatly reduced from historic levels and given the strict federal and state governmental drainage and sediment control measures, there would be no measurable surface water cumulative effects as a result of coal mining activities in the region. There are some coal mining activities that are currently under the process of reclamation on the east side of Seminoe Reservoir, and this reclamation work is not expected to impact surface waters.

Ranch management and grazing activities within and adjacent to the EIS analysis area would be required to meet standards for rangeland management on public lands (BLM 1997), and therefore are not expected to have measurable effects to surface water resources. Since livestock tend to concentrate around stock ponds and in drainage areas in search of water, there would be localized effects to surface waters, which could lead to greater erosion where surface disturbance occurs and livestock concentration areas coincide.

Irrigation activities and municipal water systems above and below the EIS analysis area would contribute additional salt loading into the North Platte System. The total annual average TDS load to Seminoe Reservoir from the Seminoe Road Project was calculated to be a maximum of 7,000 tons per year. The existing TDS load from the North Platte into Seminoe reservoir is about 250,000 tons per year.

Recreational activities like boating, fishing, swimming, hunting and camping would have minimal additional effects on surface water. Off-road travel in drainage areas could locally cause effects to surface waters, but these effects would be limited in the EIS analysis area given restricted travel through the checkerboard federal and private ownership.

Additional oil and gas exploration and development could potentially occur in the areas within and surrounding the EIS analysis area. Another coalbed natural gas pilot project development, known as the Hanna Draw Project, is being considered for an area approximately 20 miles east of the EIS analysis area. The proponent for this Hanna Draw Project is currently assessing the possibility of discharging produced water into the Medicine Bow River, which flows into Seminoe Reservoir. This project is in the exploratory stage, but could potentially produce as much water as the Seminoe Project. The conditions of the future discharge and the potential water quality are uncertain. The most likely cumulative effect if this project is developed would be salt loading to the North Platte River system.

4.4.8 Potential Monitoring and Mitigation

As explained in Section 2.4, Alternative B – Proposed Action, the Seminoe Road Project would be developed in a phased approach. Individual NEPA analyses and water management plans would be prepared for each new build-out phase of the Seminoe Road Project. Specific monitoring and mitigation requirements would also be developed for each project phase. As part of the first development phase of the project, it is recommended that the Proponent complete or obtain the following information and data:

- Monitor water quality of the North Platte River above Seminoe Reservoir, Seminoe Reservoir, and in the Miracle Mile stretch of the North Platte River. This data would be used to assess potential effects from produced water discharge into the North Platte River drainage. This would include routine water quality monitoring of existing sites on the North Platte River above Seminoe Reservoir like the Dugway Recreational area, sites on Seminoe Reservoir (near the mouth of O'Brien Creek), and monitoring at the current USGS gauging station on the Miracle Mile.
- If Alternative B is selected, analyze hydraulic characteristics of ephemeral and intermittent drainages prior to any produced water discharge into drainages and include structure designs in the water management plan for each project phase. This analysis would assess the capacity of the drainage to handle projected flows without causing excessive erosion, and would involve establishing pre-discharge drainage cross-sections and monitoring these areas during operations.
- If Alternative B is selected, develop drainage-specific erosion mitigation plans to address potential erosional problem areas prior to produced water discharge. Such plans could include targeted grade control structures, check dams, impact basins, channel reconstruction, or other possible engineered erosion control measures. Any structures would be inspected once in the spring and once in the fall.
- If Alternative B is selected, complete a site-specific water balance for any produced water released into the three playas. This assessment would address the expected aerial coverage of produced water in these playas by season and by year. The information would be used to ensure that access roads, well pad sites or any sensitive environmental sites (e.g., sage grouse leks, raptor nests, cultural sites, etc.) are not inundated by produced water accumulating in the playas.

4.5 Ground Water

Ground Water Impact Significance Criteria: *Ground water impacts would be considered significant if:*

- *Ground water depletions cause measurable effects to ground water wells;*
- *Ground water depletions cause measurable effects to surface water flow in the North Platte River downstream of Seminoe Reservoir; and,*
- *Ground water quality is degraded in any freshwater aquifer.*

The desorption (release) of coalbed natural gas occurs when the ground water pressure (hydrostatic pressure) in coal formation is reduced by pumping water out of the formation via a well. As hydrostatic pressure drops, the physical bond between the coal and the entrained natural gas breaks, and the gas diffuses through the coal into the production well. Therefore, to create favorable conditions for the release of natural gas from coal seams, ground water must be pumped from the coal seam prior to and during natural gas extraction. Studies conducted in conjunction with coalbed natural gas production in Wyoming's Powder River Basin have shown that up to 20% of the entrained water must be removed in order to depressure the coal sufficiently to facilitate gas desorption (HydroGeo 2004b).

It is important to note that the gas producing coal seams are often confined, and the ground water in these formations is naturally under high pressure. Simply put, this means that a well installed in a confined coalbed may have a ground water level far above the actual top of the coalbed and in many cases thousands of feet above the top of the coal. A reduction in ground water pressure does not mean the coalbed would be dewatered, only that the hydrostatic pressure would be reduced.

The drop in hydrostatic pressure due to well pumping also creates ground water drawdown. Drawdown is typically the greatest at the pumping well and declines with distance from the well, resulting in a drawdown cone (or cone of depression) around the pumped well.

4.5.1 Overview of Ground Water Model

A regional scale three-dimensional ground water flow model was prepared for the Seminoe Road Project (Seminoe Road Ground Water Model). Regional ground water models provide a relative tool to simulate very complex large scale natural systems and are used regularly in EIS analyses to help evaluate the effects of various action alternatives and the cumulative effects from other activities.

These types of models generate numerical results; however, the results only show the general character of the effects of the modeled action alternative as opposed to the actual size or magnitude of the effects. The Seminoe Road Ground Water Model was used to simulate and compare the short and long-term effects to the natural ground water system of Alternative B and C (ground water pumping and surface discharge of produced water) and Alternative D (pumping and re-injection of produced water).

The Seminoe Road Ground Water Model was developed using the computer program MODFLOW. MODFLOW, which is a well used and acceptable model to analyze the potential effects of gas development projects on ground water resources. The Seminoe Road Ground Water Model is based on a conceptual model of the Hanna Basin hydrogeologic system derived from site specific and regional geologic and hydrogeologic information (HydroGeo 2003a). The model domain encompasses the entire Hanna Basin, an area of approximately 1,750 square miles, see **Figure 31, Hanna Basin,** and incorporates nine layers which represent the major geologic formations, listed from geologically youngest to oldest: Fern's Formation, Hanna Formation, Medicine Bow Formation, Fox Hills Sandstone, Dad Sandstone, and Mesaverde Coal Bearing Formation (Almond Formation, Pine Ridge Sandstone, Allen Ridge Formation, and Haystack Formation).

The boundaries of the model utilize natural hydrogeologic features such as major faults, anticlines, and surface water features. The bottom of the model is bound by the impermeable Steele Shale. The hydraulic input parameters (hydraulic conductivity, storage, specific yield) for the Seminoe Road Ground Water Model were derived from site-specific data and literature based information. A more detailed description of the numerical model used to analyze ground water impacts and the detailed modeling results are set forth in the August 2004 Draft Ground Water Modeling Technical Report (HydroGeo 2004a).

4.5.2 Effects of Alternative A (No-Action)

Under Alternative A (no action), Pilot Project operations could continue under the terms and conditions of the 2001 BLM approval for this activity. There have been no measurable Pilot Project induced effects to ground water quality or ground water levels in water wells, spring flows or changes in ground water quality, or reduction of surface water flows or changes in water quality in the North Platte River.

Existing land use trends in the area would continue, and other oil and gas development and coal mining activities could cause localized impacts to ground water resources. It is not expected that ranch management activities (grazing) and recreation would have any effect on ground water resources in the area.

4.5.2.1 Effect to Mesaverde Coal Bearing Formations (Lower Formation)

The Pilot Project pumping has not caused any measurable effects either to water levels or water quality in ground water wells installed in the Mesaverde strata in the area, although the pumping activity has removed ground water from the Mesaverde formations and has caused a localized reduction in ground water pressure in the coal-bearing formations and possibly adjacent formations within and immediately surrounding the Pilot Project area. Current data from the Pilot Project observation well (a pressure monitoring well located in the center of the Pilot Project well field) indicates that the ground water level in the Mesaverde formations has lowered about 1,000 feet since the start of project ground water pumping in 2001 (Dudley 2005). The drawdown cone is localized, and Pilot Project pumping has not affected any of the area's ground water resources used for other purposes.

4.5.2.2 Effects to Medicine Bow/Fox Hills Coal Bearing Formation (Upper Formation)

Pilot Project operations involve only pumping from Mesaverde formations, and there is no indication of any hydraulic connection between the Mesaverde and Medicine Bow strata. There have been no measurable effects to either water levels or water quality in ground water wells installed in the Medicine Bow/Fox Hills Sandstone formations resulting from Pilot Project pumping activities.

4.5.2.3 Effects to Alluvial Ground Water Systems Within and Adjacent to EIS Analysis Area

Surface discharge of produced water from the Pilot Project into Pool Table Draw has saturated the alluvium in the drainage creating a localized shallow ground water system. Prior to Pilot Project operations, Pool Table Draw was an ephemeral drainage that flowed only during precipitation and snow melt events. As a result of the discharge of Pilot Project produced water, the alluvium in the drainage has become saturated and riparian vegetation has developed in some areas. See Section 3.6.2.1, Pilot Project Produced Water Riparian Zones, and Section 4.6.1, Vegetation Effects of Alternative A (No Action).

Figure 38, Pool Table Draw Photographs, illustrates some of the effects of Pilot Project produced water on the drainage. The saturated soils in Pool Table Draw are also more prone to erosion from surface water flow than unsaturated soils and as a result have shown accelerated erosion such as headcutting and downcutting of the drainage channel. The BLM has installed several monitoring sites in Pool Table Draw to evaluate changes in channel configuration. See **Appendix I, Monitoring Results for Seminoe Road Pilot Project**.

4.5.2.4 Effects to Springs Within and Adjacent to the EIS Analysis Area

There have been no measurable effects to either flows or water quality in area springs resulting from Pilot Project or other activities in the area. No additional effects to springs are anticipated at the current activity level.

4.5.2.5 Effects to Stock Wells Within and Adjacent to the EIS Analysis Area

There have been no measurable effects to either water levels or water quality in area stock wells from Pilot Project or other activities in the area based on recent monitoring data. See Section 3.4.5, Stock Wells Within and Adjacent to the EIS Analysis Area. No additional effects to stock wells are anticipated at the current activity level.

4.5.2.6 Effects to Domestic Wells Within and Adjacent to the EIS Analysis Area

There have been no measurable effects to either water levels or water quality in area domestic wells from Pilot Project or other activities in the area based on recent monitoring data. See Section 3.4.6, Domestic Wells Within and Adjacent to the EIS Analysis Area. No additional effects to domestic wells are anticipated at the current activity level.

4.5.3 Effects Common to All Action Alternatives

Under all action alternatives, the same amount of ground water would be pumped from the Mesaverde and Medicine Bow formations to liberate the natural gas entrapped in the target coal seams. The partial removal of ground water from the coal-bearing zones would affect ground water pressures and would lessen water availability within the target coal seams, as well as in the overlying and underlying water-bearing formations. No degradation of ground water quality would be expected as a result of pumping.

Existing land use trends in the area would continue, and other oil and gas development and coal mining activities could cause localized impacts to ground water resources. It is not expected that ranch management activities (grazing) and recreation would have any effect on ground water resources in the area.

4.5.4 Effects of Alternative B (Proposed Action)

Under the Alternative B (Proposed Action), the Seminoe Road Project operations would develop and produce natural gas from the Mesaverde formation coals (Almond and Allen Ridge formations) and coalbeds in the Medicine Bow Formation. Ground water would be pumped from these formations to promote natural gas production and the project-produced water would be discharged to surface drainages.

Under this alternative, ground water modeling (HydroGeo 2004a) indicates that the greatest drawdown within the EIS analysis area would occur during year 7 of project operations, when pumping is at its maximum. Following year 7, pumping rates and the resultant ground water drawdown would decrease until the end of the operations. The modeled ground water levels recovered to near their pre-pumping elevations within about a year of the end of the project (HydroGeo 2004b). Predicted temporary ground water depressurization (drawdown) and recovery during and post project operations is presented in **Figure 43, Potential Ground Water Drawdown and Recovery (Alternatives B and C)**.

Pumping of ground water is not expected to cause any measurable depletion to flows in the North Platte River system (HydroGeo 2004b). However, discharge of project-produced water would increase flows to the North Platte River system during the life of the project. It is predicted that ground water levels would return to pre-pumping levels within a year after project operations cease and long-term depletions of the North Platte River system waters are not anticipated (HydroGeo 2004b).

A ground water sample from the Mesaverde formations from a Pilot Project well was age-dated to be over 5,000 years old. The antiquity of the water demonstrates that the Mesaverde ground water system is stagnant with little or no connectivity with shallow ground water-bearing zones or area surface water resources (BLM 2001). The ground water from the Medicine Bow Formation has not been age dated.

Existing land use trends in the area would continue, and other oil and gas development and coal mining activities could cause localized impacts to ground water resources. It is not expected that ranch management activities (grazing) and recreation would have any effect on ground water resources in the area.

4.5.4.1 Effects to Mesaverde Coal Bearing Formation (Lower Formation)

In the target coal zones in the Mesaverde formations (Almond and Allen Ridge formations), maximum modeled drawdown could potentially exceed 1,000 feet near the center of the EIS analysis area and could approach 2,000 feet on the west side project area near the Haystack Mountains in year 7. After year 7, ground water drawdown would decrease to less than 5 feet at the end of operations and return pre-pumping levels a year later.

4.5.4.2 Effects to Medicine Bow/Fox Hills Coal Bearing Formation (Upper Formation)

Modeled drawdown in the Medicine Bow Formation would be greatest in outcrop areas in the Haystack Mountains where drawdown could exceed 250 feet in year 7. After year 7, ground water drawdown would decrease to less than 5 feet at the end of operations and return to pre-pumping levels a year after cessation pumping.

4.5.4.3 Effects to Alluvial Ground Water Systems Within and Adjacent to EIS Analysis Area

Project-related ground water drawdown is not expected to affect any alluvial ground water systems. However, under Alternative B, produced water would infiltrate and saturate the alluvium material in the drainages below discharge points. See **Figure 12, Produced Water Discharge Points - Alternative B**. This would create an alluvial ground water system that did not exist previously. After discharge ceases, these localized alluvial ground water systems would dry up and return to pre-discharge conditions. This situation is happening in Pool Table Draw downstream of the Pilot Project produced water discharge points. See Section 4.4.2, No Action Alternative. Natural alluvial ground water systems along the North Platte River and other perennial streams in the area would not be affected by operations of the Seminoe Road Project.

4.5.4.4 Effects to Springs Within and Adjacent to the EIS Analysis Area

The drawdown of ground water levels at the water table could affect spring flows within and adjacent to the EIS analysis area. However, because of the complex hydrogeology in the area, it is not possible to predict the quantitative effect of project-induced drawdown on area springs. The potential flow changes at springs in the EIS analysis area are shown in **Table 4.5-1, Potential Flow Reduction at Springs (Alternatives B and C)**.

Based on the Seminoe Road Ground Water Model drawdown results, the potential reduction of spring flow or water level reduction in wells has been characterized as follows:

- High - modeled drawdown greater than 500 feet;
- Moderate - modeled drawdown between 200 to 500 feet;
- Low - modeled drawdown less than 200 feet; and,
- Negligible – modeled drawdown less than 10 feet.

In all cases, after cessation of project pumping, potential reductions of water levels in alluvial wells would be negligible.

Table 4.5-1, Potential Flow Reduction at Springs (Alternatives B and C)

Monitored Site (1)	Projected Producing Interval	Potential Reduction of Spring Flow at Maximum Drawdown in Year 7	Potential Spring Flow Reduction at the End of Operations
O'Brien Spring	Mesaverde sandstone bedrock fault	High	Negligible
Corral Creek Spring	Mesaverde shallow bedrock or alluvium	Low	Negligible
Ayers Spring	Medicine Bow shallow bedrock or alluvium	Low	Negligible
Miller Bend Spring	Mesaverde fractured bedrock	Moderate	Negligible
Alkali Flat Spring #1	Medicine Bow shallow bedrock or alluvium	Low	Negligible
Alkali Flat Spring #2	Medicine Bow shallow bedrock or alluvium	Low	Negligible
St. Mary's Spring	Ferris Formation shallow bedrock fracture	Low	Negligible

Note:
1. Spring locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**.

Project operations are not expected to affect spring water quality.

4.5.4.5 Effects to Stock Wells Within and Adjacent to the EIS Analysis Area

The drawdown of ground water levels could reduce water levels in stock wells within and adjacent to the EIS analysis area. The potential water level changes in EIS analysis area wells are shown in **Table 4.5-2, Potential Water Level Reduction at Stock Wells (Alternatives B and C)**.

Project operations are not expected to affect stock well water quality.

Table 4.5-2, Potential Water Level Reduction at Stock Wells (Alternatives B and C)

Monitored Site [1]	Projected Producing Interval	Potential Reduction of Water Levels in Year 7	Modeled Reduction of Water Levels at the End of Operations
Section 19 Well	Mesaverde	High	Negligible
Miller # 1 Well	Medicine Bow	Moderate	Negligible
Little Shoe Well	Mesaverde	High	Negligible
Dry Ditch Well #1	Medicine Bow	Low	Negligible
Dry Ditch Well #2	Medicine Bow	Low	Negligible
Alkali Flat Well	Mesaverde	Low	Negligible
Note: 1. Well locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**			

4.5.4.6 Effects to Domestic Wells Within and adjacent to the EIS Analysis Area

The drawdown of ground water levels could affect reduce water levels in domestic wells within and adjacent to the EIS analysis area. The potential drawdown in EIS analysis area wells is shown in **Table 4.5-3, Potential Water Level Reduction at Domestic Wells (Alternatives B and C)**.

Table 4.5-3, Potential Water Level at Domestic Wells (Alternatives B and C)

Monitored Site [1]	Projected Producing Interval	Potential Reduction of Water Levels in Year 7	Modeled Reduction of Water Levels at the End of Operations
ID Ranch Well	Medicine Bow	Moderate	Negligible
Boat Club Well	Medicine Bow or Seminoe Reservoir Alluvium	Low	Negligible
Sheller Well	North Fork Alluvium	Low	Negligible
Note: 1. Well locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**			

Project operations are not expected to affect domestic well water quality.

4.5.5 Effects of Alternative C (Pipeline to Reservoir)

Under Alternative C, produced water would be routed directly to the Seminoe Reservoir and/or the North Platte River, and the volume of produced water and production timeframes would be the same as Alternative B. The effects on water resources in the bedrock aquifers would also be expected to be the same as Alternative B. Under Alternative C, alluvium in the discharge drainages would not receive recharge from surface infiltration of produced water, as produced water would be discharged directly into the Seminoe Reservoir and/or the North Platte River. See **Figure 14, Direct Discharge into Seminoe Reservoir – Alternative C.**

4.5.6 Effects of Alternative D (Underground Injection)

As discussed in detail in Section 2.6, Underground Injection of Produced Water Under Alternative D, produced water would be routed to centralized locations within the EIS analysis area and injected into the Dad Sandstone. See **Figure 16, Underground Injection of Produced Water – Alternative D**. The volume of produced water and production timeframes under Alternative D would be the same as for Alternatives B and C.

Impermeable shale layers of the Lewis Shale Formation encapsulate the Dad Sandstone. As a result, it is assumed that the Dad Sandstone is saturated, and the water in this formation is probably under relatively high pressure, with limited groundwater movement into adjacent to impermeable shale strata.

Given this situation, the Proponent may probably need to employ high-pressure injection, as well as hydro-fracturing techniques to increase the permeability of the Dad Sandstone. Hydro-fracturing involves injecting a sand/water mixture under very high pressure through the injection well, borehole into the target formation, creating open fractures, thus increasing the formation permeability. Further, if the existing water within the Dad Sandstone is too highly pressurized, it may be necessary to increase the number of injection wells beyond those shown on **Figure 16, Underground Injection of Produced Water – Alternative D**.

Injecting water into the Dad Sandstone would increase pressure in that formation, such that localized underground pressure mounds would be created around the injection wells. Because the Lewis Shale has very low permeability, it is not expected that re-injected produced water would migrate, or leak, into the surrounding shale strata.

It is assumed that the water quality of the Dad Sandstone is similar to that of the Mesaverde Formation. If this is true, there should be no impact to the water quality of the Dad Sandstone with underground injection of produced water.

Under Alternative D, the Seminoe Road Project ground water pumping is not expected to have any measurable effects on flows in the North Platte River system (HydroGeo 2004b). However, without surface discharge of project-produced water, there would be no increase flows to the North Platte River system for the life of the project as in Alternatives B and C. It is predicted that ground water levels would return to pre-pumping levels within a year after project operations cease, and no long-term depletions of the North Platte River system waters are anticipated (HydroGeo 2004b).

4.5.6.1 Effect to Mesaverde Coal Bearing Formation (Lower Formation)

Same as Alternative B and C.

4.5.6.2 Effects to Medicine Bow/Fox Hills Coal Bearing Formation (Upper Formation)

Because the Dad Sandstone might have some hydraulic connectivity to the Medicine Bow Formation, re-injection of produced water into the Dad Sandstone could potentially offset some of the project induced drawdown in the Medicine Bow Formation. The Ground Water Modeling results indicate that there would be negligible drawdown in the Medicine Bow Formation, and, in some areas, ground water levels could actually increase, due to pressurized injection of produced water into the Dad Sandstone (HydroGeo 2004a).

4.5.6.3 Effects to Alluvial Ground Water Systems Within and Adjacent to EIS Analysis Area

Same as Alternative C.

4.5.6.4 Effects to Springs Within and adjacent to the EIS Analysis Area

The drawdown of ground water levels could affect spring flows within and adjacent to the EIS analysis area. However, because of the complex hydrogeology in the area it is not possible to predict the actual effect of project-induced drawdown on area springs. The predicted drawdown would peak in Year 7, then decrease for the rest of the project life. See **Table 4.5-4, Potential Flow Reduction at Springs (Alternative D)**.

Table 4.5-4, Potential Flow Reduction at Springs (Alternative D)

Monitored Site (1)	Projected Producing Interval	Potential Reduction of Spring Flow at Maximum Drawdown in Year 7	Potential Spring Flow Reduction at end of Operations
O'Brien Spring	Mesaverde sandstone bedrock fault	High	Negligible
Corral Creek Spring	Mesaverde shallow bedrock or alluvium	High	Negligible
Ayers Spring	Medicine Bow shallow bedrock or alluvium	None	Negligible
Miller Bend Spring	Mesaverde fractured bedrock	Moderate	Negligible
Alkali Flat Spring #1	Medicine Bow shallow bedrock or alluvium	Low	Negligible
Alkali Flat Spring #2	Medicine Bow shallow bedrock or alluvium	Negligible	Negligible
St. Mary's Spring	Ferris Formation shallow bedrock fracture	Negligible	Negligible

Note:
1. Well locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**

4.5.6.5 Effects to Stock Wells Within and Adjacent to the EIS Analysis Area

The drawdown of ground water levels could reduce water levels in stock wells within and adjacent to the EIS analysis area. The predicted water level changes at wells in the EIS analysis area is shown in **Table 4.5-5, Potential Water Level Reduction at Stock Wells (Alternatives D)**.

Table 4.5-5, Potential Water Level Reduction at Stock Wells (Alternative D)

Monitored Site (1)	Projected Producing Interval	Potential Reduction of Water Levels in Year 7	Modeled Reduction of Water Levels at end of Operations
Section 19 Well	Mesaverde	Negligible	Negligible
Miller # 1 Well	Medicine Bow	High	Negligible
Little Shoe Well	Mesaverde	Negligible	Negligible
Dry Ditch Well #1	Medicine Bow	Low	Negligible
Dry Ditch #2	Medicine Bow	Negligible	Negligible
Alkali Flat Well	Mesaverde	Low	Negligible
Note: 1. Well locations are shown on **Figure 33, Hydrologic Monitoring Sites Location Map**			

4.5.6.6 Effects to Domestic Wells Within and Adjacent to the EIS Analysis Area

Same as Alternatives B and C.

4.5.7 Indirect Effects

The potential for indirect ground water impacts to the region are expected to be minimal, because most employees live or would choose to live in communities with established water and sewer systems. If employees choose to live in rural areas, domestic water wells would probably be drilled; however, these wells should have little indirect effect on ground water quality or quantity.

4.5.8 Cumulative Impacts

The primary activities that could affect ground water resources within and adjacent to the EIS analysis area include natural gas projects, coal mining, and pumping from local livestock and domestic wells.

Pumping operations related to future coalbed natural gas projects like the proposed Hanna Basin Project (20 miles east of the EIS analysis area) could potentially amplify the ground water drawdown effects. The Hanna Formation coal zones are the production targets for the Hanna Basin Project. These coal horizons are stratigraphically much higher than the Mesaverde Group coal targeted by the Seminoe Road Project and are not believed to be hydraulically connected. However, the Medicine Bow coals targeted for the Seminoe Road Project are relatively close to the Hanna Formation and could potentially have some hydraulic connectivity. Pumping from both of these formations could increase ground water drawdown effects in areas where the cone of depressions of the two projects overlap. The timing and pumping rates for the Hanna Basin Project are not known, so overall cumulative hydrologic impacts are not possible to assess at this time.

Coal mining operations within and surrounding the EIS analysis area have been curtailed in recent years, and much of the disturbed areas have been reclaimed. There are no known new coal mining projects planned in the future in this area. No cumulative effects due to coal mining is anticipated.

Pumping of local livestock and domestic wells use comparatively little ground water; therefore no cumulative effects as a result of pumping these wells is expected.

4.5.9 Potential Monitoring and Mitigation

As explained in Section 2.4, Alternative B, Proposed Action, the Seminoe Road Project would be developed in a phased approach. Individual EA and WMPs would be developed and updated for each new “build-out” phase of the Seminoe Road Project. Specific monitoring and mitigation requirements would also be developed for each phase of the Project. As part of the first development phase of the project, it is recommended the Proponent complete or obtain the following information and data:

- Age dating of the ground water in the target coal zones of the Medicine Bow/Fox Hills formations to determine possible connectivity to the North Platte River system;
- Hydrologic testing of the target coal zones Medicine Bow/Fox Hills formations to measure the hydraulic properties and allow better ground water characterization of these zones;
- Install monitoring wells within the target coalbeds and adjacent formations in the proposed well field of each development phase to allow on-going assessment of water pressures and water quality conditions;
- Monitoring of water levels in the new monitoring wells during and after operations to assess potential project induced ground water drawdown;
- Monitoring of water levels and flows of major springs, stock wells, and domestic wells in the area as identified in the Baseline Monitoring Study (HydroGeo 2003a) to assess potential effects from project induced ground water drawdown;
- If there is a reduction of flow to a developed springs or reduced water levels in wells, the Proponent would replace this water source with an acceptable alternative;
- Ground water replacement alternatives could include:

- Replace a spring with a guzzler (a device that captures and stores rainfall);
- Replace a spring with a water well;
- Route project produced discharge water to the effected site or to an acceptable alternative site;
- Replace a well with another well; and
- Replace a domestic well with hauled water.

➢ If produced water is to be re-injected into the Dad Sandstone, hydrologic testing of this sandstone unit would be necessary to measure hydraulic properties and allow better ground water characterization.

4.6 Vegetation

Vegetation Impact Significance Criteria: *Vegetation impacts would be considered significant if:*

➢ *There was non-compliance with the Great Divide RMP;*

➢ *Reclamation was not in compliance with Executive Order 13112 (Invasive Species);*

➢ *Reclamation would not support the pre-existing land uses, including wildlife habitat;*

➢ *The project violated the Clean Water Act, Executive Order 11988 (Floodplains), and Executive Order 11990 (Wetlands and Riparian Zones);*

➢ *Weeds jeopardized reclamation efforts or post-project land use; or,*

➢ The project jeopardized the persistence of any BLM Wyoming state sensitive plant.

Native vegetation plays an important role in controlling erosion, providing wildlife habitat and maintaining biological diversity. Disturbance to the vegetation resources can result in impacts to these ecosystem functions.

Anticipated impacts to vegetation are directly related to the estimated acres of disturbance. Reclamation would eventually mitigate most impacts to vegetation. See **Table 4.6-1, Vegetation Impact Acreage Estimates**.

Table 4.6-1, Vegetation Impact Acreage Estimates

Vegetation Community[2]	Total Area[3] (acres)	Reclamation Potential[4]	Alternatives B & D[5] (acres)	Alternative C[5] (acres)
Wyoming Sagebrush/Mixed Grass	29,320	M	1,465 / 554	1,520 / 594
Wyoming Sagebrush/Threadleaf Sedge	29,230	M	1,469 / 558	1,499 / 581
Wyoming Sagebrush/Green Rabbitbrush	1,910	M	63 / 23	63 / 23
Low Shrub/Mixed Grass	34,010	L/M	1,727 / 664	1,817 / 729
Mixed Sagebrush	3,250	L/M	120 / 44	120 / 44
Mixed Shrub	12,180	L/M	421 / 155	423 / 156
Mixed Grass	3,120	M	182 / 67	182 / 67
Threadleaf Sedge/Mixed Grass	1,260	M	63 / 23	65 / 23
Basin Big Sagebrush/Greasewood	1,970	L/M	63 / 23	65 / 24
Greasewood	1,080	L/M	25 / 9	65 / 44
Juniper	250	L	19 / 7	19 / 7
Rock Outcrop	5,670	L	253 / 100	273 / 115
Mined Area	4,400	L/M	247 / 94	249 / 95
Seminoe Reservoir Lake	9,350[6]	NA	0 / 0	25 / 25
Total	**137,000**		**6,117 / 2,321**	**6,383 / 2 527**

Notes:

1. Also see **Table 3.6-1, Vegetation Communities**; it is assumed that no acreage would be disturbed under Alternative A beyond that affected under the previously approved Pilot Project and gas pipeline to Walcott.
2. See **Figure 44, Vegetation Map**.
3. These represent the estimated areas of the various vegetation communities within the EIS analysis area.
4. M means medium potential; L means low potential; L/M means low to medium potential.
5. First number represents "initial disturbance area" in acres. Second number represents " operational disturbance area" in acres. Also see **Table 2-1, Preliminary Estimate of Surface Area Disturbance**.
6. Acreage at normal high water level of Seminoe Reservoir within the EIS analysis area.

4.6.1 Effects of Alternative A (No Action)

Under the no action alternative, the Pilot Project area would be reclaimed following the termination of exploration activities. The road network, well pads, water treatment facilities, and associated disturbances would be decommissioned according to approved plans and revegetated. Vegetation would develop across the disturbed area in response to climatic influences, the seedbed materials replaced, and the revegetation techniques employed.

As stated in Section 3.5.2.1, Pilot Project Produced Water Riparian Zones, the presence of continuous, low velocity flows of the Pilot Project – produced water below discharge points in Pool Table Draw has, in some areas, increased vegetative cover and the diversity of riparian and wetland species such as creeping spike rush (*Eleocharis palustris*), cattails (*Typha latifolia*), seaside buttercup (*Ranunculus cymbalaria*), and water thread pondweed (*Potamogeton diversifolius*). When Pilot Project operations cease, this trend would be reversed, produced water flows would be discontinued, and vegetation communities that have evolved in drainages as a result of these activities would revert to the type of communities that occurred prior to this development; possibly with an emphasis on more salt-tolerant plants.

That portion of the Seminoe Road Gas Development Project area proposed for future disturbance under this EIS would continue in its present state, subject to the vagaries of climatic influences and continued land use activities. Current land use trends in the region would continue including coal mining, oil and gas exploration ranching, and increased recreational activity. These land uses would cause incremental increased disturbances and some loss of vegetation productivity.

Weed species such as tamarisk, whitetop and Scotch thistle have also been observed in areas of disturbance related both to Pilot Project activities and recent improvements to Carbon County Road 351. The drought conditions of the past several years have likewise promoted the propagation of competitive weedy species.

4.6.2 Effects Common to All Action Alternatives

4.6.2.1 Upland Vegetation

Implementation of any action alternative would disturb vegetation as a result of road construction, well pad establishment and utility line installation. Approximately 5% of the entire EIS analysis area would be disturbed during the first ten years of project development (see **Table 2-1, Preliminary Estimate of Surface Area Disturbance**). Direct and indirect impacts of this proposed project are essentially the same in terms of size, location, intensity, and duration across all action alternatives with few exceptions. Direct effects to the vegetation resource include the removal of vegetation as a result of the construction and burial of various project components. The burial of gas and water collection lines, as well as electric distribution lines, would occur in association with road construction. This disturbance would be mitigated concurrently following utility line burial through trench backfilling, replacement of topsoil, and the application of approved revegetation techniques. Reclamation techniques for these disturbances would be completed by the first full growing season following disturbance to begin the re-establishment of the appropriate native vegetation communities.

The construction of access roads, well pad disturbances, the two compressor facilities, and the water discharge facilities would entail the initial removal of vegetation from these facility sites. Disturbances would be confined essentially to the surface soils capable of supporting the identified vegetation communities leaving the remaining subsoils in place. As for the impacts associated with utility installation, the portions of these disturbances not needed for continuing operations would be reclaimed concurrently following the construction of the necessary operations facilities. The remaining disturbed acreage would continue in a disturbed state from initial disturbance through the life of the project or until such facilities are no longer needed and are reclaimed.

The magnitude and duration of impacts related to the acreage reclaimed concurrently are reduced overall in comparison to other impacts due to the timely application of revegetation techniques. The loss of existing vegetation would reduce the plant productivity of this acreage until vegetation has become re-established. The time this would take cannot be calculated with certainty. It is assumed that acceptable revegetation on amenable sites, in terms of site stability and herbaceous vegetation production, can be achieved in a 5-year period given the application of the appropriate revegetation and weed control techniques along with a viable monitoring plan. Disturbed sites exhibiting low reclamation potentials due to soil physical/chemical, slope, erodibility, or depth limitations (see Section 4.2, Soils) could take longer to respond and require the application of more specific revegetation techniques and materials.

The approach to concurrently revegetating over half of the proposed disturbance presents a reclamation opportunity that would benefit this project. By reclaiming all or portions of disturbed facilities on a regular basis through time, observations can be made regarding the success or failure of applied revegetation techniques and materials. As a result, the reclamation program would evolve eventually employing only the most efficient and cost-effective techniques and materials thereby enhancing the potential for success and shortening the time required to achieve vegetation establishment. This approach is particularly valuable given the variability of vegetation communities occurring over the proposed disturbed area and the characteristics of the soils that support them.

The acreage associated with the operations phase of this development would remain in a disturbed state for the life of the project. Depending upon the year of construction, this timeframe would range from approximately 20 to 30 years. Less than 2% of the EIS analysis area would remain devoid of vegetation for the life of the project. Final reclamation of these sites would occur in the same manner as for the sites subject to compensatory reclamation in terms of the mitigation approach. However, these sites would remain unvegetated for a notably longer period resulting in a loss of vegetation production through time commensurate with the acreage remaining disturbed and unreclaimed by year. It is assumed that the timeframe required to achieve acceptable revegetation on amenable sites, as well as those exhibiting reclamation limitations, would be essentially the same as noted above for concurrent reclamation once revegetation activities are initiated.

It is reasonable to assume under all reclamation scenarios that, following the application of revegetation techniques, herbaceous species would become established initially with the development of a desired shrub component lagging due to typical shrub establishment and growth potentials. As compared to pre-disturbance conditions, the form, texture, and color of the vegetation communities establishing on disturbed sites would differ visually through time until forb and shrub species become established mirroring the diversity and density of adjacent, undisturbed vegetation communities. The narrow, linear nature of road disturbances and the relatively small disturbed acreage associated with well pad sites would promote the invasion of the desire native shrub and forb species from adjacent, undisturbed areas over time. The upland vegetation communities proposed to be disturbed, ranging from the Low Shrub/Mixed Grass across those dominated by Wyoming sagebrush, to the Playa type, are not considered rare in this region.

Impacts to grazing are discussed in Section 4.8, Land Use.

4.6.2.2 Wetland and Riparian Vegetation

All of the action alternatives have the potential to impact wetland and riparian areas, but this impact would principally involve road and buried utility crossings of EIS analysis area drainages. At these crossings, any wetland and riparian vegetation would be removed. To minimize impacts to wetland or riparian vegetation, the Proponent plans that such crossings would be made perpendicular to drainages. Road crossings of drainages would remain in a disturbed state for the life of the project. Final reclamation of disturbed wetland and riparian areas could take longer and would require more specific revegetation techniques and materials.

4.6.2.3 Weeds

Project related surface disturbances associated with all of the action alternatives would increase the potential for the introduction and spread of weeds such as tamarisk, whitetop, Canada thistle, Russian knapweed, and Scotch thistle.

If not controlled, weeds can become established in disturbed areas and can spread to overwhelm nearby native plant communities. Weeds can hinder the success of revegetation efforts and be poisonous to livestock and wildlife. In addition, weeds can threaten the grazing capacity of rangeland, property values, public health and safety, and general native ecosystem diversity. Tall weed species established adjacent to roads can create "snow-fence" effects, which can increase snow removal costs for roads.

Experience gained from the Pilot Project weed management, monitoring, and reclamation efforts would be incorporated into the development and implementation of aggressive weed control and monitoring programs throughout the life of the project. The most sensitive areas for potential weed infestations would occur in disturbed areas along roads and utility corridors, at drainage crossings, and in areas surrounding treatment system and well pad sites. Site-specific weed management strategies would be dependent upon several factors including the location, areal extent and duration of disturbance and the plant species present.

4.6.2.4 Sensitive Plant Species

Persistent sepal yellow-cress is the only BLM sensitive plant species of concern known to occur in the EIS analysis area. Because this species typically occurs in semi-disturbed areas, areas subject to flooding, and along the high water mark of standing or flowing water, only minimal disturbance (roads crossing drainages) would occur. Potential adverse impacts to this sensitive plant and its habitat could be minimized by conducting field surveys to locate populations prior to final well site siting and the implementation of construction activities. Although all of the action alternatives have the potential to affect this sensitive plant species and its habitat, it is expected that adverse impacts could be minimized or avoided.

4.6.2.5 Threatened and Endangered Plant Species

No federally listed threatened or endangered plant species are known to occur within the EIS analysis area. Therefore, no impacts to such species are anticipated.

4.6.3 Effects of Alternative B (Proposed Action)

Table 4.6-1, Vegetation Impact Acreage Estimates, depicts, by alterative, the acreages of each vegetation type to be impacted by the proposed project. Acreages for both concurrent and final reclamation are presented. The vegetation potentials shown, ranging from low to moderate, are estimates based on the observations made during the field surveys and cross-checked with available soil map unit data and interpretations. The low annual precipitation and high evapo-transportation rates typical for the region precluded a higher potential from being considered.

Interim and final phase reclamation would be required on a total of 3,242 acres in vegetation types having a moderate reclamation potential. These vegetation map units typically occur on nearly level to gently rolling terrain and exhibit comparatively deeper soils, the primary revegetation constraints associated with these map units include moderate to high pH values, the potential for sandy soil textures leading to droughty seedbed conditions, and occasional steep slopes.

Reclamation potentials ranging from low to moderate are characteristic for vegetation map units for which 2,603 acres of reclamation would be required. The Mixed Sagebrush and Mixed Shrub map units are typically among the more productive of the vegetation communities mapped on site. However, portions of these units occur on steeper slopes and may exhibit shallow soils that limit, in part, the revegetation potentials of these units. Revegetation constraints associated with the Low Shrub/Mixed Grass unit are predominantly allied with soil chemistry parameters including pH, salinity, and sodicity. Revegetation potentials of the Basin Big Sagebrush/Greasewood and greasewood map units are constrained by soil chemistry factors, as noted for the Low Shrub/Mixed Grass unit, though soils are typically deeper. Lower potentials are assumed where soil salinity and sodicity levels are higher, with the rating increasing to a moderate level where these soil characteristics are not a controlling factor. The constraints limiting the revegetation potential for the Disturbed map unit are varied, but revolve around the volume of suitable soil available for use as a growth medium. As available soil increases, the reclamation potential increases.

Approximately 272 acres of reclamation would be required within vegetation map units rated as having a low potential for revegetation. The low potentials stem primarily from steep slopes combined with shallow soils, or a lack there of, and high soil coarse fragment contents for the Juniper and Rock Outcrop/Broken Land/Miscellaneous map units. The Playa unit is constrained by the potential for high soil pH values and salt and sodium levels. Added to these is the potential for ponding in the spring and during periods of intense rainfall.

Under the proposed action, produced water would be discharged into ephemeral drainages and historically dry playas that currently are only seasonally inundated with water. Produced water discharge would result in the development of new wetland and riparian vegetation areas along the drainage areas, similar to what has occurred in Pool Table Draw (HydroGeo 2003a, 2004c). Hydric soils would develop, especially in areas with low gradients, where water could infiltrate into the ground. Although vegetation cover in most of the historically dry ephemeral drainages is sparse, produced water flows could affect sagebrush and other vegetation that is unable to tolerate flooding and developing saturated anaerobic conditions. Produced water could cause erosion, sedimentation, and downcutting that could adversely impact existing and developing wetlands.

Changes in plant community composition resulting from produced water discharges cannot be predicted with accuracy. Such changes would be dependent upon, among other factors, soil chemical and physical parameters, slope, amount and quality of water discharged and the timing, frequency and duration of such discharges. It would also depend to some degree on the vegetation communities, or lack thereof, currently existing in each drainage.

It can be assumed that the existing vegetation conditions of subject drainages would change through time. Within the drainage zone affected by discharges, upland plants would gradually be replaced by species more tolerant of saturated soils and flooding. Assuming sufficient water is discharged throughout the growing season, wetland (hydric) species would become established to the general exclusion of upland species. Community gradations would likely occur typically with grass – like species (sedges, rushes, bulrushes, etc.) tolerant of flooding inhabiting the central portions of flooded drainages or in areas with continually saturated soil moisture regimes. Immediately upslope, or adjacent to such zones, a fringe wetland community could become established where intermittent flooding or subsurface irrigation gives rise to temporarily saturated soil conditions supporting a mixture of grass, grass-like, and forb species. This type of community could also dominate where drainage floor slopes are nearly level, notably wide, and saturated soil conditions occur throughout the majority of the growing season. Where drainage banks are gradually sloping, and not abrupt, a narrow wetland/upland transition zone, supporting an array of both upland and wetland species could form taking advantage of the enhanced soil moisture regime. Plant community fluctuations would normally occur as the factors noted above change.

When flows are terminated, a plant community reversal would take place with upland species rapidly invading the existing wetland communities though various wetland plant species would continue to be present for a limited time depending upon rooting depth and above-ground biomass. Depending upon the quality of the water that was discharged, salt- and sodium-tolerant plants could dominate the resulting plant community.

Extensive areas of tamarisk occur along the edge of Seminoe Reservoir and the North Platte River. Produced water flows in historically dry ephemeral drainages could increase the potential for tamarisk, and other weedy species such as Canada thistle, Scotch thistle, and whitetop to spread and become established in drainages and playa areas receiving produced water flows for the life of the project.

Because Persistent sepal yellow-cress (the only BLM sensitive plant species known to occur in the EIS analysis area) typically occurs along the high waterline of flowing or standing water, the discharge of produced water into historically dry ephemeral drainages could provide additional suitable habitat for this species during the life of the project. This effect would be reversed upon cessation of produced water pumping at the end of the project life. The discontinuation of pumping would cause the artificially generated habitat to disappear for this sensitive plant species.

Produced water discharged into the playas would pool and evaporate, or infiltrate. Playas are closed basins that are naturally inundated by spring runoff or periods of high precipitation, but, in this region of south-central Wyoming, they are typically dry for extended periods of time. The continuous presence of water in these playas would facilitate the development of hydric soils and enhance development of wetland and riparian habitat. However, over time, evaporation of produced water, which is slightly alkaline and contains elevated concentrations of salts, could cause increased concentrations of these alkaline salts in the closed basins. Increasing salt concentrations in these playas could affect the diversity and nature of the vegetation growing in 430 to 575 acres within and surrounding the three playas (Ferris Lake, Alkali Flats, and St. Mary's Anticline Flats) found in the EIS analysis area. See Section 3.4.4, Playas Within the EIS Analysis Area, and Section 4.4.3.2, Effects to Playas Within the EIS Analysis Area.

4.6.4 Effects of Alternative C (Pipeline to Reservoir)

The disturbances proposed under this alternative would result in similar impacts to vegetation as described for Alternative B in Section 4.6.2, Effects Common to All Action Alternatives and Section 4.6.3, Effects of Alternative B (Proposed Action), with one exception. No water would be discharged into drainages or playa areas. Rather, pipelines, located away from drainages, would discharge water directly into the North Platte River and/or Seminoe Reservoir. Under Alternative C, there would be no development or enhancement or hydrophytic vegetation and/or hydric soils along the drainages or within playa areas. The potential spread of weeds including species such as tamarisk would be lower than with the proposed action, since there would be no continuous flows of produced water in the drainages. In addition, there would be no need for reclamation of the playas.

The pipeline constructed to convey process water to the river and/or reservoir would require the removal of vegetation. This disturbance would be reclaimed following pipeline burial to stabilize the disturbed area and reestablish native plant communities.

Pipeline or road drainage crossings could adversely impact existing wetlands and persistent sepal yellow-cress habitat.

4.6.5 Effects of Alternative D (Underground Injection)

With underground injection, the effects of Alternative D to vegetation would be similar to the effects of Alternative C. See Section 4.6.4, Effects of Alternative C (Pipeline to Reservoir). The areal extent of surface disturbance and potential for spreading weedy species would be proportionally lower with this alternative than with the proposed alternative or Alternative C. Groundwater model results (HydroGeo 2004a) indicate that the development of surface springs could potentially enhance small, localized areas of suitable habitat for persistent sepal yellow-cress. When the project operations cease, this effect would be reversed.

4.6.6 Cumulative Impacts

Current land use practices that contribute to cumulative impacts on vegetation communities include coal mining, oil and gas exploration and development, range management activities (such as grazing) and recreational use. Potential short-term incremental cumulative impacts to wetland and riparian areas are anticipated from present and foreseeable activities in the region. Information is not available to allow for a quantitative analysis of impacts to these sites. Current and future uses combined with the proposed Seminoe Road Project operations would continue to create surface disturbances that provide potential habitat for weeds to be introduced, spread, and/or become established. Minimizing the areal extent and duration of surface disturbances and implementing aggressive reclamation monitoring, and weed control programs would minimize the potential spread of weedy species in the EIS analysis area. Actual cumulative surface disturbance and vegetation removal associated with other potential projects in the area is expected to be low, thus actual vegetation disturbance and removal would likewise not contribute to any major regional cumulative impacts. Grazing levels and disturbance from grazing is expected to remain relatively constant.

Livestock tend to concentrate in areas where density of grass cover is the highest (e.g., channel bottoms, edges of drainages, in wetlands and riparian areas, and near stock ponds). The continuous presence of produced water in drainage channels would attract cattle and increase the potential for soil compaction and trampling and could contribute to the inadvertent introduction of weedy species in and around wetlands and riparian areas. To prevent cumulative impacts, careful range management practices must be maintained such that livestock use would not over graze an area or cause trampling of vegetation, which can subsequently cause an influx of weeds. Given current range management practices in the region and oversight by BLM range management specialists for activities on BLM-administered lands, no substantive cumulative impacts from such practices are anticipated.

Since there are no known occurrences of threatened, endangered, candidate or proposed plant species and/or critical habitats in the EIS analysis area, no incremental increase in impacts is expected from current or foreseeable activities in the area.

Activities within and surrounding the EIS analysis area could cause impacts to populations and habitat to sepal yellow-cress, a BLM sensitive species, but these impacts would be minor because most activities avoid disturbing the riparian habitat where this species is known to exist.

4.6.7 Potential Monitoring and Mitigation

No vegetation monitoring and mitigation measures are proposed beyond those committed by the Proponent in Section 2.8.5, Vegetation; Section 2.8.6, Weeds; Section 2.8.13, Wetlands, Special Aquatic Sites and Waters of the U.S; and Section 2.8.16, Threatened, Endangered, and Proposed, Candidate and Sensitive Species.

General revegetation plans set forth in **Appendix F, Reclamation Plan**, need to be finalized in advance of construction.

4.7 Wildlife/Fisheries

Wildlife Impact Significance Criteria: *Wildlife impacts would be considered significant if:*

- *The project resulted in non-compliance with existing BLM, USFWS, or Wyoming Game and Fish Department wildlife management objectives for natural gas mineral developments;*

- *The project caused a substantial increase in direct wildlife mortality due to road kills;*
- *There was total elimination or a sustained reduction of crucial wildlife habitat in the project area;*
- *The project resulted in a long-term decline in recruitment and/or survival of a wildlife population;*
- *The project caused disruption of greater sage-grouse, or raptor breeding or nesting activities to the extent that reproductive success is impaired;*
- *The project jeopardized or substantially decelerated the recovery program of any USFWS listed or proposed species;*
- *The Biological Assessment (prepared for compliance with Section 7 of the Endangered Species Act of 1973) concluded a "likely to adversely affect" any listed threatened or endangered species; this designation would trigger formal USFWS consultation, or*
- *The project jeopardized the persistence of any BLM Wyoming state sensitive wildlife or fish species.*

General effects on for wildlife are the physical loss of habitat; displacement of wildlife; habitat fragmentation and isolation; increased competition for wildlife and fishery resources; and impacts to threatened, endangered, and sensitive species. These effects can be classified as short-term and long-term. Short-term impacts arise from habitat removal and disturbance, as well as from activities associated with construction, drilling and production. These impacts would cease upon project closure and completion of successful reclamation. Long-term impacts would consist primarily of permanent changes to habitats and the wildlife populations dependent on those communities.

4.7.1 Effects of Alternative A (No Action)

Under the no action alternative, there would be no direct disturbance or indirect effects to wildlife, wildlife habitat and fisheries from the proposed build-out of the Seminoe Road Project. However, current land use trends in the area would continue, including Pilot Project operation, potential for increased oil and gas development, coal mining, and increased recreational use, such as hunting, camping, fishing and boating. These land use trends would have continued effect on wildlife populations and habitat.

Deer and pronghorn populations in the region are expected to remain stable into the near future. Sage-grouse populations statewide seem in decline, although there is no documented evidence as to the reasons, wildlife specialists from the BLM, USFWS, and WGFD believe that drought conditions of the past decade and increased natural resource development activities (such as oil and gas exploration and development) may be contributing factors. There are no established trends for other wildlife species in the area, and wildlife populations seem to be stable.

4.7.2 Effects Common to All Action Alternatives

The principal effects to wildlife and fisheries populations under all action alternatives would be direct habitat removal or alteration, increased human presence and activities, and habitat fragmentation and isolation. These potential effects are expected to be the same for each action alternative. Impacts to threatened, endangered and sensitive species are also discussed in this section.

4.7.2.1 Physical Loss of Habitat

Direct habitat losses would result from well pad, access road and utility line construction, and indirectly from increased human presence (see **Table 2-1, Preliminary Estimate of Surface Area Disturbance**).

Direct habitat losses would account for approximately 4.5% of the total project area. With interim reclamation, these direct habitat losses would be reduced over time to 1.7% of the project area (see **Table 2-1, Preliminary Estimate of Surface Area Disturbance**).

Final reclamation would be implemented after project closure and would focus on replacement of existing grassland and shrub communities. With successful revegetation, there should be no long-term net loss of habitat within the EIS analysis area.

Disturbed habitats would be anticipated to recover to a productive state for grasses and shrubs over a 3 to 5 year period after reclamation, but vegetation succession toward mature sagebrush and other shrub habitats could take 20 years or more.

4.7.2.2 Displacement of Wildlife

The most common wildlife responses to noise and human presence are avoidance and accommodation.

Displacement is unavoidable in the short-term under all action alternatives, and this displacement has the potential to be the most significant effect on wildlife. Avoidance of disturbed areas would result in wildlife displacement from an area larger than the actual disturbed sites. The extent of displacement would be related to the duration, magnitude, and the visual prominence of the activity, as well as the extent of construction and operational noise levels above existing background levels. Visual prominence of facilities is dependent upon surrounding topography.

Displacement would result in local reductions in wildlife populations if adjacent, undisturbed habitats are at carrying capacity. In this situation animals are either forced into less than optimal habitats or they compete with other animals that already occupy unaffected habitats. Possible consequences of such displacement are lower survival, lower reproductive success, lower recruitment, and ultimately lower carrying capacity and reduced populations (Oil and Gas Mitigation Working Group 2004).

Reaction of animals to noise and human presence varies depending on the intensity of the noise source and whether it is continuous or intermittent. Transient loud noises would provoke alarm responses; however, many animals learn to ignore more constant, lower level noise sources that are not associated with negative experiences such as being chased or hunted (Busnel 1978).

The extent of wildlife displacement is impossible to predict for most species since the response severity varies from species to species and can even vary between different individuals of the same species. After initial avoidance, some wildlife species (usually certain birds and rodents and to a lesser extent deer and pronghorn) may acclimate to the activity and begin to reinvade areas previously avoided. This acclimation and reoccupation would be expected to occur following construction and drilling when the project moves into the production phases where less noise and human activity would take place. Acclimation to activity may increase predation on some species.

Construction and drilling noise have the potential of affecting wildlife species at the project site as well as areas surrounding disturbance sites. Man-made construction such as well pads and roads can reduce use of surrounding habitat by wildlife. These impacted sites reduce foraging due to the direct loss of native vegetation from ground disturbance. In addition, there is an area surrounding these sites that tends not to be utilized due to the increased human activity. This “zone” can extend up to a half mile from the developed area. Consequently, development impacts to wildlife can extend further offsite than the actual amount of disturbed area. Although some individual animals can habituate to the increased infrastructure, it is generally assumed that, overall the increased human footprint on a previously lightly developed area is detrimental to big game species. In addition to the avoidance response, increased human presence intensifies the potential for wildlife-human interactions ranging from the harassment of wildlife to poaching and increased legal hunting pressure. Also, increased traffic levels on new and existing roads could increase the potential for wildlife-vehicle collisions. Following drilling and well completion operations, noise levels would be essentially eliminated because well pumps would be powered by electric motors. As a result, species might acclimate to the well pad production facilities and utilize habitats immediately adjacent to such sites. This has been observed at other natural gas production sites in Wyoming.

4.7.2.3 Habitat Fragmentation and Isolation

Habitat fragmentation and isolation are difficult to determine and probably vary species to species but they could occur as a result of gas field developments, which are typically configured as point and linear disturbances scattered throughout broader areas. Although these types of disturbances (well pads, utility lines and access roads) do not usually create physical barriers to wildlife movement, the effective use of adjacent undisturbed habitats could diminish as densities of well pads, utility lines and roads increase. A total of 270 miles of new roads, 200 miles of upgraded existing roads, and 470 miles of utility lines (gas, water, electric) are proposed to be constructed in the 137,000 acre EIS analysis area under all action alternatives. Habitat fragmentation and isolation can be problematic in areas of limited habitat such as crucial big game winter range and sage-grouse breeding areas.

The BLM standard mitigation stipulation of restricting or prohibiting surface occupancy in big game crucial winter range (November 15 – April 30) would limit impacts to big game crucial winter range; however, the action alternatives would result in the construction of approximately 42 miles of new or upgraded roads and 42 miles of pipelines within pronghorn and mule deer crucial winter ranges.

The greatest concern for habitat fragmentation and isolation within the EIS analysis area would involve sage-grouse leks. See **Figure 45, Wildlife Map**. Additional discussion on sage-grouse is set forth in Section 4.7.2.14, Sensitive Species.

4.7.2.4 Wildlife Mortality

During construction, most larger, mobile wildlife species would be displaced to adjacent undisturbed habitats; however, direct habitat disturbance could result in some direct losses of smaller, less mobile species of wildlife, such as small mammals, reptiles and ground nesting birds.

Predictions of wildlife population losses based on habitat disturbance and displacement are hard to make since accurate information on wildlife population numbers is difficult to obtain for many species. Even if accurate population numbers were available, projections of losses may not be accurate since it is impossible to account for the effects of weather and natural cyclical population changes. If it is assumed that the existing adjacent habitats are at carrying capacity for most species, locally displaced populations may be eliminated until final reclamation is successful. However, due to their relatively high reproductive potentials, populations of most small mammals, reptiles and birds would be expected to rapidly recover once construction and production activities are complete. Similarly, with successful reclamation, other wildlife species would be expected to reutilize the once disturbed areas. However, successful reclamation, especially for sagebrush and other shrub habitats, may take 5 to 20 years or longer.

Although roads would access well pad sites, overall public access to the EIS analysis area would be limited. The Proponent plans to locate site access from public roads (i.e., Carbon County Road 351) to private surface, where gates can be kept closed and/or locked. Although there may be increased access roads in the area, this should not translate to an increased legal or illegal harvest of mule deer and pronghorn.

Mule deer and pronghorn road kills along Carbon County Road 351 have not been a major problem in the past, although nearly 50% of the accidents reported for this road do involve animal-vehicle collisions. See Section 4.12, Transportation. Increased human presence and subsequent related increases in traffic levels, specifically on Carbon County Road 351, could result in more animal-vehicle collisions. The potential for animal-vehicle collisions is typically highest in the early morning and evening hours and where roads traverse areas where big game concentrates. The risk of animal-vehicle collisions is expected to be relatively low on the project-internal graveled access roads because of low speed limits.

4.7.2.5 Increased Competition for Wildlife and Fishery Resources

The level of increased competition for wildlife and fishery resources is unknown. Currently, hunting access within the EIS analysis area is limited given the checkerboard ownership pattern. However, private guided hunting groups do utilize the project area (see Section 3.11, Recreation).

Hunting and fishing is expected to increase in the general area as recreation activities increase. However, given hunting and fishing management policies of the WGFD, no detrimental increased competition for wildlife and fishery resources is anticipated.

4.7.2.6 Wildlife Threshold Classifications

The WGFD has recently developed criteria for wildlife impact thresholds and mitigation recommendations for oil and gas development projects (Oil and Gas Mitigation Working Group 2004). The impact thresholds are based on the density of well locations and the cumulative disturbance (acres) per section, and the WGFD describes impacts as “moderate”, “high”, or “extreme”.

Given the relative density of wells for the Seminoe Road Project (four wells per 1-mile square section) and cumulative disturbances of up to 28.6 acres per 1 square mile section, the wildlife impacts created within the EIS analysis area would be considered “low” to “moderate” for most species. Given the number of sage-grouse leks in the EIS analysis area (see **Figure 45, Wildlife Map**), special attention and mitigation measures would be needed for any construction and drilling activity within 2 miles of a lek. For more information about sage-grouse, see Section 4.7.2.14, Sensitive Species. The 28.6-acre average initial construction disturbance per section (640 acres) assumes a 75-foot wide ROW disturbance for roads, and pipelines and utilities. In reality, total ROW disturbance would probably be less; the actual Pilot Project initial construction disturbance width for roads and pipelines averaged around 30 feet. Under a 30-foot disturbance corridor, the average disturbance per section would be approximately 20 acres. Interim reclamation would reduce the initial construction disturbance per section by almost 60%. Even using the 75-foot ROW, the long-term disturbance per section would be reduced to 16.6 acres. This reduces the WGFD impact category to moderate for most species.

4.7.2.7 Big Game

Mule deer and pronghorn are expected to be displaced within the immediate area of construction activities (well pad construction, road building and utilities installation) and drilling operations.

Displacement would occur in the immediate vicinity of the construction or drilling activity due to noise and human presence; however, most pronghorn should move back into the area upon completion of the construction or drilling activity. Mule deer populations are more sensitive and may not return to pre-project levels for the life of the project. As the project is put into production, there would be little noise related impacts because well pumps and compressors would be powered with electricity. Traffic and human presence would be associated with ongoing operational production and maintenance activities; however, mule deer and pronghorn would be expected to habituate to some extent to the periodic traffic and human presence.

The majority of the EIS analysis area is outside occupied mule deer range. However, a small portion of crucial winter/yearlong mule deer range is located within the southeast corner and the extreme northwest corner of the EIS analysis area. See **Figure 45, Wildlife Map**. There is no development activity planned in mule deer crucial winter range in the northwest part of the EIS analysis area, and only minor development (five wells) is planned in crucial winter range in the extreme southeast corner of the EIS analysis area. Given the general avoidance of crucial winter range, no significant impacts to mule deer populations are expected as a result of the Seminoe Road Project.

For pronghorn, most gas development would be within winter/yearlong range, which is not considered limiting to pronghorn populations. However, portions of crucial winter/yearlong range would be impacted in the western and northwest portions of the project area. In pronghorn crucial winter/yearlong range, the total possible maximum disturbance resulting from well development and road construction would be 28.6 acres per 1-mile square section. This level of disturbance would exceed the “moderate” category specified by the WGFD (Oil and Gas Mitigation Working Group 2004) though the number of wells would not exceed four per section, which does meet the “moderate” impact category. As indicated in Section 4.7.2.6, Wildlife Threshold Classifications, the average of 28.6 acres of disturbance per section represents disturbing a 75-foot construction ROW for roads and utilities and actual disturbance per section would likely be closer to the 20 acres per section threshold level. Given additional careful design of development layout schemes, the Proponent should be able to reduce the total acreage of disturbance within pronghorn crucial winter/yearlong range to less than or equal to 20 acres, which would not exceed the "moderate" category. In addition, each phase of the Seminoe Road Project would require an APD and an EA, and project planning within pronghorn crucial winter/yearlong range may need to be revised to maintain disturbance levels within the "moderate" category. Once short-term disturbances are reclaimed, the average acreage of disturbance per section would be below the less than 20-acre requirements to meet the "moderate" impact classification.

Under the "moderate" category of impact, "impacts can be minimized or avoided through effective management practices and habitat treatments" (Oil and Gas Mitigation Working Group 2004). Therefore, significant impacts to pronghorn populations in the project area are not likely if appropriate mitigation measures are implemented.

The BLM stipulation of prohibiting construction and other activities potentially disruptive to wintering wildlife during the period of November 15 to April 30 for the protection of big game winter habitat would minimize the potential for direct and indirect disturbance of wintering mule deer and pronghorn during construction phases. It does not address the potential loss of wintering habitat due to the presence and operation of wells in winter range for the life of the project after construction is complete. The BLM may need to consult with the WGFD to determine what additional mitigation measures may be necessary to minimize the impacts. Not all areas of designated crucial winter range are of equal quality. Habitats with better quality and quantity of forage and topography and/or vegetation that provide cover from extreme weather conditions provide higher quality crucial winter habitat.

4.7.2.8 Predators, Furbearers and Small Mammals

Predators and furbearers are typically shy, some being wide ranging; they typically avoid areas with human activities. Construction activities may cause these animals to avoid the site of activity, but this effect would be relatively short-term and temporary. Similarly, a small reduction in prey base could affect the populations of these species, but such effects are not expected to be significant. Following construction and drilling, they would move back into the area, but they may continue to avoid any areas of human presence. Many of these species are secretive and mainly nocturnal. Much of the construction would be conducted during daylight hours, although drilling would be conducted on a 24-hour schedule.

Construction activities could result in some direct losses of smaller, less mobile mammal species such as voles, cottontails, and deer mice. In addition, these species could be displaced from areas construction and development. However, reclamation that would occur following construction would minimize long-term disturbance and provide favorable grassland habitat for many of these species.

4.7.2.9 Waterfowl

No impacts are projected for habitats utilized by this group of species. Based on the analysis provided in Section 3.5.3, Hanna Basin Alluvial Ground Water Systems, no water quality or quantity impacts are anticipated for Seminoe Reservoir or the North Platte River. Therefore, waterbird use of these water bodies as well as adjacent wetland habitats is not likely to change.

4.7.2.10 Raptors

Raptor nesting activity could potentially be affected by construction activities within 0.5 mile to 1.0 mile of active nest sites, depending on topography and direct line-of-sight exposure to development activities. In addition, raptor foraging activity and prey populations could be impacted by project development. Potential impacts to raptors include: 1) nest desertion or reproductive failure because of project activities or proximity of new roads, 2) reductions in prey populations, and 3) mortality associated with roads. The primary potential impact to raptors with project development would be nest disturbance resulting in reproductive failure. To minimize this potential the BLM stipulates that there would be no construction activity within 3/4 to 1 mile of active or inactive nest according to the time constraints set forth in **Table 2-2, Raptor Nest Protection Dates**. Raptor nest surveys would also be required for all new disturbance areas prior to construction to locate any potential nest sites that may not be recorded in the BLM's or WGFD's raptor nesting map database. The nature of the restrictions, exclusion dates, and the protection radius would vary depending upon activity status of nests, species involved, natural topographic barriers, and line-of-sight distances and would be determined by the BLM on a case-by-case basis. Buffer restrictions are important for inactive nest sites since an inactive nest may be used in subsequent years and precluding development near these nests may ensure these nests are suitable for use in future years.

To prevent impacts on raptor breeding activity, the Proponent has committed to avoiding construction and drilling activity that might affect occupied raptor nests. See Section 2.8.15, Wildlife and Fisheries. With the implementation of this Proponent-proposed environmental protection measure, there would be no anticipated adverse effects on nesting raptors in the project area.

4.7.2.11 Upland Game Birds

Discussion of impacts on the greater sage-grouse is provided in Section 4.7.2.14, Sensitive Species.

4.7.2.12 Migratory Songbirds

Construction activities (e.g., well pad and road construction, utilities line installation) have a potential for unintentional loss of ground or shrub nesting species, primarily during the avian breeding season, but ground-dwelling species could be impacted outside the breeding season as well.

Species of greatest management concern are the migratory birds of Conservation Concern listed by the USFWS for the region of the project area (USFWS 2002). These birds of Conservation Concern are comprised entirely of waterbirds, raptors, or BLM listed sensitive species. Potential impacts to raptors and waterbirds were discussed in preceding sections. Potential effects on BLM sensitive species are discussed under Section 4.7.2.15, Sensitive Species.

4.7.2.13 Fisheries

Short-term, local increases in turbidity and suspended sediments could occur in drainages adjacent to construction activities, but, because construction activities are remote from the Seminoe Reservoir and the North Platte River, the impact of increased sediment levels on aquatic species and their habitat would be low. The Miracle Mile, below Kortes dam, would not be affected by any project-related sediment generation. Sediment concentrations would stabilize and return to typical background concentrations after construction activities are completed.

As explained in Section 4.4, Surface Water, under Section 4.4.1, Effects of Alternative A (No Action), WET tests showed no impacts on aquatic organisms from produced water. The conductivity of produced water (1,580 µmhos/cm) is below the 2,000 µmhos/cm, a threshold value where concentrations of dissolved solids maybe sufficient to cause acute toxicity to aquatic organisms (Goodfellow et. al. 2000). The volume of produced water to be discharged annually represents a volume less than one percent of Seminoe Reservoir's total capacity. Given this disproportionate mixture of the two waters, conductivity in the Seminoe Reservoir water is expected to remain in it's current range of 500 to 600 µmhos/cm. Therefore, given the above referenced threshold value, there would be no impacts to aquatic resources from conductivity in Seminoe Reservoir, or downstream in Miracle Mile. See Section 4.4.3.5, Effects to Seminoe Reservoir, and Section 4.4.3.6, Effects to Miracle Mile.

The use and transport of fuels to the construction and operational facilities could represent a risk to aquatic species and their habitat, if a spill or accident was to occur adjacent to the North Platte River. Based on the expected frequency of traffic and mitigation measures employed by trucking firms, the risk of a fuel spill or leak reaching the North Platte River, is considered extremely low. See Section 4.15, Accidents and Spills.

4.7.2.14 Sensitive Species

The BLM has identified a number of sensitive species potentially occurring within and adjacent to the EIS analysis area. This section describes the expected impacts on those sensitive species.

White-tailed Prairie Dog. White-tailed prairie dog towns are located in low shrub/mixed grass, threadleaf sedge/mixed grass, mixed grass, and disturbed site habitats throughout the EIS analysis area. See **Figure 44, Vegetation Map**. Project development and construction activities in these habitats could impact prairie dog towns. Under BLM sensitive species policies, the BLM would require the operator to locate development sites outside of prairie dog towns whenever possible. Although project development may result in some short-term reduction in white-tailed prairie dog populations, these species have a high reproductive potential and should rapidly recover following concurrent and final reclamation activities. Additional habitat would also be available for these species as reclamation of disturbed shrublands would result in open grassland habitats that would be readily reoccupied by prairie dogs.

Swift Fox. The EIS analysis area is near the periphery of the known range of the swift fox, and expanses of shortgrass prairie preferred by this species are generally lacking. In the unlikely event that swift foxes inhabited the EIS analysis area, this species, like other predators, would avoid areas of construction and development.

White-faced Ibis, Trumpeter Swan, Long-billed Curlew. These species would not be impacted by construction or production activities of the Seminoe Road Project. Their habitat of riparian areas surrounding permanent stock ponds or marshy wetlands and riparian areas along the North Platte River would remain undisturbed. Under Alternative B, Proposed Action, produced water discharged into the three closed playa basins (St. Mary's anticline basin, Alkali Flats, and Ferris Lake) located in the southern portion of the EIS analysis area would create additional habitat, which could increase the use of the area by white-faced ibis and long-billed curlew.

Mountain Plover. Mountain plovers utilize low shrub/mixed grass, thread-leaved sedge/mixed grass, mixed grass, disturbed sites, and playa habitats and are often found in association with prairie dog towns. Project development and construction activities would result in minor losses of mountain plover habitat. The Proponent would prohibit construction in suitable mountain plover habitat from April 10 through July 10 (see Section 2.8.16, Threatened, Endangered, Proposed, Candidate and Sensitive Species); therefore, impacts to mountain plovers would be minimized. Although project development may cause some short-term reduction in mountain plover habitat, these species should return to the area following concurrent and final reclamation activities. Additional habitat would be available as reclamation of disturbed shrublands would result in a long-term (20 years or more) increase in open grassland habitats favored by mountain plover.

Peregrine Falcon. Peregrine falcons may fly over the construction and production sites of the EIS analysis area, but their preferred foraging habitat would be primarily along the North Platte River. No impacts are anticipated to this species as a result of the Seminoe Road Project.

Ferruginous Hawk. Ferruginous hawks are generally shy of human activity and presence; project construction and development activities within the EIS analysis area are likely to reduce the total extent of foraging habitat for this species. Nesting activity would be protected by standard BLM nest protection stipulations.

Burrowing Owl. Burrowing owls rely on prairie dog towns for nesting, foraging and protective cover. Because project development and construction activities could result in minor loss to prairie dog towns, there would be a subsequent reduction in available burrowing owl habitat. Habitat for prairie dogs, and subsequently burrowing owls would be restored following interim and final reclamation activities. There would be an overall gain in potential habitat for prairie dogs (and thus burrowing owls) as disturbed mature shrublands would be initially re-established as open grassland habitats that would attract prairie dogs.

Greater Sage-grouse. Sage-grouse leks exist in and within 2 miles of the EIS analysis area. See **Figure 45, Wildlife Map**.

In Wyoming, information suggests that greater sage-grouse populations are negatively affected by energy development activities, especially those that degrade important sagebrush habitat, even when mitigation measures are implemented (Braun 1998, Lyon 2000). Greater sage-grouse populations can repopulate areas developed for resource extraction after habitat reclamation for the species (Braun 1987). However, there is no evidence that populations attain their previous levels and reestablishment of sage-grouse in a reclaimed area may take 20 to 30 years, or longer (Braun 1998). BLM mitigation standards are established to ensure that energy development projects do not exacerbate greater sage-grouse declines on either a local or range-wide level.

> **Sage-grouse leks -** 1) Avoid surface disturbance or occupancy within 0.25 mile of the perimeter of occupied sage-grouse leks. 2) Avoid human activity between 8 p.m. and 8 a.m. from March 1 through May 15 within 0.25 mile of the perimeter of occupied sage-grouse leks.
>
> **Sage-grouse nesting/early brood-rearing habitat -** Avoid disturbing the disruptive activities in suitable sage-grouse nesting and early brood-rearing habitat within 2 miles of an occupied lek, or in identified sage-grouse nesting and early brood-rearing habitat outside the 2-mile buffer from March 15 through July 15.
>
> **Sage-grouse winter habitat -** Avoid disturbance and disruptive activities in sage-grouse winter habitat from November 15 through March 15.

The Proponent has committed to these protection measures as stated in Section 2.8.15, Wildlife and Fisheries.

The level of disturbance per 1-mile square section could be as high as 28.6 acres, with four wells per section. This level of development would result in “moderate” category specified by the WGFD (Oil and Gas Mitigation Working Group 2004) though the number of wells would not exceed four per section, which does meet the “moderate” impact category for sage-grouse. As indicated in Section 4.7.2.6, Wildlife Threshold Classifications, the average of 28.6 acres of disturbance per section represents completely disturbing 75 feet of construction ROW for roads and utilities and actual disturbance per section would likely be closer to the 20 acres per section threshold level. Given additional careful design of development layout schemes, the Proponent should be able to reduce the total acreage of disturbance within sage-grouse nesting and brood-rearing habitat to less than or equal to 20 acres. In addition, each phase of the Seminoe Road Project would require an APD and an EA, and project planning within sage-grouse nesting and brood-rearing habitat may need to be revised to maintain disturbance levels within the “moderate” category. Once short-term disturbances are reclaimed, the average acreage of disturbance per section would be below the less than 20-acre requirement to meet the “moderate” impact classification.

Under the “moderate” category of impacts, “impacts can be minimized or avoided through effective management practices and habitat treatments” (Oil and Gas Mitigation Working Group 2004). Significant impacts to sage-grouse populations in the EIS analysis area are not likely if appropriate mitigation measures are implemented.

Loggerhead Shrike, Sage Thrasher, Sage Sparrow, Brewer's Sparrow. These avian species utilize sagebrush habitats. Project development and construction activities would result in the loss of approximately 1 to 2% of sagebrush habitat within the EIS analysis area for the life of the project (30 years) and up to an additional 20 years until mature sagebrush habitats re-establish following final reclamation activities. Construction of roads and well pads, along with the installation of buried utility lines, in sagebrush habitats could displace these species and possibly eliminate nest sites.

Northern Leopard Frog. The northern leopard frog is a highly aquatic species and is usually found in close association with banks and shallow water areas of permanent marshes, ponds, streams, lakes and reservoirs. Water bodies with rooted aquatic vegetation are preferred. No impacts to populations of the northern leopard frog are anticipated as a result of the Seminoe Road Project because permanent stock ponds and backwater areas of the North Platte River with rooted emergency vegetation would not be directly affected by project development and construction.

4.7.2.15 Threatened and Endangered Species

Impacts to threatened and endangered species would be similar for all alternatives and result from removal of potential suitable habitat and displacement from increased human activity.

Black-footed Ferret (Federal Endangered). No black-footed ferret sightings have been made within and surrounding the Pilot Project area during surveys in 2000, 2001, 2002, and 2003.

White-tailed prairie dog towns or complexes greater than 200 acres represent potential habitat for black-footed ferrets, and, if development within such habitat cannot be avoided, the USFWS requires ferret surveys within 1 year of planned development. If no ferrets are found, the prairie dog town would be cleared for development for the next year. Although no black-footed ferrets have been sighted within the area of past activity (Pilot Project), annual surveys for black-footed ferrets would be necessary in white-tailed prairie dog towns or complexes greater than 200 acres for development and construction. At this time, it is not possible to predict if black-footed ferrets would be found but, given past survey results, future annual surveys and appropriate mitigation (avoidance if black-footed ferrets are found), project development is not likely to adversely affect black-footed ferrets within the EIS analysis area.

Bald Eagle (Federal Threatened, Proposed for De-listing). Suitable nesting and winter roosting habitat exists along the North Platte River within the EIS analysis area, and bald eagles may fly over the more upland sites within the region. The BLM has identified two potential nest sites along the river that need to be verified. To prevent disturbance of any bald eagle nest sites, the Proponent, would only allow construction activities to occur within a mile of any occupied nest site between August 1 and February 1. This restriction would preclude any disturbance to nesting eagles.

North Platte River Species. No suitable habitat exists within or near the EIS analysis area for whooping crane (endangered), least tern (endangered), pallid sturgeon (endangered), Eskimo curlew (endangered) and the piping plover (threatened). Important habitat areas do exist for these species along downstream portions of the Platte River system, particularly in Nebraska. No water depletions in the North Platte River are expected as a result of production from the Mesaverde formation at the Seminoe Road Project. See **Appendix L, Biological Assessment**. The BLM would continue to coordinate and consult with the U.S. Fish & Wildlife Service on potential impacts to downstream threatened and endangered species once the exact method of produced water discharge is established and before production from the Fox Hill/Medicine Bow formations to assess any depletions in the North Platte River.

4.7.3 Effects of Alternative B (Proposed Action)

Wildlife impacts for Alternative B would be the same or similar to those discussed in Section 4.7.2, Direct Effects Common to All Action Alternatives.

Discharge of produced water in drainages and closed playa basins could provide benefit to wildlife species. Produced water discharge would result in the development of narrow, linear habitats along discharge drainages (similar to what is currently happening in Pool Table Draw as a result of Pilot Project produced water discharges). This would provide additional short-term habitat for waterfowl and short-term watering areas for other types of wildlife, including mule deer and antelope. Further, the year-round inundation of the three closed playa basins (St. Mary's anticline basin, Alkali Flats and Ferris Lake) in the southern portion of the EIS analysis area could create additional wildlife watering area. However, losses of existing sagebrush and other habitats, including playa, would occur as a result of these gains in surface water and wetlands.

The vegetative habitats created through the discharge of produced water would disappear at the completion of the project and would revert to pre-project conditions. Any increase in wildlife populations as a result of these artificially created or enhanced vegetative communities would likewise diminish at the close of the project.

4.7.4 Effects of Alternative C (Pipeline to Reservoir)

Impacts to wildlife under this alternative would be the same as set forth in Section 4.7.2, Direct Effects Common to All Action Alternatives. Under this alternative, produced water would be piped directly to the North Platte River and Seminoe Reservoir rather than being released in drainages (Alternative B) or discharged through underground injection (Alternative D). Water quality and quantity effects to the North Platte River and Seminoe Reservoir would be similar to those described before the proposed action (Alternative B) except the quantity of produced water reaching those receiving waters would be greater. The increase in available water would provide additional water to downstream portions of the Platte River system, which, in turn, could provide additional benefits to the threatened and endangered species in this river system, particularly in Nebraska.

4.7.5 Effects of Alternative D (Underground Injection)

The effects of this alternative would be similar or the same as those discussed in Section 4.7.2, Direct Effects Common to All Action Alternatives. However, there would be no creation of enhanced vegetative habitats along drainages and in playa areas, and no produced water would be available for down stream benefits.

4.7.6 Cumulative Impacts

Historic and ongoing land uses in the area have resulted in the loss of some native wildlife habitats. Land use practices that contribute to cumulative effects on vegetation communities and wildlife habitats include coal mining, oil and gas exploration and development, grazing, and increased recreational use for hunting and other dispersed recreation. Increased and ongoing human presence in the area would cause cumulative effects to big game and other wildlife species through vehicle mortalities, increased legal or illegal hunting, noise effects, and harassment. In the context of cumulative impacts, any proposed disturbance, especially linear disturbance such as new roads, incrementally add to wildlife habitat losses and overall habitat fragmentation within the project area and surrounding region.

4.7.7 Potential Monitoring and Mitigation

See **Appendix K, Wildlife Monitoring and Protection Plan**.

4.8 Land Use

Land Use Impact Significance Criteria: *Land use impacts would be significant if the project jeopardized current land uses or reclamation failed to achieve post-project land uses of rangeland, wildlife habitat and dispersed recreation.*

In the long-term, following natural gas extraction, the EIS analysis area would be used much as it is now. The reclamation and revegetation techniques to be undertaken on disturbed sites are comparatively simplistic, and commonly accepted techniques with a history of successful application in Wyoming and other western states. Reclamation would be initially employed concurrently for site stability and to lessen overall disturbance. Both interim and final reclamation would allow disturbed sites to return to conditions that existed prior to any disturbance. See **Appendix F, Reclamation Plan**.

4.8.1 Effects of Alternative A (No Action)

Under the no action alternative, the land use of the EIS analysis area would not be disturbed by construction and production activities associated with the proposed action. Current land use trends in the region would continue, including coal mining, oil and gas exploration and development, electric power generation and transmission, grazing activities, and increased recreational use. Pilot Project operations could continue, but disapproval of the entire build-out would probably cause cessation of such operations in the near-term.

4.8.2 Effects Common to All Action Alternatives

Although oil and gas exploration and development activities have historically occurred within and adjacent to the EIS analysis area, the construction and operation of the proposed project would introduce a noticeable land use change within the immediate EIS analysis area. However, on a more regional basis, the Seminoe Road Project would not substantially change other land uses in Carbon County or on BLM-administered lands in south-central Wyoming.

Disturbance would occur almost equally on both public and private lands. Approximately 4.5% of the 137,000-acre EIS analysis area would be disturbed with initial construction and drilling activities. With concurrent reclamation following drilling operations and installation (burial) of electric, water and gas utility lines, the area of total disturbance would be reduced to 1.7% of the 137,000-acre EIS analysis area. See **Table 2-1, Preliminary Estimate of Surface Area Disturbance**. Upon project closure, these remaining disturbed areas would be reclaimed.

A small portion of the EIS analysis area (approximately 3.2%) includes areas disturbed (mined) and reclaimed by coal mining companies. See **Appendix E, Regional Activity**; **Figure 19, Regional Activity**, **Figure 44, Vegetation Map**; and, **Table 3.6-1, Vegetation Communities**. Because coal mining companies maintain reclamation bonds of reclaimed lands with the Wyoming DEQ, Land Quality Division, any redisturbance of bonded mine reclaimed areas by Seminoe Road Project operations would require a transfer of reclamation success liability and responsibility from the coal mining company to the Proponent.

Interim and final reclamation of surface disturbance is planned to re-establish wildlife habitat and livestock grazing. With mitigation and reclamation, the approval of any of the action alternatives would not substantially affect the long-term land use or land use planning on BLM-administered or adjacent private areas.

The Seminoe Road Project would cause a short-term loss of rangeland, non-shrub wildlife habitat and dispersed recreation. Site access restrictions would continue to exist, primarily because of “checkerboard” land ownership patterns; disturbed sites would be restored as part of reclamation although re-establishment of shrub (sagebrush) habitat may take 15 to 20 years following reclamation. The short-term impacts would essentially be the same for all action alternatives, with very slight differences in the total number of acres disturbed.

The main consequence effecting grazing management is the loss of available forage for livestock, as expressed in the short-term (0 to 10 years) and long-term (11 to 30 years). See **Table 4.8-1, Grazing Allotment Impact Summary**. AUMs lost are calculated by multiplying disturbed areas times the percent of allotment acres suitable for livestock grazing, then dividing by the allotment stocking rate on suitable lands.

Table 4.8-1, Grazing Allotment Impact Summary

	Allotment Name					
	Ft. Steele Breaks	**North Walcott**	**Quealey Block**	**Seminoe**	**Horseshoe Ridge[1]**	**Totals**
Total Allotment Within EIS Analysis Area (acres)	5,300	41,400	5,850	75,000	100	127,650[5]
Disturbance Within Allotment Short-term (acres)[2]	274	1,990	280	3,630	0	6,174
Disturbance Within Allotment Long-term (acres)[2]	99	762	110	1,380	0	2,349
Total Potential AUMs Within EIS Analysis Area[3]	221	1,375	415	5,260	5	7,276
Lost AUMs – Short-term (0-10 years)[4]	11	66	20	252	0	349
Lost AUMs – Long-term (10-30 years)[4]	4	25	7	95	0	131

Notes:
1. There would be no development on the Horseshoe Ridge allotment.
2. Based on a short-term estimated disturbance of 4.5% and a long-term disturbance of 1.7% based on a total EIS area of 137,000 acres. (**See Table 2-1, Preliminary Estimate of Surface Area Disturbance**.)
3. Based on AUMs/acre for each allotment (see **Table 3.8-1, Allotment Summary**).
4. Based on AUMs/disturbed acre for each allotment.
5. Acreage calculations for allotments within EIS analysis area indicates land area. An estimated 9,350 acres for the Seminoe Reservoir at the high water level within the EIS analysis area is not included in total.

Source: BLM, 2004b.

Minor impacts to roadside vegetation are anticipated as a result of dust generated along site roads within the EIS analysis and adjacent areas. Deposition of dust may result in the loss of vigor or plants because they would have reduced capability of photosynthesis as a result of lessened light availability. These effects are not considered substantial and would be minimized by proposed dust control measures (graveling of roads, speed limits).

Project-related traffic, particularly during field development and drilling activities, would increase the potential for vehicle/livestock accidents. This potential would be greater in areas where calves and lambs are present. Traffic volume would decrease following development and drilling so vehicle/livestock collisions would be of less concern during field operations.

There is also a potential for damage to BLM and livestock operator fences, gates and cattle guards from the movement of trucks, drilling rigs and other heavy equipment and for the scattering of livestock off allotments and on to highways (Carbon County 351) from gates being left open. Unless gates, fences, or cattle guards are promptly repaired to appropriate standards, livestock may scatter off the allotment. Livestock scattering would result in additional costs for grazing permittees for locating and moving livestock and potential damage to the range outside of authorized allotments.

Disturbance of soil and movement of vehicles would increase the potential for introduction and spreading of weed species. See Section 4.6, Vegetation**.**

Reclamation objectives for all the action alternatives would be to return disturbed areas to a stabilized and productive condition and to protect and maintain the area's land and water resources. Preliminary evaluations of the reclamation work at the Seminoe Road Pilot Project indicate that revegetation can be successfully accomplished.

4.8.3 Effects of Alternative B (Proposed Action)

The impacts associated with Alternative B would be the same as those described in Section 4.8.2, Effects Common to All Action Alternatives. With proposed water discharges into drainages within the EIS analysis area, livestock would tend to congregate adjacent to flowing water or any ponds in the drainages. This activity would lead to concentrated livestock use, increased animal distribution, trampling of vegetation, and the potential for introduction and spread of weeds.

Any erosion (head-cutting and side-cutting) of drainages caused by concentrated livestock use along water discharges (or by natural processes) could cause livestock to “trail” both sides of the drainages to locations where they can access water or cross the drainage. This natural process presently occurs in Pool Table Draw (where Pilot Project produced water is currently discharged) and in most of the drainages in the surrounding area. Pool Table Draw and other drainages have been incised by natural causes including heavy runoff from snow melt and summer thunderstorms.

4.8.4 Effects of Alternatives C (Pipeline to Reservoir) and D (Underground Injection)

The impacts associated with Alternatives C and D would be the same as those described in Section 4.8.2, Effects Common to All Action Alternatives. There would be no water released in the draws and drainages of the EIS analysis area by either of these alternatives; therefore, no increased livestock trailing along drainages would occur. Under Alternative C, if a produced water pipeline is buried in the floodplain drainages, there would be a long term loss of sagebrush habitat in the stretch of area disturbed by produced water pipeline installation.

4.8.5 Cumulative Impacts

No major cumulative land use effects are expected for any of the alternatives. Oil and gas development, coal mining, grazing, and recreation would remain the dominant land uses within and immediately adjacent to the EIS analysis area.

4.8.6 Potential Monitoring and Mitigation

The BLM is responsible for issuing and managing leases that involve federal minerals and for specifying mitigation measures to protect surface resources as part of the APD approval process.

4.9 Noise

Noise Impact Significance Criteria: *Noise effects would be considered significant if activities exceeded 55 dBA at either human or animal sensitive locations.*

Noise has historically been recognized as a health hazard with the potential for causing hearing damage. Efforts by industry and regulatory actions have lessened the likelihood for hearing damage occurrence. OSHA imposes noise standards on industrial operations for worker hearing protection.

A secondary impact associated with noise is the nuisance effects of noise that include interference with speech, psychologically unsettling environment at home and work, and more specific problems such as sleep disruption. The extent of these effects varies, sometimes significantly, between individuals and as a factor of the noise source. The noise characteristics which affect the listener’s response include overall loudness, sound pressure level, duration of exposure, time distribution of occurrence, and sound frequency. Other factors include the listener’s total exposure, age and individual susceptibility.

4.9.1 Effects of Alternative A (No Action)

Under the no action alternative, noise level from the propane-powered water pumps at the Pilot Project would continue, albeit in relatively isolated locations. Noise levels in the remainder of the EIS analysis area would continue at background levels, affected by wind speed and direction, traffic, recreational activities, nearby coal mining operations, and general rangeland management. Upon decommissioning and reclamation of the Pilot Project, the overall site would return to existing background noise levels.

4.9.2 Effects Common to All Action Alternatives

Noise impacts associated with the Seminoe Road Project would be short-term and primarily occur during site development and construction activities, which include road building, well pad construction, utility installation and well drilling. Noise levels would essentially disappear after construction and drilling activities. Sources of operational noise would involve periodic vehicle trips to the well sites, noise from three compressors, and a few isolated, gas-powered, well-site pumps. Expected equipment and facility noise levels are presented in **Table 4.9-1, Equipment Noise Levels**.

Table 4.9-1, Equipment Noise Levels

Equipment	dBA Range[1]
Drills	85 - 90
Loaders	75 – 85
Backhoes	80 – 90
Dozers	80 – 90
Graders	80 – 85
Compressors	80 – 90 gas powered[2]
	50 – 60 electric powered
Well Pumps	70 – 80 gas powered
	40 – 50 electric powered

Notes:
1. As projected at 50 feet from source.
2. If compressor is enclosed in a building, noise levels at 50 feet would drop to 55 to 65 dBA.

The inverse square law of noise propagation states that noise will decrease (attenuate) by 6 dBA for every doubling of distance. For example, if noise levels from a bulldozer measure 85 dBA at 50 feet, the noise levels would be expected to drop to 79 dBA at 100 feet, 73 dBA at 200 feet, 67 dBA at 400 feet, 61 dBA at 800 feet, and 55 dBA at 1,600 feet.

Not all construction equipment operates continuously or at full load, so the average noise level during well pad construction or during drilling is estimated to be approximately 85 dBA. Using the propagation formulation, average construction and drilling noise levels would decrease as set forth in **Table 4.9-2, Noise Impacts Versus Distance**.

Table 4.9-2, Noise Impacts Versus Distance

Distance From Source (feet)	General Construction Noise (dBA)	Well Pump Noise (Gas Powered) (dBA)	Compressor Facility Gas Powered/Enclosed) (dBA)
50	85	80	65
100	79	74	59
200	73	68	53
400	67	62	47
800	61	56	41
1600	55	50	--
3200	49	44	--

Assuming well pad construction and/or drilling activities have average noise levels of approximately 85 dBA, it would be expected that noise levels would drop to near 55 dBA at approximately a quarter mile from the construction and/or drilling activities.

Gas powered well pumps would drop to 55 dBA at approximately 900 feet from the well pad, while noise levels from electric-powered compressors (which are located in an enclosed building) would be negligible immediately outside the structure.

Since the Boat Club is located over a mile north of the EIS analysis area, there would be no construction or operational noise from the Seminoe Road Project; before reaching the Boat Club, noise levels would attenuate to background levels given the distance. Conversely, during proposed road and drill pad construction and drilling activities, fishermen and other recreationists using the Coal Bay area would be subject to elevated noise levels. With completion of drilling and well installation, noise levels would return to existing background conditions.

Recreationists and visitors to the Dugway Picnic area and Campground would be exposed to the noise from increased traffic on Seminoe Road (County Road 351).

The effects of noise on wildlife is generally avoidance and accommodation. See Section 4.7, Wildlife/Fisheries**.**

Indirect noise effects would result from additional non-work related trips made by new persons (workers and their families) that would move into Carbon County as a result of the Seminoe Road Project. This might include new workers hired for the project, workers hired to be employed for the service industries, or people simply looking for potential jobs associated with oil and gas activities.

This increase in activity would be minor and dispersed throughout Carbon County, primarily in the town of Rawlins.

4.9.3 Effects of Alternatives B, C and D

The noise effects of Alternatives B, C and D would generally be the same as those described in Section 4.9.2, Effects Common to All Action Alternatives; however, gas-powered compressors would cause elevated noise levels surrounding the three compressor sites.

4.9.4 Cumulative Impacts

Noise generated by the Seminoe Road Project would attenuate to near background noise levels within a relative short distance from its source. Overall noise on a cumulative basis would be negligible. Traffic noise would continue along the Seminoe Road (County Road 351) and from recreation users and visitors at Seminoe Road State Park and Reservoir.

4.9.5 Potential Monitoring and Mitigation

If permanent residents become established in the Miller Bend development (Sections 17 and 18, T22N, R85W), the Proponent should conduct noise monitoring to obtain a more detailed understanding of noise impacts generated by construction and drilling activities, as well as for ongoing operational aspects. This survey work would provide additional site-specific data, but the overall conclusions from the additional survey work would probably confirm the EIS noise assessment. Specific noise mitigation could be implemented to lessen noise level impacts at residential receptors. This could include relocating the well pad access roads near the Miller Bend development, as well as providing additional noise control measures for construction, drilling, and operations.

4.10 Cultural Resources

Cultural Resource Impact Significance Criteria: *Cultural resource impacts would be considered significant if project development or activities result in adverse effects to properties listed or determined eligible for listing on the NRHP or considered important to Native American groups.*

4.10.1 Effects of Alternative A (No Action)

Under the no action alternative, both known or undiscovered cultural resources would continue to exist in their present state. There would be no project-related surface disturbances beyond those currently permitted for the Pilot Project. Cultural resources would continue to be exposed to natural geomorphic processes or other disturbances associated with coal mining, oil and gas exploration and production, residential development and ranch management.

4.10.2 Effects Common to All Action Alternatives

During each phase of the planned development of the Seminoe Road Project, the Proponent would construct access roads and drill pads and install utility lines (gas, water and electricity). This development would have the potential to affect cultural resources. As described in detail in Chapter 2 under Alternative B, the Seminoe Road Project would be developed in distinct development phases. Each phase of the project would be permitted by the BLM under APD permit regulations, and NEPA compliance (environmental assessment) would be needed for each APD. Prior to any development, i.e. construction of each phase of the project, cultural resources surveys would be conducted for any areas planned to be disturbed by project construction including roads, drill pads, compressor sites, ROWs, water discharge points, etc. Any cultural resource sites discovered during the surveys, would be identified as well as evaluated based on practices as outlined in **Appendix M, Cultural Resource Management Plan**.

Prior to any project disturbance, Class III cultural field surveys must be conducted. Identification, evaluation and recording of any cultural resources would follow BLM cultural resource management guidelines as described in **Appendix M, Cultural Resource Management Plan**.

The BLM operates under procedures promulgated under NHPA, 36 CFR 800, and/or the National Programmatic Agreement and Statewide Protocol to assess effects to sites deemed eligible for nomination to the NRHP. Significant adverse affects to cultural resources within the Seminoe Road Project analysis area would include:

(1) Destruction or alteration to all or part of a property;

(2) Isolation of a cultural resource from or alteration of, its surrounding environment;

(3) Introduction of visual, audio or atmospheric elements that are out of character with the property or alter its setting; and,

(4) Neglect and subsequent deterioration.

The BLM prefers to avoid disturbance to cultural resources and employ mitigation measures only if a site cannot be avoided.

In the event an unanticipated discovery is made during the construction or operational activities, the following procedures will be employed:

(1) Disturbance activities in the immediate vicinity of the discovery would be halted;

(2) The BLM Rawlins Field Office Area Manager would be contacted;

(3) A qualified BLM and/or Proponent-designated archaeologist would evaluate the site discovery. The BLM would be responsible for notifying Native American representatives, if necessary, for the particular discovery; and,

(4) Mitigation measures would be employed at the site, which could include total avoidance, redesign of the development activities, or other measures as required by the BLM.

4.10.3 Effects of Alternatives B, C and D

The impacts associated with Alternatives B, C and D would be similar to those discussed in Section 4.10.2, Effects Common to All Action Alternatives.

4.10.4 Cumulative Effects

Oil and gas exploration and development, coal mining, recreational activities, livestock grazing and residential development could cause continued use and impacts to the region. This increased activity could cause impacts to cultural resources

4.10.5 Native American Consultation

Pursuant to the NEPA, NHPA, the Federal Land Policy and Management Act, the American Indian Religious Freedom Act, and Executive Order 13084, the BLM has engaged in consultation talks with Native American representatives for the EIS development process. As part of the formal EIS scoping process in 2003, the BLM mailed letters, which requested input on any issues and concerns resulting from the proposed Seminoe Road Project, to the following Native American tribes: Eastern Shoshone, Northern Arapaho, Northern Ute, Northern Cheyenne, Ogallala Sioux, Rosebud Sioux, Shosone-Bannock, Crow, Comanche, Ute Mountain Ute, Uinta-Ouray Ute, and Southern Ute.

Only one comment was received during the formal EIS scoping process, that from the Southern Ute Tribe, which stated: “There are no known impacts to areas of Native American cultural sites that are sensitive to this (Southern Ute Indian) tribe in regards to the Seminoe Road Project.” Subsequent to the scoping process, the BLM mailed follow-up letters in 2004, again seeking input on the project, to the Native American tribes listed in the previous paragraph, plus the Cheyenne River Sioux. These 2004 letters offered meetings and tours of the project site.

The BLM will continue the Native American consultation process, as appropriate, throughout the completion of the EIS. No specific Native American sensitive sites (Native American Sacred Sites, TCPs) or issues have been identified by the tribes for the EIS analysis area; however, potentially sensitive sites such as burials, Native American cairns, and stone circle sites are known to occur in the region. The BLM plans to correspond with aforementioned Native American tribes prior to the implementation of each phase of the proposed project. As necessary or when requested, the BLM would meet with any interested tribe and conduct a tour of the planned development areas.

4.10.6 Potential Monitoring and Mitigation

See **Appendix M, Cultural Resources Management Plan**.

4.11 Recreation

Recreation Impact Significance Criteria: *Recreation impacts would be considered significant if the project resulted in elimination or displacement of recreation activities for more than one season of use.*

4.11.1 Effects of Alternative A (No Action)

Under the no action alternative, recreational activity in the area (hunting, fishing, boating, camping, wildlife viewing, sightseeing, etc.) would continue, but the region is expected to experience increased recreational visitation. Current land use trends would also continue, including oil and gas development, coal mining and grazing, and these activities could incrementally degrade dispersed recreational opportunities, especially for certain visitors who seek solitude.

4.11.2 Effects Common to All Action Alternatives

Construction, drilling and production activities would have no impacts on developed recreational facilities (such as the Seminoe State Park and Dugway Recreation Site) and only minimal effects on dispersed recreation within the EIS analysis area, due to the checkerboard land ownership patterns within the EIS analysis area. Access to private lands is limited to those who obtain permission from the private landowners. Recreationalists can only access and use the few BLM-administered lands where legal public access is available.

Hunting would be the primary dispersed recreation activity that would be directly affected by the project; this effect would result from wildlife avoidance in the immediate vicinity of construction and drilling activities.

Recreation users traveling through the EIS analysis area on Carbon County Road 351 in route to the Seminoe State Park or Miracle Mile area would be subject to increased traffic on Carbon County Road 351 and to the visual impact of equipment and crews during construction and drilling periods, and to a lesser extent during actual production activities. The presence of equipment and crews may affect a user's recreational experience, with noise levels and elevated traffic, which could increase the possibility of an accident (construction and drilling traffic merging onto Carbon County Road 351, trouble in passing, increased speed).

During 2 or 3 years of construction and drilling in this area, fishermen and boaters on Seminoe Reservoir adjacent to the EIS analysis area and on Coal Creek Bay could be affected by the noise, dust, and visual intrusions caused by construction and drilling equipment and activities. Visitors to Seminoe Reservoir and Coal Creek Bay would not be displaced from the entire reservoir, but they may chose to go to other parts of the reservoir while construction and drilling is underway in the vicinity of Coal Creek Bay.

As described in **Appendix A, Proponents Project Description**, the project would be completed in phases generally expanding to the south. Once construction and drilling activities are completed in a particular phase, the only residual activity would be routine operations and maintenance activities thus reducing any noise, dust, and visual impacts. During operations, the physical presence of roads, drill pads and compressor sites would remain, thus making the area less desirable for recreation than before the project.

The visual impacts associated with natural gas construction and production activities affect the aesthetic quality of the recreational experience. Such impacts would be considered substantial in VRM Class II areas until reclamation is successful, but the same impacts would be considered minimal in VRM Class III areas. See Section 4.13, Visual Resources and **Figure 48, Visual Resource Management**. Interim and final reclamation work would allow disturbed sites to eventually blend into the natural surroundings once revegetation is successful.

Recreation visitors traveling on Carbon County Road 351 from Sinclair would experience increased traffic (see Section 4.12, Transportation) and would view construction and production activities as they pass through the EIS analysis area (see Section 4.13, Visual Resources).

Production operations and maintenance would have little effect on recreation resources or opportunities in the region, since such activities would be relatively infrequent, primarily be adjacent to Carbon County Road 351 and would be located primarily in areas without legal public access.

Recreationists at the developed campgrounds of Seminoe State Park and Dugway Recreation Site would not hear any project-related noise. If visitors, such as hunters or boaters on Seminoe Reservoir (particularly in Coal Creek Bay), pass through the EIS analysis area, they might hear project-related noise; however, such noise levels are expected to be low (see Section 4.9, Noise). There would be no direct impact to visitors or individuals fishing at the Miracle Mile section of the North Platte River, which is located 10 miles north of the EIS analysis area.

Indirect effects to recreational resources could result from Seminoe Road project-related population increases in Carbon County. All of the action alternatives would require a temporary workforce during construction, some of which would migrate to the area. Given the current availability of housing in Rawlins and other communities in Carbon County, these temporary workers should not place pressure on local recreation facilities. Project workers would not be allowed to camp during the week on BLM lands or recreation sites.

Project-related population growth could, however, increase demand on recreation resources in the area, especially the developed recreation facilities at Seminoe State Park and at Miracle Mile.

4.11.3 Effects of Alternatives B, C and D

The impacts associated with Alternatives B, C and D would be similar to those discussed in Section 4.11.2, Effects Common to All Action Alternatives. However, Alternative C might generate a noticeable increase in noise from gas-powered facilities, which could affect the recreation experience within and adjacent to the EIS analysis area.

4.11.4 Cumulative Impacts

Cumulative impacts on recreational resources would result from the combined effects of normal increase in recreational demand in the region and the increased intensity of other land use practices. Current land use practices that could contribute to cumulative impacts to recreation would include oil and gas exploration and development, coal mining and grazing activities.

With regional increases in employment from oil and gas development and increased use of the region by people from distant population centers such as the Denver/Front Range, developed recreational sites at Seminoe State Park and at the Miracle Mile would be expected to experience increased use. Since undeveloped and dispersed recreational use within the EIS analysis area is limited by the checkerboard ownership pattern, such dispersed undeveloped recreational use would not be expected to increase in the future, unless landowners choose to allow increased access to their private lands.

4.11.5 Potential Monitoring And Mitigation

The Seminoe Road Project would comply with U.S. Bureau of Reclamation buffer zones from the Seminoe Reservoir (i.e., well pads and roads are required to be at least 500 feet from the Seminoe Reservoir high water line unless exemptions are granted). Exemptions would be required for Alternative C for the installation of produced water pipeline facilities adjacent to the high water line of the Seminoe Reservoir.

4.12 Transportation

Transportation Impact Significance Criteria: *Transportation impacts would be significant if:*

- *Public highways were unable to handle project-related traffic levels;*
- *Project-related traffic would cause measurable increases in accident rates or greatly increase the risk to highway users; or,*

- *Project roads did not comply with BLM road construction regulations.*

ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles passing a specific point from both directions on a given road.

4.12.1 Effects of Alternative A (No Action)

Under the no action alternative, no project build-out would occur, and no well pad access road network would be constructed. Existing two-track roads would continue to experience traffic for ranch management activities and dispersed recreational activities, such as hunting.

Traffic patterns and volumes on Carbon County Road 351 and other highways in Carbon County would continue, and current land use trends in the area would also continue, including expected increased recreational activity such as hunting, boating, fishing and camping. This activity would cause additional traffic on Carbon County Road 351, but this road has been recently improved within and immediately outside of the EIS analysis area (see Section 3.12, Transportation), so any added traffic volume associated with recreational use would not effect the integrity of this road.

Under the no action alternative, the Proponent's activities at the Pilot Project could continue under existing permits and approvals until the Proponent decides to close and reclaim the project. Pilot Project final reclamation would probably take place in the summer and related increased in traffic for such reclamation work would be minimal and short-term.

4.12.2 Effects Common to All Action Alternatives

If an action alternative is selected, direct effects to the existing transportation network, especially Carbon County Road 351, would result from an increase in daily traffic to the EIS analysis area. This would result from employee related traffic combined with drilling equipment, supply and material transport.

With all proposed action alternatives, there are three separate phases:

- Construction and drilling;
- Operations and production; and,
- Final reclamation.

The construction and drilling phase for all action alternatives would last approximately 10 years and would have the largest impact to traffic loads. Supply trucks, gravel trucks and pickup trucks associated with construction and drilling would cause an increase of approximately 110 trips per day to the EIS analysis area. For the first 5 years, the main access to the project would be via County Road 351. Traffic levels would increase by 50% on this road during this time period. Drill rigs and heavy equipment used to construct roads and well pads would be transported to the site and would typically remain on site until construction and drilling activities are completed. Construction and drilling traffic would peak during the summer and fall construction seasons, then decline during the winter and spring months.

Operational and production traffic would require approximately 40 trips per day. This traffic would mainly be pickup trucks for operational and maintenance personnel required on site. Periodically, work-over drill rigs and associated equipment would be required for refurbishing wells; this traffic would occur sporadically during the operational and production phase of the project. There would be operation and production traffic through the first 10 years of the project. During the final 10 to 20 years of operation, traffic would consist primarily of operation and maintenance personnel.

Upon cessation of gas production from the site, final reclamation activities would commence. It is anticipated that final reclamation activities would require 2 years, with most reclamation occurring during summer and fall months. Final reclamation would experience a peak traffic load of approximately 40 trips per day to the project site. Heavy equipment used for final reclamation would be transported to the site at the beginning of each season and would probably remain until reclamation activities are complete.

The following aspects of the Carbon County transportation network would be affected by employee, supply and equipment transport to the EIS analysis area:

- Public Access,
- Traffic Load,
- Public Safety,
- Environmental Safety, and
- Road Maintenance.

4.12.2.1 Public Access

Under all action alternatives, public access into the “working” sites of the EIS analysis area would be restricted. Access from Carbon County Road 351 would be located on private surface such that access points could be gated. In addition, access north of the Union Pacific Railroad line in Section 26, T21N, R84W would similarly be restricted. Access in the ROW of the WAPA 69 kV electric transmission line would be limited to “perpendicular” crossings. Unless otherwise needed for some long-term land use (i.e., WAPA 69 kV line and Conoco pipeline maintenance) or requested by the private landowners, access roads throughout the EIS analysis area would be reclaimed following completion of natural gas extraction.

4.12.2.2 Traffic Load

Existing traffic loads for County Road 351, State Highway 30/287, and I-80 are set forth in Section 3.12, Transportation.

County Road 351. During the first 5 years of the project, construction and drilling traffic would access the project site via County Road 351 and cause an estimated 50% increase in traffic over current traffic levels. Much of the traffic would include tractor-trailer rigs and gravel trucks. However, because County Road 351 has recently been upgraded, the additional traffic should not result in any major increased maintenance costs for the road.

Following construction and drilling activities, project-related traffic loads on Carbon County 351 would decline. Ongoing operations and production traffic would be approximately 25% higher than 2002/2003 traffic levels.

State Highway 30/287. For construction and drilling activities south of Seminoe Reservoir and the North Platte River, traffic would access the site via Walcott Junction on I-80 east of Sinclair, utilize State Highway 30/287 for approximately one-quarter mile, then use an existing gravel road north into the project site. Construction and drilling traffic on State Highway 30/287 would be approximately 20% above current levels; and, similar to traffic on Carbon County Road 351, operations, production and reclamation traffic would decrease but still be approximately 5% above 2002 and 2003 levels.

Interstate 80. Given the large current traffic load on I-80 in the vicinity of Rawlins and Sinclair, any traffic volume created by Seminoe Road Project activities would be minimal on I-80. Even at peak construction and drilling periods, project related traffic on I-80 would be less than 1% of the total traffic loads.

Internal Project Roads. Although there are an estimated 300 miles of existing, two-track roads criss-crossing throughout the EIS analysis area, these roads are subject to minimal traffic, principally traffic associated with ranch management activities. Approximately 200 miles of existing roads and 270 miles of new roads would be needed for the Seminoe Road Project. These roads would be constructed to provide year-round access, with gravel surfacing, and they would be maintained throughout the life of the project. The existing two-track roads would require upgrading. See **Figure 4, General Layout Map,** for projected project road locations.

4.12.2.3 Public Safety

Accident statistics were collected for Carbon County Road 351 and I-80 (Walcott Junction to Rawlins) from the Wyoming Department of Transportation. The data were collected for 1999 through 2003. A summary of the data is presented on **Table 4.12-1, Accident Data: Carbon County Road 351 (1999-2003)** and **Table 4.12-2, Accident Data: Interstate 80 Walcott to Rawlins (1999-2003)**.

Table 4.12-1, Accident Data: Carbon County Road 351 (1999-2003)

Year	Number Persons Injured	Number Persons Killed	Crashes Involving Property Damage Only	Injury Crashes	Fatal Crashes	Total Crashes
1999	0	0	6	0	0	6
2000	4	0	9	2	0	11
2001	0	0	6	0	0	6
2002	9	0	3	4	0	7
2003	6	0	2	4	0	6
Total	19	0	26	10	0	36
Source: Wyoming Department of Transportation (2004)						

Table 4.12-2, Accident Data: Interstate 80 Walcott to Rawlins (1999-2003)

Year	Number Persons Injured	Number Persons Killed	Crashes Involving Property Damage Only	Injury Crashes	Fatal Crashes	Total Crashes
1999	64	10	77	34	5	116
2000	48	0	83	32	0	115
2001	56	3	69	29	2	100
2002	49	2	62	2	2	92
2003	88	3	82	45	2	129
Total	305	18	373	168	11	552
Source: Wyoming Department of Transportation (2004)						

The data for Carbon County Road 351 reveals that there were 36 accidents from 1999 through 2003. Of these, 18% were alcohol and speed related, 18% due to bad weather, 41% caused by animal-vehicle collisions, and the remaining 23% due to miscellaneous factors including driver fatigue. There were no fatalities on Carbon County Road 351 from 1999 through 2003.

A reported 552 accidents occurred on I-80 between Walcott Junction and Rawlins from 1999 through 2003. There were eleven fatal accidents with a total of 18 fatalities. Winter weather conditions were a factor in 58% of the accidents, with only 5% involving animal-vehicle collisions. With the expected increase in traffic and the transport of equipment and supplies to the EIS analysis area, there is a potential for accidents involving employees or the supplies and equipment hauled to the site.

4.12.2.4 Environmental Safety

Diesel fuel would be the principal supply transported to the EIS analysis area. Whenever and wherever diesel, propane, or other dangerous or environmentally hazardous materials are transported, there is a potential for an accidental spill. These materials would be transported to the project site in conformance with U.S. and Wyoming Departments of Transportation regulations. Spill prevention would be an important objective during transportation of such materials. Areas approximate to the North Platte River and the various intermittent/ephemeral streams within the EIS analysis area would be susceptible to degradation if an accident resulting in a spill occurred.

4.12.2.5 Road Maintenance

Given projected traffic loads, coupled with the existing conditions of Carbon County Road 351, State Highway 30/287, and I-80, minimal additional maintenance would be required on these roads for the life of the project. These roads have the surfacing, grade and width to handle any project-related traffic. State and county maintenance departments are responsible for any regular road maintenance and snow removal. It is expected that there would be times during extreme snowstorms or blizzard conditions when these state and county roads would be closed to traffic.

Internal project roads, however, would require routine maintenance throughout the life of the project. Such maintenance measures would include grading, watering or other dust controls, resurfacing with gravel, and snowplowing in winter months. Since there is expected to be no or negligible public use of these access roads, such maintenance requirements, including snowplowing, would be the responsibility of the Proponent.

4.12.2.6 Indirect Effects

Indirect effects to the Carbon County transportation network would result from additional non-work related trips made by new persons (workers and their families) that would move into the region as a result of the Seminoe Road Project. The projected number of new workers is expected to be minimal (see Section 4.14, Socioeconomics). Any increase in traffic would probably be dispersed throughout Carbon County. It would not be concentrated in the vicinity of the EIS analysis area. Therefore, this traffic would be only a minor component in the cumulative impacts on any roads near the project site.

4.12.3 Effects of Alternatives B, C and D

The impacts associated with Alternatives B, C and D would be the same or very similar to those discussed in Section 4.12.2, Direct Effects Common to All Action Alternatives.

4.12.4 Cumulative Impacts

Project traffic combined with traffic associated with future recreational and other land use activities, particularly on Carbon County Road 351 would result in some cumulative effects and could add to the possibility of accidents. However, even with the projected traffic volumes associated with the Seminoe Road Project and surrounding future activities, it is not expected that such activities would affect the operational conditions of Carbon County Road 351, State Highway 30/287 or I-80.

4.12.5 Potential Monitoring and Mitigation

No additional mitigation beyond that discussed in Section 2.8.7, Road Construction/Transportation would be needed for the project.

4.13 Visual Resources

Visual Resources Impact Significance Criteria: *Visual impacts would be considered significant if there was long-term non-compliance with the RMP designations for visual resources within the project area (VRM Class II and III).*

The visual resource analysis is based on the premise that many travelers on County Road 351 (a BLM-designated National Back Country Byway) and visitors who recreate on Seminoe Reservoir and at Miracle Mile would prefer to see the landscape in a condition as close as possible to its natural state. Approximately 55% of the EIS analysis area designated as a VRM Class II area, and the BLM manages Class II area so any development is as compatible as possible with the landscape's natural form, line, color and texture.

The severity of a visual effect is dependent upon a number of factors including:

- The capability of the surrounding landscape to integrate visual changes without attracting attention;
- The distance from sensitive viewing areas;
- The level of disturbance to the visual resource; and/or,
- Reclamation potential of disturbed landscapes.

The duration of the impact would be a function of both the time to complete the action and the time to return the disturbed area to a pre-disturbance condition. In general, the visual impact would be greatest where visual contrast exists and revegetation would be slow to restore the landscape to pre-project vegetative conditions (such as in sagebrush communities where mature sagebrush revegetation may take 20 years after reclamation to blend with surrounding undisturbed areas).

As indicated in Section 3.13, the EIS analysis area contains BLM VRM Class II and III areas. See **Figure 48, Visual Resource Management**. The Class II areas, which constitute over half (55%) of the EIS analysis area allow only minor changes to the existing landscape, and these areas are visible to travelers along County Road 351 and by recreationists who visit Seminoe Reservoir and the North Platte River. The remainder of the EIS analysis area, including the lands adjacent to Carbon County Road 351 are VRM Class III areas, which allow for moderate changes to the existing landscape.

A viewer would judge visual impacts of natural gas development and production activities from a perspective of foreground, middleground and background. These terms are defined as follows:

Foreground – generally the area that lies within one-half mile of the viewer;

Middleground – the area between the foreground and background in a landscape, typically from 1/2 mile to 5 miles from the viewer; and,

Background – the distant part of a landscape located beyond 5 miles from the viewer.

4.13.1 Effects of Alternative A (No Action)

Under the no action alternative, visual contrasts would remain in their current state and, other than the localized visual effects created by the Pilot Project, the overall viewshed in the EIS analysis area would not be disturbed.

The Pilot Project would continue under the terms of its previous approval, but upon cessation of this activity, the disturbed areas would be reclaimed. For the near term, signs of Pilot Project operations would be visible to those passing through the immediate area. However, following reclamation and as vegetation becomes established, the disturbed areas would blend into the surrounding landscape.

The area's visual character would continue to be affected by existing facilities, such as the WAPA 69kV electric transmission line and Carbon County Road 351. Seminoe Reservoir and its fluctuating shoreline would remain visible. In the southern portion of the EIS analysis area, the communications tower in Section 31, T22N, R84W, would be visible from I-80 near Walcott. Coal mining operations and reclamation activities would also remain visible within and adjacent to the southeast portion of the EIS analysis area.

4.13.2 Effects Common to All Action Alternatives

All action alternatives would present short-term visual contrasts between the industrial character of construction and drilling equipment and surrounding natural landscape. Roads constructed and used to access well pad sites would present distinct linear contrasts with the existing natural landscape's colors and textures.

Regardless of the direction of travel on County Road 351, surface disturbance (roads and well pads) within the EIS analysis area would be visible from both a foreground and middleground perspective. The compressor sites would be generally hidden from view for travelers on Carbon County Road 351; these facilities would be located in lower areas or behind low ridgelines to hide them. The perspective of background for viewers traveling north on Carbon County Road 351 through the EIS analysis area would be dominated by the Seminoe Mountains located north of the project area, while the south-looking view from a background perspective would be dominated by Elk Mountain to the southeast and the ridgeline (Cedar Ridge) that forms the southwest boundary of the EIS analysis area. Recreationists, hiking the ridges of the Seminoe Mountains would see the road network within the project area. However, the view would be from nearly 10 miles away, which would tend to diminish the visual effects.

Mitigation measures set forth in Section 2.8.21, Visual Resources, would minimize the visual impacts of construction and production activities from Carbon County Road 351. As a result, the proposed Seminoe Road Project would not violate the VRM Class II and III direction for the area or produce contrasts beyond the degree allowed for in VRM guidelines from a middleground or background perspective. From a foreground perspective, surface disturbance and non-blending facility coloration may attract viewer attention, thus exceeding the Class II VRM objective in some locations.

Approximately 5 miles of County Road 351 in the EIS analysis area traverses lands designated by the BLM as VRM Class II. Travelers on this stretch of road would be able to observe construction and drilling activities. The masts of the drill rigs would be particularly noticeable on each side of the roadway, although actual drilling time for each well would be minimal, averaging one to two weeks. Following well development and interim reclamation, well site facilities (well head and gas/water separator building) and well site access roads would remain visible, but mitigation and reclamation would cause well site facilities to blend with surrounding undisturbed areas. Sections of the project graveled access roads would remain visible from Country Road 351 throughout the project life.

Because electric utility (power) lines to well pad sites would be buried, there would be no visual impacts associated with overhead powerlines, except for the 115kV 8,000-foot long feeder line that would provide electricity to the compressor site located in Section 10, T23N, R85W. The projected centerline for this feeder line is located in a VRM Class III area and is shown on **Figure 4, General Layout Map**.

Boaters on Seminoe Reservoir would generally be screened for direct viewing of project well pads and roads by topography. The lower the water level, the less likely that boaters would be to view construction and production activity. In addition, the U.S. Bureau of Reclamation regulates construction activities within 500 feet of the high water mark of the Seminoe Reservoir.

Drill rig lights would be visible from Carbon County Road 351 at night, depending on the type, intensity, location of lighting used, and on weather conditions. Given the remoteness of the EIS analysis area and the concentrated nature of the drilling activity, this lighting is not expected to impact the general nighttime scenic quality of the area for campers and stargazers. Similarly, lighting from production facilities, such as compressor facilities, would not affect nighttime scenic quality.

4.13.3 Effects of Alternatives B, C and D

The visual effects of Alternatives B, C and D would be the same as those described in Section 4.13.2, Direct Effects Common to All Action Alternatives, except that the increase in the scope of the project would cause visual impacts to be apparent over a greataer acreage, thereby increasing the probability that development would exceed Class II VRM objectives.

4.13.4 Cumulative Impacts

Roads, the Conoco pipeline, the WAPA 69 kV electric transmission line, coal mining and the Seminoe Reservoir have permanently altered the scenery of the EIS analysis area. The visual effects of these developments would continue into the foreseeable future.

4.13.5 Potential Monitoring and Mitigation

To avoid unacceptable visual impacts that would exceed BLM VRM objectives, mitigation would be employed for the permanent structures (facilities onsite for 6 months or longer) including pumping units, well-site separator buildings, compressor housings, water treatment tanks, roads, etc. Roads must be planned and sited to minimize visibility from Carbon County Road 351, especially in Class II VRM areas.

4.14 Socioeconomics

Socioeconomic Impact Significance Criteria: *Socioeconomic impacts would be significant if:*

- *An increase in county or community population would strain the ability of Rawlins to provide housing and services or otherwise adapt to growth related social and economic changes; or,*

- *An aggregate change in revenue and expenditure flows would cause Carbon County or the town of Rawlins to be unable to maintain public services and facilities at established service levels.*

The socioeconomic effects discussed in this section consider information presented in Section 3.14, Socioeconomics. In addition, projections regarding the Proponent's project description (**Appendix A, Proponent's Project Description**) and specifically the workforce projections made in Section 2.4.11, Workforce, were used for the impact analysis.

Direct and indirect socioeconomic impacts are evaluated for Carbon County. Fiscal effects are evaluated primarily in terms of direct consequences, as indirect effects are less readily quantified. Cumulative impacts are discussed in the context of other activities occurring in Carbon County. See **Appendix E, Regional Activity**.

Whenever possible, socioeconomic effects are identified in quantitative or numerical terms (such as number of jobs, housing units or school students). Some impacts (such as effects on social values) are more difficult to evaluate numerically and so are described primarily in a qualitative or narrative manner.

All of the action alternatives would have socioeconomic effects, including increased employment and additional federal, state and local government tax revenues. Statistical measures such as population, school enrollments, housing and community and public services would not be significantly affected by the Seminoe Road Project as Carbon County (and in particular the town of Rawlins) already has the general infrastructure necessary to support the proposed employment at the project.

Many of the socioeconomic effects can be assessed from an historic perspective. Oil and gas exploration, development and production in south-central Wyoming have been cyclical rather than constant. Further, the "boom" cycle created by coal mining in Carbon County during the late 1970s and early 1980s created peak population, employment, and general socioeconomics to which Carbon County has not yet recovered. The projected pace of development and production from the Seminoe Road Project would not cause any dramatic influx of population or employment. To a great extent, many persons already living within Carbon County would be afforded opportunities for employment at the Seminoe Road Project.

4.14.1 Effects of Alternative A (No Action)

Under the no action alternative, the EIS analysis area would remain undeveloped. Selection of the no action alternative would forgo an opportunity for increased economic activity and income for Carbon County and Wyoming. Pilot Project operations could continue, but disapproval of the entire build-out would probably cause cessation of such operations in the near-term.

4.14.2 Effects Common to All Action Alternatives

There would be little variation in the socioeconomic effects among action alternatives: the primary differences in the alternatives relate to physical design and operation. The effects for all action alternatives are discussed for the following aspects:

- Employment
- Income
- Population
- Housing
- Community and Public Services
- Fiscal Conditions
- Social Values

4.14.2.1 Employment

All of the action alternatives would result in increased employment in Carbon County. Both direct and indirect employment estimates are based on assumptions as outlined in **Table 4.14-1, Employment Assumptions**.

The proposed construction and drilling activities are scheduled to take place in phases over a period of 10 years. Actual gas production would follow construction and drilling activities and is projected to last over a 30-year period. Employment would be scaled back as production ceases and final reclamation activities begin.

Each phase of the Seminoe Road Project would involve a different workforce component. The construction and drilling workforce would be composed of many different categories of occupations including drillers, driller helpers, heavy equipment operators, truck drivers and miscellaneous support laborers. In addition, carpenters, electricians and pipe fitters would be employed to complete specialized tasks.

Table 4.14-1, Employment Assumptions

Category	Years				
	1 – 2	3 – 4	5 – 9	10 – 30	31 - 32
Direct Employment[1]					
Construction & Drilling	60	60	60	--	--
Operations	20	35	50	50	--
Closure & Reclamation	--	--	--	--	30
Total Direct Employment	80	95	110	50	30
Indirect Employment[2]	64	76	88	40	24
Total New Job Opportunities	144	171	198	90	54

Notes:

1. These direct employment numbers represent an estimate of annual job equivalents. Typically in Wyoming, oil and gas construction, development and operational employment rates are higher from July into December, and they are lower from late December to June because of wildlife concerns and weather (winter and springtime) conditions. These numbers are used to "annualize" employment. Like other Wyoming operations, the Seminoe Road Project would experience peak employment in the months between July and December, especially for drilling and construction activities where such related employment in years 1 – 9 could peak at over a hundred workers.
2. Indirect employment refers to new jobs that would be created in the service, retail and non-gas related sectors to support the Seminoe Road Project and its workforce. For this analysis, an employment multiplier of 1.8 was used. The 1.8 multiplier means that for every 100 new basic jobs at the Seminoe Road Project, another 80 service and retail jobs would be created in the local economy.

The operational production phase of the Seminoe Road Project would require crews experienced in gas production, along with on-site supervisory personnel. Administration and maintenance personnel would also be employed during production.

Reclamation would employ heavy equipment operators, construction personnel, and individuals experienced in reclamation. On-site management and reclamation specialists would also be involved during this period.

New (indirect) jobs would be created in the service, retail and other non-gas related sectors of the local and regional economy to support the Seminoe Road Project and its workforce. A wide variety of employment multipliers are used to predict indirect employment. For purposes of this analysis, and employment multiplier of 1.8 was used. This means that for every new job created at the Seminoe Road Project, an estimated 0.8 support or service sector job would be created in Carbon County. This figure represents that some gas related service and retail jobs already exist in Carbon County (particularly in Rawlins); however, many oil and gas supporting industries are located outside of Carbon County.

4.14.2.2 Income (Wages)

According to 2000 occupational employment and wage figures published by the Wyoming Department of Labor for Carbon County (see Section 3.14.5, Income), medium wage for oil and gas workers within this County was approximately $46,000 per year. Similarly, annual wage for all occupations within Carbon County was approximately $25,000 per year.

During the first 9 years of activity, which would include construction, drilling and production, payroll income from direct employment would range from an estimated $3.7 to $5.1 million per year. Following the completion of all drilling and construction activities in year 9, the payroll income from direct employment at the Seminoe Road operation for years 10 through 30 would average approximately $2.3 million per year. During closure and final reclamation activities (projected to be in years 31 and 32), payroll income as a result of direct employment would be approximately $1.4 million per year. All of these estimates regarding payroll income for direct employment are based on 2000 Wyoming Department of Labor wage figures.

Over the life of the entire Seminoe Road Project, total payroll from direct employment is estimated to reach approximately $925 million. See **Table 4.14-2, Estimated Payroll Income**.

Table 4.14 2, Estimated Payroll Income[1,2]

Payroll ($ x 1,000,000)	Years					Total
	1 – 2	3 – 4	5 – 9	10 – 30	31 - 32	
Construction/Drilling	5.52	5.52	13.80	--	--	24.84
Operations	1.84	3.22	11.50	48.30	--	64.86
Closure/Reclamation	--	--	--	--	2.76	2.76
Direct Payroll Income[3]	7.36	8.74	25.30	48.30	2.76	92.46
Indirect Payroll Income[4]	3.20	3.80	11.00	21.00	1.20	40.20
Total Payroll Income[5]	10.56	12.54	36.30	69.30	3.96	132.66

Notes:
1. Payroll income estimates are based on employment assumptions set forth in **Table 3.14-1, Employment Assumptions**.
2. 2000 dollars.
3. Annual average 2000 wage for oil and gas workers in Carbon County, Wyoming estimated at $46,000 based on Occupational Employment and Wage Figures from Wyoming Department of Labor.
4. Annual mean 2000 wage for all occupations in Carbon County, Wyoming estimate at $25,000 based on Occupational Employment and Wage figures from Wyoming Department of Labor.
5. Total payroll income = direct payroll income + indirect payroll income.

During the life of the Seminoe Road Project, payroll income from indirect employment would average over $1 million annually. Indirect payroll would range from approximately $0.6 million during reclamation (years 31-32), to a peak of $2.2 million during the first 9 years of operation. Total payroll income for indirect employment over the life of the project would amount to $40.2 million.

Total direct and indirect payroll income for the life of the Seminoe Road Project is estimated to be $132.7 million. See **Table 4.14-2, Estimated Payroll Income**.

4.14.2.3 Population

The Seminoe Road Project is not expected to significantly increase the population of Carbon County. See **Table 4.14-3, Population Increase Potential**. Even during the peak employment periods projected for years 5 through 9 of the project, the population of Carbon County would increase less than 1%. Assuming that all newcomers were to move into the town of Rawlins, the peak population growth for Rawlins itself would still be less than 2%.

The projected population increases as a result of the Seminoe Road Project would not (by itself) reverse the projected declines in Carbon County population that are expected to occur over the next 20 years. See **Table 4.14-3, Population Increase Potential**.

Table 4.14-3, Population Increase Potential

Employment Category	Peak Years 5 - 9		
	Total Employment[1]	Non-local Employment	Population Growth
Construction & Drilling	60	30[2]	63[5]
Operations	50	10[3]	26[6]
Indirect Jobs	88	22[4]	53[7]
Total	198	62	142

Notes:

1. See **Table 3.14-1, Employment Assumptions**.
2. Assumes 50% of employees from outside of Carbon County.
3. Assumes 20% of employees from outside of Carbon County.
4. Assumes 25% of employees from outside of Carbon County.
5. Assumes 20% of non-local employees single; 40% with household size (rental-occupied for Rawlins of 2.16); and 40% with household size (owner-occupied for Rawlins of 2.58). See **Table 3.14-4, Average Household Size: 2000**.
6. Assumes 100% with household size of 2.58 for owner-occupied for Rawlins. See **Table 3.14-4, Average Household Size: 2000**.
7. Assumes 50% split between those who rent and own, for household sizes for Rawlins. See **Table 3.14-4, Average Household Size: 2000**.

Changes in population from this proposal are driven by three factors:

(1) The number of new (or non-local) employees transferred or recruited to the area by the Proponent;

(2) The number of households and average household size associated with new employees that become new residents; and

(3) The number of new (non-local) workers and their families drawn to the area in industries that provide goods or services to those employed at the oil and gas operations.

Construction and drilling related jobs at the Seminoe Road Project would occur over a 9-year period; however, these jobs would not have a long-term impact on Carbon County population. Many drilling and construction workers generally do not bring their families to the area due to the relative short duration of construction activities, which occur mainly between July and November of any given year. About 50% of the construction workers are expected to be non-local, due to a need for specific task experienced workers who have experience in oil and gas field construction and drilling.

For operations and production, an estimated 80% of the workforce would consist of local hires. This represents a fairly high rate of local hiring, but there are many people in Carbon County who have experience in the oil and gas industry and a portion of the construction and drilling employees that do move to the area may decide to stay and work permanently at the Seminoe Road Project.

Local expenditures made directly for the Seminoe Road Project and by employees would result in an increased demand for goods and services in Carbon County. Some of this demand would be met by existing residents working in stores, real estate offices and other businesses. However, the new demands generated by the Seminoe Road Project (and other potential oil and gas projects in Carbon County) would be expected to draw new service providers and residents into the area, even though they are not directly connected with the Seminoe Road Project. Given the current relatively high availability of local labor force, it has been assumed that approximately 75% of the new indirect jobs would be taken by existing Carbon County residents. About 25% would involve non-local hires.

The term “local hire” is intended to mean persons who have lived in Carbon County prior to hiring and who did not move into Carbon County in anticipation of being hired at the Seminoe Road Project. Employment used to characterize construction and drilling, operations and indirect employment are set forth in **Table 4.14-3, Population Increase Potential.**

4.14.2.4 Housing

The Seminoe Road Project could create a potential long-term demand for 25 to 30 housing units (houses, apartments, mobile homes, etc.) with a potential peak of 60 units. This demand can be accommodated by existing housing resources, which report a vacancy rate of over 1,000 unit for sale or rent in Carbon County and nearly 500 units in Rawlins. See **Table 3.14-3 Housing**

Profile: 2000. Even with a peak demand of 60 units, the Seminoe Road Project would only account for slightly more than 10% of the available housing supply in Rawlins.

The Seminoe Road Project could also generate demand for temporary housing, particularly during the construction and drilling phases of the project. The town of Rawlins would be able to accommodate temporary housing needs, specifically for those individuals seeking hotel or motel rooms and recreational vehicle park spaces. Similarly, it is expected that workers seeking apartments, houses or mobile homes to rent could be accommodated by the available supply of such rental units in Rawlins and Carbon County.

4.14.2.5 Community and Public Services

The Seminoe Road Project would not strain community facilities and public services in Carbon County, specifically in the town of Rawlins. As explained in Section 3.14.1, Population, the population levels in Carbon County, and specifically Rawlins, remain substantially below peak levels of the 1980s. Most public facilities were sized to accommodate larger populations and would be able to accommodate the relatively small population increment associated with the Seminoe Road Project. Further, the Seminoe Road Project is expected to generate substantial tax revenues, which could be used to fund any demand for community or public services created by direct or indirect employment and population as a result of the project.

4.14.2.6 Fiscal Conditions

Over its projected 30-year life, the Seminoe Road Project would generate substantial tax revenues, including ad volorem property taxes on production and field facilities, Wyoming severance taxes, federal mineral royalties, Wyoming state mineral royalties, and sales and use taxes on materials, supplies and equipment used at the project site. In addition, drilling and construction, production and reclamation workers, combined with the indirect workforce created as a result of the project, would pay federal, state and local taxes.

Assuming that the Seminoe Road Project produces 500 million cubic feet (mcf) of natural gas over its 30 year life (an average of approximately 16,700,000 mcf per year), the estimated revenues associated with this production, along with the costs associated with development, operation and reclamation are set forth in **Table 4.14-4, Estimated Revenues and Costs**. It is important to note that the estimated revenues and costs set forth for the Seminoe Road Project are simply a "best guess" at this time. Actual revenues and costs could be substantially different as the Proponent gains actual field experience during project build-out.

Table 4.14-4, Estimated Revenues and Costs

TOTAL REVENUES	**$1,500,000,000**
500 million mcf @ $3/mcf at wellhead in Wyoming (mcf = thousand cubic feet: typical measure of gas production)	
CAPITAL AND DEVELOPMENT INVESTMENT	**$620,000,000**
(For project development, drilling, completion, gas gathering systems and field infrastructure) 1,240 wells @ $500,000/well and associated infrastructure	
LABOR (DIRECT)	**$92,460,000**
(For construction and drilling, operations and production, closure and reclamation: See **Table 4.14-1, Employment Assumptions** and **Table 4.14-2, Estimated Payroll Income**)	
LABOR (GENERAL OVERHEAD)	**$27,740,000**
(Includes costs for health and life insurance, retirement, vacation, FICA, unemployment, workman's compensation, training, etc. – assume 30% of direct labor costs)	
DEVELOPMENT. OPERATIONAL & RECLAMATION EXPENDITURES	**$155,000,000**
(For ongoing expenditures such as fees, general site costs, contract engineering and environmental costs, administration, repair and maintenance, periodic well work-over costs, electric power consumption, miscellaneous supplies) 1,240 wells @ $5,000/well/year for 25 years	
TAXES AND ROYALTIES	**$402,500,000**
(See **Table 4.14-5, Projected Tax Revenues and Royalties**: includes ad volorem property tax, severance tax, federal and state mineral royalties, and sales and use taxes)	
EARNINGS	**$202,300,000**
(Pre-corporate federal income tax, before depreciation expense and allowable depletion rates)	

The various tax revenues for the proposed 30-year life of the Seminoe Road Project are set forth in **Table 4.14-5, Projected Tax Revenues and Royalties**. Details of these revenues are set forth in the following discussion.

Ad Volorem Property Taxes. These are taxes on a commodity as a percentage of its value. Ad volorem taxes on natural gas production in Wyoming go directly to the county in which the gas is produced. Wyoming ad volorem taxes are divided into two types:

(1) Production and

(2) Property.

Production taxes, as the name implies are levied on the assessed valuation of the commodity amount produced. Property taxes are levied on wells and producing equipment. The property taxes are levied in mils (thousandths of a percent) set by each Wyoming county. The Carbon County ad volorem tax rate was estimated at 75 mils. This value was used to calculate project life ad volorem property tax estimates. See **Table 4.14-5, Projected Tax Revenues and Royalties**.

Table 4.14-5, Projected Tax Revenues & Royalties[1]

AD VOLOREM PROPERTY TAXES	**$120,500,000**
Production Ad Volorem - $1,500,000,000 @ 75 mil rate @ 100% of value = $112,500,000 Property Ad Volorem ➢ Assume 10% of capital and development assessment from **Table 4.14-4, Estimated Revenues and Costs** subject to property ad volorem $62,000,000 @ 10% $62,000,000 ➢ Assume average 50% depreciation in Property over 30 year life $62,000,000 @ 50% = $31,000,000 ➢ Assume industrial property taxes at 11.5% of value $31,000,000 @ 11.5% = $3,565,000 ➢ Assume 75 mil rate for 30 year life $3,565,000 @ 75 mil rate for 30 years = $8,021,000 (assume $8,000,000)	
SEVERANCE TAXES	**$90,000,000**
($1,500,000,000 total revenues @ 6% rate)	
FEDERAL MINERAL ROYALTIES	**$185,625,000**
(Assume 99% of gas production from federal leases: 0.99 x $1,500,000,000 @ 12.5% rate)	
STATE MINERAL ROYALTIES	**$2,500,000**
(Assume 1% of gas production from state leases: 0.01 x $1,500,00,000 @ 16.67% rate)	
SALES AND USE TAXES	**$3,875,000**
(Assume 50% of development, operational and reclamation expenditures shown on **Table 4.14-4, Estimated Revenues & Costs**, subject to sales and use taxes) ➢ Wyoming sales tax – 0.50 x $155,000,000 @ 4% rate = $3,100,000 ➢ Carbon County local use tax – 0.50 x $155,000,000 @ 1% rate = $775,000	
CORPORATE FEDERAL INCOME TAXES	**$35,400,000**
(Assume 50% of earnings from **Table 4.14-4, Estimated Revenues and Costs**, taxable at 35% tax rate) $202,300,000 x 0.50 x 0.35 = $36,785,000	
EMPLOYEE RELATED TAXES	**$40,730,000**
(Assume $132,660,000 in total (direct and indirect) payroll income – see **Table 4.14-2, Estimated Payroll Income** ➢ State/local taxes as % of income (8.5%) = $11,280,000 ➢ Federal taxes as % of income (22.2%) = $29,450,000	
Note: 1. Tax revenues and royalties are estimated for life of the project in 2003 dollars.	

In reality, the ad volorem property tax mil levies are adjusted each year by Carbon County commissioners and officials of the various taxing districts, and most mil levies change year to year in order to reflect the revenue needs of the taxing entity and the estimates of assessed valuation within each taxing district. Natural gas is assessed based on the previous year's production, and well field facilities are depreciated after the first year of production.

Ad Volorem property taxes are primarily used to fund school districts.

Wyoming Severance Taxes. The Wyoming Department of Revenue collects and distributes a state tax based on mineral production. The current severance tax rate for natural gas is 6% on the fair market value of natural gas produced within the state. The severances taxes expected to be collected from the Seminoe Road Project over the life of the project are estimated in **Table 4.14-5, Projected Tax Revenues and Royalties**. Severance tax revenues fund a variety of state level projects and go into a number of accounts, including the General Fund, the Water Development Fund, the Mineral Trust Fund and the Budget Reserve, as well as a portion being distributed back to Wyoming counties and municipalities. Wyoming distributed $279 million in severance taxes in the year 2000.

Federal Mineral Royalties. The U.S. government collects a 12.5% royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of the mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund. Federal mineral royalties expected to be collected over the life of the Seminoe Road Project are set forth in **Table 4.14-5, Projected Tax Revenues and Royalties**.

Wyoming Mineral Royalties. The State of Wyoming receives a royalty of 16.67% on the fair market value of gas produced from state leases. Similar to severance taxes, these state royalties are used for state expenses, and a portion of these royalties are returned to local counties and municipalities.

Sales and Use Taxes. Wyoming collects a 4% sales and use tax on the gross receipt of sales and tangible goods and certain services (drilling services are exempt). The state returns 28% of the revenue (less administrative costs) to the county where the taxes were collected. Counties distribute the revenues to incorporated municipalities based on population.

Carbon County also levies a 1% local optional sales and use tax that is distributed to the County and its municipalities.

The amount of sales and use taxes to be paid on goods and services for the life of the Seminoe Road Project is estimated in **Table 4.14-5, Projected Tax Revenues and Royalties**.

Employee Related Taxes. Wyoming does not have corporate or personal income taxes. State and local taxes are (property taxes, general sales taxes, motor vehicle licensing, and other miscellaneous taxes) estimated to be 8.5% of Wyoming workers' income. Employee related state and local taxes collected over the life of the Seminoe Road Project are set forth in **Table 4.14-5, Projected Tax Revenues and Royalties**.

In addition, the Seminoe Road Project workforce and the indirect employment workforce would pay federal income tax and other federal taxes based on income. It is estimated that these federal taxes represent 22.2% of a worker's income. The amount of employee related federal taxes paid over the life of the Seminoe Road Project are set forth in **Table 4.14-5, Projected Tax Revenues and Royalties**.

4.14.2.7 Social Values

Carbon County has a long history of oil and gas development, and consequently most residents are generally familiar with the natural gas industry activities and their economic benefits. The combination of familiarity and anticipated economic benefit creates a climate of general community acceptance of and support for continued and expanded oil and gas development within the County. Combined with this general climate of acceptance are resident attitudes and values that may diminish support or create opposition for a particular development proposal, especially if residents perceive that such development might damage wildlife habitat or degrade the quality of recreation.

These attitudes and values are evident in the comments submitted in response to the BLM scoping process for the Seminoe Road Project. Additionally, a discussion of these attitudes and values, as expressed by Carbon County residents, is included in the findings of the 1996 Resident Survey conducted for the Carbon County Land Use Plan.

According to the Carbon County Land Use Plan, resident response to the survey suggests “a need to balance the conservation of natural resources and the economic viability of resource-based industries in the County.” This sentiment coupled with partial support for leasing more federal lands for oil and gas development (about 50% countywide) suggests that development of natural gas resources on existing leases would be generally supported by Carbon County residents.

Livestock operators who control property or hold grazing permits within the EIS analysis area may experience dissatisfaction with the proposed project if conflicts between grazing and drilling/field development activities arise. Opportunities for conflict would probably be reduced once drilling and field development activities are completed.

Objections to the Seminoe Road Project would typically be related to concern over unknown changes, loss of personal or local control, concern for long-term well being of the environment, and protection of lifestyle. Those who opposed coalbed natural gas development express concern that water quality and quantity could be negatively impacted within and immediately surrounding the project. This is coupled with concerns about aesthetic qualities of the environment (such as air pollution, noise, traffic, and impact to wildlife).

Those who support the Seminoe Road Project relate to employment potentials, economic benefit to the region, and stimulation of change and growth in the area such as housing, social services and infrastructure. Also identified are interests in providing jobs for area youth and unemployed workers, and maintaining an ongoing tradition of oil and gas activity in the county.

4.14.3 Effects of Alternative B (Proposed Action)

The socioeconomic effects of Alternative B would be the same as those addressed under Section 4.14.2, Effects Common to All Action Alternatives.

4.14.4 Effects of Alternative C (Pipeline to Reservoir)

The socioeconomic effects of Alternative C would essentially be the same as discussed in Section 4.14.2, Effects Common to All Action Alternatives.

4.14.5 Effects of Alternative D (Underground Injection)

The socioeconomic effects of Alternative D would be similar to those addressed in Section 4.14.2, Effects Common to All Action Alternatives; however, given the underground injection program, an additional 10 to 15 workers will be needed during operations. Like Alternatives B and C, 80% of these additional workers would be hired locally in Carbon County so there would be negligible increase to the local population as a result of Alternative D.

The community and public services would not be impacted with these additional workers; however, these workers would add to the tax base of Carbon County and at the same time slightly diminish overall Proponent earnings.

4.14.6 Cumulative Impacts

Natural gas exploration and development activities are expected to increase in Carbon County, while oil activities remain steady and coal mining continues to decline.

The Atlantic Rim Project, located southwest of Rawlins, is a major natural gas project in Carbon County, and this proposal encompasses over 300,000 acres with expectations of drilling over 2,000 new wells. The BLM is currently assembling an EIS for the project, and the draft EIS is expected to be released for public review in mid 2005. It is assumed that the Atlantic Rim Project would operate in the same general time frame as the Seminoe Road Project.

Carbon County, specifically the town of Rawlins, would have sufficient motels, empty trailer spaces, and housing to accommodate both the Seminoe Road and Atlantic Rim projects, along with other miscellaneous natural gas development in the area. In addition, Rawlins has sufficient community and public service infrastructure for these projects. The local economy and tax base would benefit from the potential revenues and taxes generated from these two natural gas projects.

4.14.7 Potential Monitoring and Mitigation

Consistent with any surface owner agreement, the Proponent would coordinate project activities with ranch management operations to minimize conflicts with livestock movement or other ranch operations.

4.15 Accidents and Spills

Accident and Spill Impact Significance Criteria: *Accidents and spills would be considered significant if they caused environmental damage (such as a fuel spill into an area drainage) or caused injury to public and employee health and safety.*

There are an infinite number of accident and spill scenarios that could be developed for a project like the Seminoe Road Project. Analysis of such scenarios can include varying levels of complexity and portray a variety of results.

Strict safety procedures and precautions are mandated by safety regulations of OSHA. Over the years, systems have been developed to ensure safe working environment for the people who work the well sites, as well as those individuals working with natural gas pipelines. Strict safety procedures and precautions are mandated by safety regulations of OSHA.

As discussed in Section 4.12, Transportation, diesel fuel would be hauled to the EIS analysis area, with the most substantial volumes needed during construction and drilling activities. There is always the risk of an accidental spill during the transportation of diesel fuel. The impact from a transport related diesel spill would depend on a number of conditions including:

- Accident severity and volume of spill;
- Integrity of the transport containers;
- Clean-up response time and effectiveness;
- Weather conditions;
- Local soil and vegetation types;
- Proximity of the accident to a stream; and,
- Volume of receiving water body.

A WAPA 69 kV electric transmission line and a Conoco high-pressure fuel pipeline cross the EIS analysis area. Similar to what was stated above, scenarios for accidents associated with these two facilities are unlimited.

Prior to project start-up, the Proponent would prepare a detailed Hazardous Material Management Plan, which would include emergency response procedures. The Proponent would coordinate with the BLM in the preparation of this plan, as the BLM has its own Rawlins Field Office procedures for emergency response measures. The Proponent's plan would be kept on-site, and employees would receive training pertaining to hazardous materials and emergency response. The Hazardous Material Management Plan is described in **Appendix G, Hazardous Materials Management Plan**.

4.16 Irreversible and Irretrievable Commitment of Resources

Irreversible resource commitments are those that cannot be reversed (loss of future options), except perhaps in the extreme long-term. It relates primarily to non-renewable resources, such as oil and gas, minerals, cultural resources or those resources that are renewable only over long periods of time, such as mature vegetation or forests. Projects such as the Seminoe Road Project are designed to remove natural gas from the ground; this action results in an irreversible loss of the natural gas resource.

Irretrievable resource commitments are those that are lost for a period of time. Examples are: the loss of production, harvest, or use of natural resources such as wildlife habitat or grazing use, until disturbed sites are reclaimed and revegetation success is achieved. For example, if a grazing allotment is in poor condition and is likely to remain so, the time gap between its current condition and its ideal (potential) productivity is an ongoing irretrievable loss.

Given the planned well pad spacing within the EIS analysis area, overall disturbance would be minimal, less than 5% of the area would be affected by well pads and access roads. However, during this activity, some existing grazing and wildlife habitat would be disturbed during the estimated life of the project and for a period thereafter. With reclamation of these disturbed sites, land uses would essentially return to current uses and levels of use or even be enhanced, but this could take a period of time for some resources.

4.16.1 Irreversible Resource Commitment

The irreversible commitment of resources would include the consumption of non-renewable energy or materials, such as diesel fuel and gasoline, and effects to natural gas resources and cultural resources.

To extract the natural gas resources from coal seams, ground water resources would be pumped during the project life. Given the low recharge rates within and surrounding the EIS analysis area, the pumping of water would result in an irreversible commitment. Eventually, the hydrology of the area would return to a similar condition that existed prior to natural gas extraction, but this could take decades. On the other hand, pumping of water from the EIS analysis area during the 30 year life of the project could be used to offset downstream depletions in the North Platte River, particularly for threatened and endangered waterfowl species in Nebraska.

Fossil fuels (diesel and gasoline) used during the construction, operation and transportation aspects of the project would result in irreversible commitments of those resources. The extraction of natural gas from the EIS analysis area would also result in an irreversible use of the natural gas resource. On the other hand, however, the extraction and use of natural gas would make this resource available for society.

Any soil or subsoil material not salvaged prior to disturbance could result in an irreversible commitment. In addition, any disturbance of cultural sites could result in an irreversible commitment.

4.16.2 Irretrievable Resource Commitment

Vegetation removed from well pad sites, roads, and utility line corridors would result in an irretrievable resource commitment. Similarly, such activity could displace wildlife (e.g., loss of habitat). Reclamation plans and mitigation measures would eventually return vegetation and restore wildlife habitat.

4.17 Unavoidable Adverse Effects

There are unavoidable impacts, which could occur as a result of natural gas extraction from the EIS analysis area. Some of these effects would be short-term, while others would be long-term. These unavoidable effects could include:

- The generation of fugitive dust and gaseous emissions (short-term);
- The loss of vegetation and wildlife habitat (short- and long-term);
- The extraction of ground water resources (long-term);
- The use of water resources for dust control (short-term);
- The demand on public services and utilities (short-term);
- Loss of wetlands, riparian areas, springs and seeps (short- and long-term);
- The visual effects for travelers on County Road 351 (short-and long-term);
- Increases in noise levels which could effect human aesthetics and wildlife use and effectiveness (short-term); and,
- Increased road traffic (short-term).

4.18 Short-Term Use Versus Long-Term Productivity

Short-term uses are those that generally occur on a year-to-year basis. Examples are wildlife and livestock use of forage, recreation and use of the water resource. Long-term productivity is the capability of the land to provide resources, both market and non-market, for future generations.

Relationships between short-term uses of the environment and long-term productivity occur in all alternatives. Short-term uses such as natural gas extraction may be said to represent irretrievable commitments of resources. As an example, removal of vegetation from well pads and roads certainly prevents the vegetation from serving as forage for wildlife and livestock for a certain period of time. However, following project closure and final reclamation, revegetation would again re-establish and serve the desired purpose. This would occur because the basic long-term vegetative productivity would not be destroyed by the short-term use of natural gas extraction; therefore, no irreversible damage would occur.

Natural gas production would be relatively short-term, expecting to last up to 30 years. The short-term use of the EIS analysis area would be to recover as much natural gas as is economically feasible, while mitigating adverse impacts to acceptable levels.

Long-term productivity refers to the basic capability of the land to produce according to desired future levels (e.g., vegetation, wildlife habitat, etc.). Long-term productivity would depend on the reclamation measures applied, the ability to retain soil productivity, and the desired long-term management objectives.

All of the alternatives discussed in this EIS result in short-term uses which irretrievably commit certain resources. Proper reclamation and environmental mitigation should restore any disturbed sites to long-term productivity.

Chapter 5 – List of Agencies, Organizations and Individuals to Whom Copies of the Draft EIS Were Sent

Copies of the draft EIS are available for review at the BLM offices in both Rawlins and Cheyenne, Wyoming, as well as the Carbon County Library in Rawlins.

Copies of the draft EIS were distributed to the following governmental agencies, organizations and individuals.

5.1 Federal Agencies

Army Corps of Engineers

Bureau of Indian Affairs

Bureau of Land Management Library

Bureau of Land Management, MS1075

Bureau of Land Management, Rawlins Field Office

Bureau of Land Management, Wyoming State Office

Bureau of Reclamation, Casper Office

Bureau of Reclamation, Office of Program and Policy Services

Department of Energy, Western Area Power Administration

Department of the Interior, National Science and Technology Center

Department of the Interior, Natural Resources Library

Department of the Interior, Office of Environmental Policy and Compliance

Department of the Interior, Office of Environmental Policy and Compliance

Department of the Interior, Regional Environmental Officer

Environmental Protection Agency, Office of Federal Activities

Environmental Protection Agency, Region VIII

Federal Energy Regulatory Commission

Fish and Wildlife Service, Denver Office

Fish and Wildlife Service, Division of Federal Projects

Fish and Wildlife Service, Ecological Services

Forest Service, Bridger-Teton National Forest

Forest Service, Medicine Bow-Routt National Forest

Forest Service, Pinedale Ranger District

State Government

Geological Survey

Government Printing Office

Library of Congress

Minerals Management Service

National Park Service

National Park Service, Air Resources Division

National Park Service, NEPA/Section 106 Specialist

Natural Resource Conservation Service, Wyoming State Office

Office of Surface Mining

5.2 Tribal Governments

Cheyenne River Sioux Tribal Council

Cheyenne River Sioux Tribe, Tribal historic Preservation Officer

Comanche Tribal Business Council

Crow Tribal Administration, Cultural Director

Crow Tribal Council

Medicine Wheel Coalition for Sacred Sites of North America

Northern Arapaho Business Council

Northern Arapaho Tribe, Tribal historic Preservation Officer

Northern Cheyenne Tribal Council

Northern Cheyenne Tribe, Traditional Spokesman

Northern Cheyenne Tribe, Tribal Historic Preservation Officer

Ogala Sioux Tribal Council

Rosebud Sioux Tribal Council

Rosebud Sioux Tribe, Cultural Resource Coordinator

Shoshone and Northern Arapaho Tribes, Wind River Environmental Quality Commission

Shoshone Business Council

Shoshone Business Council

Shoshone Cultural Office

Shoshone-Bannock Tribes of Fort Hall, Business Council

Shoshone-Bannock Tribes, Interim Cultural Resource Coordinator

Southern Ute Indian Tribe

Ute Indian Tribe, Cultural Rights and Protection

Ute Tribal Council

5.3 Elected Officials

U.S. Representative Barbara Cubin

U.S. Representative Barbara Cubin, Cheyenne Field Office

U.S. Representative Barbara Cubin, Rock Springs Field Office

U.S. Representative Craig Thomas, Cheyenne Field Office

U.S. Senator Craig Thomas

U.S. Senator Craig Thomas, Rock Springs Field Office

U.S. Senator Mike Enzi

U.S. Senator Mike Enzi, Casper Field Office

U.S. Senator Mike Enzi, Cheyenne Field Office

U.S. Senator Mike Enzi, Gillette Field Office

Wyoming Senator Bill Vasey

5.4 State Government

Colorado State University Libraries

Field Museum of Natural History, Department of Geology

Governor's Planning Office

Medicine Bow Conservation District

Nebraska Department of Natural Resources

Office of the Governor, Environmental Policy Division

Saratoga-Encampment-Rawlins Conservation District

University of Wyoming Libraries, Collection and Development Office

Western Wyoming College, Archeological Services

Wyoming Association of Municipalities

Wyoming Business Council

Wyoming Department of Agriculture

Wyoming Department of Employment, Research and Planning Division

Wyoming Department of Environmental Quality, Air Quality Division

Wyoming Department of Environmental Quality, Land Quality Division

Wyoming Department of Environmental Quality, Water Quality Division

Wyoming Department of Environmental Quality, Water Quality Division, Lander

Wyoming Department of Revenue, Ad Volorem Tax

Wyoming Game and Fish Department, Green River

Wyoming Game and Fish Department, Office of the Director

Wyoming Game and Fish Department, Savery

Wyoming Natural Diversity Database

Wyoming Oil and Gas Conservation Commission

Wyoming Public Service Commission

Wyoming State Engineer's Office

Wyoming State Geological Survey

Wyoming State Historic Preservation Office

Wyoming State Parks and Cultural Resources, Historic Sites Division

5.5 County and Local Government

Carbon County Commissioners

Carbon County Planning Commission

Carbon County Public Library

Carbon County Road and Bridge Department

City of Rawlins

Rawlins and Carbon County Chamber of Commerce

Rock Springs Library

Sweetwater County Library System

Town of Bairoil

Town of Hanna

Town of Medicine Bow

Town of Saratoga

Town of Sinclair

5.6 Businesses and Organizations

3-Shot Sage Grouse Foundation

Air Quality Resource Management

Anadarko Petroleum Corporation

Anadarko Petroleum Corporation, Rock Springs

Animal Welfare Institute

Audubon Society, Cheyenne

Bio Environmental Associates

Biodiversity Conservation Alliance

Bjork, Linkley, and Little, PC

Carbon County Coalition

Casper Star-Tribune

Casper Star-Tribute, Green River

CBMCC

Coleman Oil and Gas

Colorado Interstate Gas Company

Colorado River Basin Salinity Control Forum

Continental Divide Trail Society

Defenders of Wildlife

Desert Cattle Company

Devon SFS Operating Inc.

DRU Consulting, LLC

Dudley and Associates, LLC

Earth Tech

Earthjustice Legal Defense Fund, Inc.

Energy Analysts

Environmental Defense

Evergreen Construction

Fisher Ranch

Flying J Oil and Gas Inc.

Forsberg Ranch

Gary Holsan Environmental Planning

Gerald Jacob Environmental Consulting

Greystone

Hayden Wind Associates

Hi-Allen Ranch Company

HIS Energy Group

Hyland Enterprises

ID Ranch

IPAMS

Julander Energy Company

Kaiser-Francis Oil Company

KCWY-TV

Klabzuba Oil and Gas

KRAL/KIQZ

KTWO-TV and KTWO Radio

KUWR

Land and Water Fund of the Rockies, Wyoming Representative

Lander Journal

Laramie Daily Boomerang

MacPherson, Kelly and Thompson, LLC

McElvain Oil and Gas Properties

Miller Estate Company

National Wildlife Federation

National Wildlife Federation, Boulder Office

Natural Resources Defense Council

OCI Wyoming LP

OCTA

OCTA – Wyoming Chapter

Oil and Gas Accountability Project

PacifiCorp

People for the West

Petrogulf Corporation

Petroleum Association of Wyoming

Poulson, Odell and Peterson

Power River Basin Resource Council

Predator Project

Public Lands Advocacy

Q Creek Grazing Association, LLC

Qwest

Rawlins Daily Times

River Gas Corporation

Rocky Mountain Casing Crews Inc.

Rocky Mountain Sheep Grazing Association

Saratoga Sun

Schmid Oilfield Services, Inc.

Seminoe Boat Club

Sierra Club

Sierra Club, Montana

Sinclair Oil Company, Casper Refinery

Sinclair Oil Corporation

Southwest Wyoming Industrial Association

Swift Creek Consulting

The Natural Resources Defense Council

The Nature Conservancy

The Nature Conservancy, Public Land Program

The Sierra Club, Wyoming Chapter

The Wilderness Society

Three Forks Ranch Corporation

Thunder Basin Consulting

TRC Environmental Corporation

TRC Mariah

Trigon-Sheehan, LLC

Trout Unlimited

Uintah Engineering and Lands Surveying

URS, Woodward-Clyde

US Energy/Crested

Wamsutter Ltd. Partnership

WESTECH

Western Ecosystems

Western Gas Resources

Western Wyoming Mule Deer Foundation

Wildlife Management Institute

Wildlife Management Institute

Williams Field Services

Wyoming Association of Professional Archaeologists

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Wyoming Outdoor Council, Rawlins

Wyoming People for the USA

Wyoming Sportsman's Association

Wyoming Wilderness Association, Greater Yellowstone Coalition

Wyoming Wildlife Federation

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Wyoming Woolgrowers Association

Yates Petroleum Corporation

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Chapter 6 – List of Preparers

6.1 Introduction

The BLM is the lead agency for the Seminoe Road Project EIS and is responsible for the contents of this EIS document. S. Edwards Inc. served as the third-party EIS contractor under the direction of the lead agency and utilized numerous subcontractors in the assemblage of the EIS. A number of individuals have contributed to this document. The academic background and experience of the third-party contractor (S. Edwards Inc) and its subcontractors are presented in this chapter.

6.2 Bureau of Land Management

David Simons – Environmental Coordinator

Bob Lange – Hydrology

Heath Cline – Wildlife

Mike Bower – Fisheries

Patrick Walker – Archaeology

Krystal Clair – Recreation and Visual Resources

Susan Foley – Soils and Vegetation

Larry Jackson – Natural Resource Specialist

Mike Murray – Range

Mark Newman – Geology

Hugh Wolfe – Realty Specialist

Susan Caplan – Air Quality

6.3 Saratoga – Encampment – Rawlins Conservation District

Jeb Stewart

Larry Bentley

6.4 S. Edwards Inc.

Alan Czarnowsky – Project Manager: B.S. in Mining Engineering, 1975, Colorado School of Mines. Experience in mining and oil/gas operations and environmental aspects of projects and operations in western North America, including Alaska.

Dan Keuscher – Assistant Project Manager/Engineer/Transportation: B.S. in Mining Engineering, 1974, University of Nevada, Mackay School of Mines. A.A.S. in Hazardous Materials Management, Mount Hood Community College. Additional college coarse work in ecology, reclamation and wildlife habitat. Experience in planning, operations, environmental management, and reclamation of western United States and South American mining operations.

Rita Edinger – Document Coordination/Word Processing – United States Army Training Center, Fort Jackson, South Carolina, 1974. Clerical, management, and administrative experience, in particular on EA and EIS documents for western United States mining and oil/gas activities.

6.5 S. Edwards Inc. Primary Consultants

Joe Frank – Groundwater: M.S. in Hydrogeology/Geology, 1987, and B.S. in Geology 1978, University of Colorado. President and Senior Hydrogeologist/Geologist with HydroGeo Consultants, Inc. Twenty-five years experience in hydrogeologic studies for mining and oil/gas projects in the United States and abroad. Experience includes surface and ground water technical studies, ground and surface water computer modeling, well installation and logging, aquifer testing and analysis, and water quality sampling.

Scott Effner – Groundwater: B.S. in Geology, 1988 and M.S. in Geological Science, 1992, University of Idaho. Senior Hydrogeologist and Geochemist with HydroGeo Consultants, Inc. and Whetstone Associates Over twelve years experience working on projects in the United States and abroad. Experience in geochemical and ground water technical studies, ground water flow and contaminant transport modeling, well installation and testing, packer permeability testing, and water quality sampling.

Gabriele Walser Ph.D.: – Surface Water Model: Ph.D. in Civil Engineering from the University of Colorado; an M.S. degree in Environmental Engineering from the University of Montana; and a Dipl. Ing. (FH) degree in Engineering Physics and Environmental Engineering from Fachhochschule München, Germany. Senior Engineer and Hydrologist for HydroGeo, Inc. with over 12 years of experience in surface and ground water hydrologic studies and surface and ground water computer modeling.

Steve Long – Soils/Vegetation/Wetlands: M.S. in Regional Resource Planning/Soil Science Reclamation, 1977, Colorado State University. B.S. in Wildlife Biology, 1972, Colorado State

University. Principal of Cedar Creek Associates, serving as the soils and wetlands specialist. Twenty-seven years of experience in environmental management and remediation design.

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Jim Brechtel – Archaeology: M.A. in Anthropology/Archaeology, 1980, University of Northern Colorado and B.A. in Anthropology, 1976, Colorado State University. Nearly twenty-five years as consulting archaeologist working on hundreds of archaeological compliance projects in the western United States.

Gary McFaddin – Air Quality: B.S. in Chemical Petroleum Refining, 1981 and M.S. Chemical Petroleum Refining, 1985, Colorado School of Mines. President and Principal Engineer of Compliance Partners, Inc. Nearly twenty years of air quality experience working on mining and oil/gas projects in western North America.

Joe Nagengast – Drafting and Graphics: Billings Vo-Tech College, AA Drafting Technology, 1978. Design technology studies at Northern Montana College and geologic studies at Eastern Washington University. Studies in AutoCAD I, II, III and AutoCAD Management at CAD Institute in Phoenix, Arizona. President and Principal Graphics Specialist at Nagengast Brothers, LLC. Over twenty-five years experience in geologic, mining, civil, oil and gas, and environmental graphics and design.

Chapter 7 - References

Andrews, R. and R. Righter. 1992. Colorado birds. Denver Museum of Natural History, Denver, Colorado. 442 pp.

Arch Coal. 2004. http://www.archcoal.com/aboutus/archofwyoming.asp.

Baxter, G.T. and M.D. Stone. 1985. Amphibians and reptiles of Wyoming. (2nd Edition) Wyoming Game and Fish Department, Cheyenne, Wyoming. 137 pp.

Beinap, Jayne, R. Rosentreter, S. Leonard, J.H. Kaltenechkler, J. Williams, and D. Eldridge. 2001. Biological soil crusts: ecology and management. USDI Bureau of Land Management Technical Reference 1730-2.

Beinap, Jayne. 1995. Surface disturbances: their role in accelerating decertification. Environmental Monitoring and Assessment 37: 39-57.

Breithaupt, B.H., 1985. Non-mammalian Vertebrate Faunas from the late Cretaceous of Wyoming. Wyoming Geological Association 36th Annual Field Conference Guidebook.

Breithaupt, B.H., 1994. New for University of Wyoming, Department of Geology and Geophysics. Society of Vertebrate Paleontology, New Bulletin, February 1994.

Braun, C.E. 1987. Current issues in sage-grouse management. Proceedings of the Western Association of Fish and Wildlife Agencies 67:134-144.

Braun, C.E. 1998. Sage-grouse declines in western North America: what are the problems? Proceedings of the Western Association of Fish and Wildlife Agencies 78:139-156.

Busnel, R.G. 1978. Introduction, pp 7-22 In: Fletcher, J.L. and R.G. Busnel (eds). 1978. Effects of Noise on Wildlife. Academic Press. New York.

Campbell, T.M., III and T.W. Clark. 1981. Colony characteristics and vertebrate associates of white-tailed and black-tailed prairie dogs in Wyoming. American Midland Naturalist, 105:269-275.

Carter, Patsy, Memorial Hospital of Carbon County, 2004. Personal Communication.

Case, J.C., R.N. Toner, and R. Kirkwood, 2002. Basic Seismological Characterization for Carbon County, Wyoming. Wyoming State Geological Survey, September 2002.

Cedar Creek Associates, Inc. 2004. Biological investigations for the Seminoe Road Coalbed Methane Pilot Project area and potential expanded pilot project area. Unpublished report to be prepared by Cedar Creek Associates, Inc., Fort Collins, Colorado.

Clark, T.W. and M.R. Stromberg. 1987. Mammals in Wyoming. Public Education Series, University of Kansas, Museum of Natural History, 10:1-314.

Conder, Al. 2004. Biologist, Wyoming Game & Fish Department. Personal communication with Mike Phelan, Cedar Creek Associates.

Cowardin, L.M., V. Cater, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and deepwater habitat of the United States. USFWS. FWS/OBS-79/31, 103 pp.

Cox, Roger. District Conservationist. Natural Resources Conservation Service. Saratoga, Wyoming. Personal communication. January 2004.

Dorf, E, 1942. Upper Cretaceous Floras of the Rocky Mountain Region 1; Stratigraphy and Paleontology of the Fox Hills and Lower Medicine Bow Formations of Southern Wyoming and Northwestern Colorado; 2, Flora of the Lance Formation at its Type Locality, Niobrara County, Wyoming. Carnegie Institution of Washington Publication 508.

Dorn, J.L. and R.D. Dorn. 1990. Wyoming Birds. Mountain West Publishing, Cheyenne, Wyoming. 138 pp.

Dudley & Associates, LLC, 2005. Pilot Project pressure observation well data.

Eberle, J.J. and J.A. Lillegraven, 2003. A new important record of the earliest Cenozoic mammalian History: Geologic Setting, Multituberculata, Peradictia and Eutheria paleogeographic/biostratigraphic summaries. In Rocky Mountain Geology 33.1.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birder's handbook, a field guide to the natural history of North American birds. Simon & Schuster Inc., New York. 785 pp.

Eldridge, D.J. and R.S. B. Greene. 1994. Microbiotic soil crusts: a review of their roles in soil and ecological processes in the rangelands of Australia.

EPP, Robert. 2004. BLM, Rawlins Field Office. Information Provided to Daniel Keuscher (SEI).

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History, University Press of Colorado, Niwot, Colorado. 467 pp.

Foley, Susan. Soil Scientist. Bureau of Land Management. Rawlins, Wyoming. Personal communication with Mr. Steve Long of Cedar Creek Associates. August 2002.

Foley, Susan. Soil Scientist. Bureau of Land Management. Rawlins, Wyoming. Personal communication with Mr. Steve Long of Cedar Creek Associates. August 2003.

Foley, Susan. Soil Scientist. Bureau of Land Management. Rawlins, Wyoming. Personal communication with Mr. Steve Long of Cedar Creek Associates. January 2004.

France, Carbon County Fire Marshal, 2004. Personal Communication with Mr. Dan Keuscher of S. Edwards Inc.

Freeze, R.A., and J.A. Cherry, 1979. Groundwater. Prentice Hall, Inc., Englewood Cliffs, New Jersey, 603 pp.

Frison, George C. 1991. Prehistoric Hunters of the High Plains. Second Edition. Academic Press, New York.

Gill, J.R., E.A. Merewether, and W.A. Cobban, 1980. Stratigraphy and Nomenclature of Some Upper Cretaceous and Lower Tertiary Rocks in South-central Wyoming. U.S. Geological Survey Professional Paper 667.

Glass, G.B. and J.T. Roberts, 1980. Coals and Coal Bearing Rocks of the Hanna Coal Field, Wyoming, Geological Survey of Wyoming, Report of Investigations No. 22.

Goodfellow, W.L., L.W. Ausley, D.T. Burton, D.L. Denton, P.B. Dorn, D.R. Grothe, M.A. Heber, T.J. Norberg-King, and J.H. Rodgers, Jr., 2000: Major ion toxicity in effluents: a review with permitting recommendations. Environ. Toxicol. Chem. 19: 175-182.

Hausel, W.D., 1994. Economic Geology of the Seminoe Mountains Mining District. Wyoming State Geological Survey, Report of Investigation, No. 50.

HydroGeo, Inc. and TRC Mariah Associates, Inc. 2001. Spring 2001 Monitoring, Seminoe Road Project. Report prepared for Dudley & Associates, LLC.

HydroGeo, Inc., 2001. Fall 2001 Monitoring, Seminoe Road Project. Report prepared for Dudley & Associates, LLC.

HydroGeo, Inc. 2003a. 2002 Baseline Hydrologic Monitoring Study, Seminoe Road Gas Development Project. Prepared for Dudley & Associates, LLC.

HydroGeo, Inc. 2003b. Modeling Approach and Preliminary Input Parameters for Numerical Modeling of Ground Water Flow and Surface Water Quality, Dudley & Associates, LLC, Seminoe Road Gas Development Project. Prepared for Bureau of Land Management, Rawlins Field Office, June 2003.

HydroGeo, Inc. 2004a. Draft Groundwater Modeling Technical Report, August 2004.

HydroGeo, Inc. 2004b. Draft Surface Modeling Technical Report, August 2004.

HydroGeo, Inc. 2004c. Draft 2003 Vegetation Addendum Report, October 2004.

HydroGeo, Inc. 2004d. Seminoe Road Project Water Quality Database, unpublished document.

Lillegraven, J.A., 1993. Correlation of Paleogene Strata Across Wyoming. A User's Guide. Wyoming State Geological Survey Memoir 5.

Lillegraven, J.A., 1995. Nature Timing, and Paleogeographic Consequences of Laramide Deformation in the Northeastern Hanna Basin, Wyoming. AAPG Rocky Mountain Section Meeting; Abstracts AAPG Bulletin 78.

Lowham, H.W., D.A. Peterson, E.A. Zimmerman, B.H. Ringer, and K.C. Mora, 1985. Hydrology of Area 52, Rocky Mountain Coal Province, Wyoming, Colorado, Idaho and Utah. U.S. Geological Survey Water Resource Investigations Open File Report 83-761.

Lyon, A.G. 2000. The potential effects of natural gas development on sage-grouse (*Centrocercus urophasianus*) near Pinedale, Wyoming. Thesis, University of Wyoming, Laramie, USA.

Robbins, C.S., J.R. Sauer, R.S. Greenberg, and S. Droege. 1989. Population declines in North American birds that migrate to the neotropics. Proceedings of the National Academy of Science 86:7658-7662.

Sanders, Carbon County School District 1, 2004. Personal Communication.

Scheffe, Richard D. 1988. VOC/NO_x Point Source Screening Tables. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. August 1988.

Simons, Dave. Planning and Environmental Coordinator. Bureau of Land Management. Rawlins, Wyoming. Personal communication. November 2003

Snigg, Mike. 2004. Fisheries Biologist, Wyoming Game & Fish Department. Personal communication with Mike Phelan, Cedar Creek Associated.

Terres, J. K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York. 1109 pp.

TRC Mariah Associates, Inc. 2001. Riparian Vegetation Baseline Investigation of Discharge Drainage Channels for the Seminoe Road Pilot Project, Carbon County, Wyoming. December 2001.

TRC Mariah Associates, Inc. 2000. Biological Assessment for the Seminoe Road Coalbed Methane Pilot Project, Carbon County, Wyoming. Prepared by TRC for the BLM, Rawlins Field Office, Rawlins, Wyoming. December 2000. 40 pp. + appendices.

TRC Mariah Associates, Inc. 2002a. Black-footed ferret survey of prairie dog towns 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 18, Seminoe Road Coalbed Methane Pilot Project pipelines, Carbon County, Wyoming. Unpublished report prepared by TRC, Laramie, Wyoming. March 2002. 7 pp. + appendix.

TRC Mariah Associates, Inc. 2002b. Seminoe Road Coalbed Methane gas gathering pipeline and access road project biological investigation. Unpublished letter report prepared by TRC, Laramie, Wyoming. April 16, 2002. 9 pp. + table.

TRC Mariah Associates, Inc. 2002c. Supplement to the Seminoe Road Coalbed Methane gas gathering pipeline and access road project biological investigation. Unpublished letter report prepared by TRC, Laramie, Wyoming. May 22, 2002. 4 pp. + maps.

TRC Mariah Associates, Inc. 2002d. 2002 sage grouse lek inventory of the Dudley Leasehold, gas gathering pipeline and access road routes, and 2-mile buffer. Unpublished letter report prepared by TRC, Laramie, Wyoming. May 22, 2002. 2 pp. + data sheets & map.

TRC Mariah Associates, Inc. 2002e. Black-footed ferret survey, Seminoe Road Coalbed Methane natural gas gathering pipeline and access road project, Carbon County, Wyoming. Unpublished report prepared by TRC, Laramie, Wyoming. July 2002. 6 pp. + map & appendices.

TRC Mariah Associates, Inc. 2004. Air Quality Technical Support Document, Atlantic Rim Natural Gas Project and the Seminoe Road Gas Development Project. October 2004.

USDA Forest Service. 2000. Screening Methods for Calculating ANC Change to High Elevation Lakes, User's Guide. USDA Forest Service, Rocky Mountain Region. January 2000.

USDI, Bureau of Land Management (BLM), 1990. Great Divide Resource Management Plan.

USDI, Bureau of Land Management (BLM). 1997. Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Land Administered by the Bureau of Land Management in the State of Wyoming August 12, 1997, Bureau of Land Management, Wyoming State Office, Cheyenne, Wyoming.

USDI, Bureau of Land Management (BLM). 2001. Environmental Assessment for the Seminoe Road Coalbed Methane Pilot Project, Carbon County, Wyoming, April 2001.

USDI, Bureau of Land Management (BLM). 2001b. Decision Record and finding of no significant impact for the Seminoe Road Coalbed Methane Pilot Project, Carbon County, Wyoming.

USDI, Bureau of Land Management (BLM). 2002. Environmental Assessment for the Hanna Draw Coalbed Methane Exploration Project, Carbon County, Wyoming, June 2002.

USDI, Bureau of Land Management (BLM). 2002. Water Resources in the Seminoe Reservoir Area. Data provided by Bob Lange and Robert Epp of the Rawlins Field Office of the BLM, September 2002.

USDI, Bureau of Land Management (BLM). 2003. Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project. January 2003.

USDI, Bureau of Land Management (BLM). 2004. Phone conversation between Mr. Mike Neumann, geologist for the Rawlins Field Office of the BLM and Mr. Joe Frank of HydroGeo, Inc., February 10, 2004.

USDI, Bureau of Land Management (BLM). 2004a. Personal Communication between Mr. David Simons, Project Manager for BLM Rawlins Field Office, and Mr. Dan Keuscher of S. Edwards Inc.

USDI, Bureau of Reclamation. 2003. http://www.usbr.gov/gp/aop/np/0102/tables.htm

USDI, Bureau of Reclamation. 2004. http://www.usbr.gov/dataweb/html/kendrick.html

USDI, Bureau of Land Management (BLM). 2004b. Personal Communication between Mr. Mike Murray, Rangeland Specialist for the BLM Rawlins Field Office, and Mr. Dan Keuscher of S. Edwards Inc.

USDI, Bureau of Reclamation. 2000. Seminoe Reservoir Systems Operation Water Year 2000.

U.S. Department of Labor, 2003. Occupational Noise Exposure, CFR 29, Part 1926.

U.S. Fish and Wildlife Service (USFWS). 1984. American peregrine falcon recovery plan (Rocky Mountain/ Southwest population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. U.S. Fish and Wildlife Service, Denver, Colorado. 105 pp.

U.S. Fish and Wildlife Service (USFWS). 1984. American peregrine falcon recovery plan (Rocky Mountain/ Southwest population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. U.S. Fish and Wildlife Service, Denver, Colorado. 105 pp.

U.S. Fish and Wildlife Service (USFWS). 1989. Black-footed ferret survey guidelines for compliance with The Endangered Species Act. U.S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico. 10 pp. + appendices.

U.S. Fish and Wildlife Service (USFWS). 2004. http://mountain-prairie.fws.gov/special/mammals/blackfootedferret.

U.S. Fish and Wildlife Service (USFWS). 2002. Birds of Conservation Concern. USFWS, Division of Migratory Bird Management. Arlington, Virginia. 99 pp.

U.S. Geological Survey. 1978. Coal Resource Occurrence Maps of the Seminoe Dam SW Quadrangle, Carbon County, Wyoming. Open-File Report 78-060.

U.S. Geological Survey. 2002. Streamflow data for the N. Platte River above Seminoe Reservoir USGS station 06630000. http://www.waterdata.usgs.gov/nwis

U.S. Geological Survey. 2004. Water quality data for the N. Platte River and Seminoe Reservoir. http://www.waterdata.usgs.gov/nwis

WRCC (Western Regional Climate Center). 2005. Wyoming Climate Summaries. http://www.wrcc.dri.edu

WRDS (Water Resources Data System). 2005. Hydrological and climatological data for the State of Wyoming. http://www.wrds.uwyo.edu/.

Wyoming Department of Environmental Quality. 2001. Water Quality Rules and Regulations, Chapter 1, adopted June 21, 2001.

Wyoming Department of Transportation. 2004. Personal Communication by Mr. Dan Keuscher of S. Edwards Inc.

Wyoming State Engineer. 2002. Surface Water and Ground Water Records for Carbon County Wyoming.

Wyoming Game and Fish Department. 1998. Basin management plan. Provided to Mike Phelan (Cedar Creek Associates) by Al Conder (WGFD).

Wyoming Game and Fish Department. 2003. Wyoming greater sage-grouse conservation plan. Wyoming Game and Fish Department, June 24, 2003. 78 pp. + appendices.

Wyoming Natural Diversity Database (WYNDD). 2002. Botany Comments, Plant Species of Special Concern for J. Frank, HydroGeo, Inc. Completed September 12, 2002. University of Wyoming, Laramie, Wyoming. Unpublished document.

Wyoming Natural Diversity Database (WYNDD). 2003. Botany Comments Compiled by B. Heidel for C. Frank, HydroGeo, Inc., completed May 5, 2003. University of Wyoming, Laramie, Wyoming. Unpublished document.

Wyoming Natural Diversity Database (WYNDD). 2004. Botany Comments for C. Frank, HydroGeo, Inc. completed February 9, 2004. University of Wyoming, Laramie, Wyoming. Unpublished document.

Wyoming Natural Diversity Database (WYNDD). 2004a. Data compilation for C. Frank, HydroGeo, Inc., completed February 25, 2004. University of Wyoming, Laramie, Wyoming. Unpublished document.

Wyoming Natural Heritage Program. 2004. Database search for rare animal occurrences within the SREPA.

Chapter 8 – Glossary

A

AAQS: Ambient Air Quality Standards (set by EPA based on Federal Clean Air Act).

acre-foot: The amount of water or sediment volume which covers an acre of land to a depth of one-foot; an acre-foot is equal to 325,851 gallons or 43,560 cubic feet.

ADT: Average daily traffic – A measure of traffic over a 24-hour period. Determined by counting the number of vehicles (from both directions) passing a specific point on a given road.

aeration: The supplying of air to reach or penetrate something, such as spraying water.

aerial: Consisting of, moving through, found, or suspended in the air.

affect: To conduct an activity which will impact land, air, or water resources, so as to disturb the natural land surface.

affected environment: A physical, biological, social, and economic environment within which human activity is proposed.

air quality: Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.

alluvial: Used to describe the environment, action, and sedimentary deposits of rivers or streams.

alluvium: Unconsolidated sedimentary material (including clay, silt, sand, gravel, and mud) deposited by flowing water.

alternatives: The different means by which objectives or goals can be attained. One of several policies, plans, or projects proposed for decision-making.

ambient: The environment as it exists at the point of measurement and against which changes (impacts) are measured.

ambient air quality standard: Air pollutant concentrations of the surrounding outside environment, which cannot legally be exceeded during fixed time intervals within specific geographic areas.

anticline: An arch-shaped formation of layers of sedimentary rock folded upward by movements in the earth's crust.

APD: Application to Permit Drilling.

aquatic: Growing, living in, frequenting, or taking place in water; in this environmental impact statement, used to indicate habitat, vegetation, and wildlife in fresh 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.

aquitard: A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer; a leaky confining bed. It does not readily yield water to wells or springs, but may serve as a storage unit for ground water.

areal: The spatial extent or location.

ARM (coast). A long, narrow inlet of water, extending inland from another body of water, such as an "arm of the sea."

artesian well: A well drilled through impermeable rocks into strata where water is under enough pressure to force it to the surface without pumping.

artifact: An object made or modified by humans.

aspect: The direction toward which a slope faces.

attachment area: A geographic region with which National Ambient Air Quality Standards (NAAQS) are met; three categories of attainment are defined as Class I, Class II, and Class III on the basis of the level of degradation of air quality which may be permitted.

ATV: All terrain vehicle.

audible: Capable of being heard.

B

BA: Biological Assessment – Refers to the information prepared by or under the direction of the federal agency concerning listed and proposed species and designated and proposed critical habitat that may be present in the action area and the evaluation of potential effects of the action on such species and habitat.

BACT: Best available control technology.

base flow: A sustained or fair-weather flow of a stream.

baseline data: Data gathered prior to the proposed action to characterize pre-development site conditions.

BCC: Birds of Conservation Concern.

BE: Biological Evaluation – Refers to the information prepared by or under the direction of the Forest Service concerning listed and Regional Forester Sensitive Species that may be present in the action area and the evaluation of potential affects of the alternatives on such species and habitat.

Best Management Practices (BMPs): Management actions that are designed to maintain water quality by preventative rather than corrective means.

big game: Large mammals that are hunted, for sport or sustenance. These include animals such as deer, bear, elk, bobcats and mountain lions.

biological opinion: A document that states the opinion of the USDI Fish and Wildlife Service as to whether or not the federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

BLM: Bureau of Land Management – The agency of the United States Government, under the Department of the Interior, responsible for administering certain public lands of the United States.

bond: A sum of money which, under contract, one party pays another party under conditions that when certain obligations or acts are met, the money is then returned; such as after mining reclamation occurs. Also referred to as performance security. See "reclamation guarantee."

BOR: Bureau of Reclamation - Agency of the United States government, under the Department of the Interior, responsible for managing, development, and protection of water resources in the interest of the American public.

BP: Before present.

BTU: British Thermal Unit – The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

C

capability: The potential of an area of land to produce resources, supply goods and services, and allow resource users under an assumed set of management practices at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices.

capillarity. The action by which a fluid, such as water, is drawn up (or depressed) in small interstices of tubes as a result of surface tension.

Carbon 14: A naturally radioactive isotope of carbon with atomic mass of 14 and a half-life of 5,780 yeas, used as a tracer element and in carbon dating.

CBM: Coalbed methane.

CEQ: Council on Environmental Quality – An advisory council to the President of the United States; established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

CFR: Code of Federal Regulations – A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government.

cfs: Cubic feet per second – 1 cfs equals 448.33 gallons per minute.

colluvium: Soil material or rock fragments moved down slope by gravitational force in the form of creep, slides, and local wash.

concern: A point, matter, or question raised by management or the public that must be addressed in the planning process.

cone of depression (or drawdown cone): The groundwater drawdown surrounding a pumped well.

confined aquifer: In hydrogeology where groundwater pressure is controlled by a confining layer and not atmospheric pressure.

confining bed: A body of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

confining layer: Geologic layer that prevents movement of fluids such as groundwater.

consumptive use: A use, which lessens the amount of water available for another use. Water uses normally associated with man's activities, primarily municipal, industrial, and irrigation uses that complete water supplies. Water removed from available supplies without direct return to a water resource system, for uses such as manufacturing, agriculture, and food preparation. A non-consumptive use would be one such as boating or swimming. Combined amounts of water needed for transpiration by vegetation and for evaporation from adjacent soil, snow, or intercepted precipitation.

consumptive water use: Total amount of water used by vegetation, man's activities, and evaporation of surface water.

critical habitat: Defined in Section 3, (5)(A) of the Endangered Species Act (ESA) as: (1) The specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features essential to the conservation of the listed species and which may require special management considerations for protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary of the Department of the Interior that such areas are essential for the conservation of the species. These areas have been legally designated via Federal Register notices.

crucial winter range: Those areas, which, during the winter months, determine a population's ability to maintain and reproduce itself at a certain level over the long term.

cultural resources: The remains of sites, structures, or objects used by humans in the past, historic or prehistoric. More recently referred to as heritage resources.

cumulative effects or impacts: Cumulative effect or impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taken place over a period of time (40 CFR 1508.7 – these regulations use effects and impacts synonymously). For example, the impacts of a proposed timber sale and the development of a mine together result in cumulative impacts.

D

dam: A barrier built across a watercourse to impound or divert water. A barrier that obstructs, directs, retards, or stores the flow of water. Usually built across a stream. A structure built to hold back a flow of water.

DB: Decibel – A unit of expressing the relative intensity (loudness) of sound (decibel or dBA), weighted along the audible frequencies.

decision-makers: The agencies, or designated representatives within the agencies, who must make the final decisions based upon the information presented in this Environmental Impact Statement.

decommissioning: Suspension and/or closure of operations and possible removal of facilities.

demography: Statistical study of the characteristics of human populations with reference to size, density, growth, distribution, migration, and effect on social and economic conditions.

density: The number of individuals in a given area. Expressed per unit area.

deposit: A natural accumulation, such as precious metals, minerals, coal, gas, oil, etc., that may be pursued for its intrinsic value; coal deposit.

DEQ: Department of Environmental Quality (Wyoming).

desorption: The action or process of releasing an absorbed substance from something, for example, gas from rocks.

detection limit: The lowest concentration of a chemical that can be reliability reported to be different from zero concentration. Various analytical instrumentation has different detection limits.

dewatering: The removal and control of ground water from pores and other open spaces in rock or soil formations.

dilution: The act of mixing or thinning, and therefore decreasing a certain strength or concentration.

dip (structural geology): The angle that a structural surface, e.g. a bedding or fault plane, makes with the horizontal, measured perpendicular to the strike of the structure and in a vertical plane.

direct effects: The effects that result from an action and occur at the same time and place as the action.

direct impacts: Impacts which are caused b the action and occur at the same time and place.

Directional drilling: Used to guide a well to a predefined target.

discharge: See water discharge.

domestic water use: Water for household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.

DOT: Department of Transportation (Federal).

Draft EIS: The draft state of environmental effects which is required for major federal actions under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

drainage area: The area which drains to a particular point on a river or stream. The drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point.

drawdown: The drop in hydrostatic pressure in an aquifer due to pumping of a well.

drilling: Mechanical process of boring into the earth's surface to gather subsurface geologic, physical, or chemical data to determine the location, quantity, or quality of the natural mineral deposit on an area, including holes drilled for use as water wells.

drought: Climactic condition in which there is insufficient soil moisture available for normal vegetative growth. A prolonged period of below-average precipitation.

droughty soil conditions: Dry soils caused by the lack of rain or water; soils affected by the prolonged dryness of weather, which prevents or inhibits plant growth.

E

EA: Environmental Assessment - A NEPA compliance document used to determine if an action would have a significant effect on the human environment. If not, a finding of no significant impact (FONSI) is written. If so, an environmental impact statement (EIS) is written.

effects: "Effect" and "impact" are synonymous as used in this document. Environmental changes resulting from a proposed 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. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

EIS: Environmental Impact Statement – An analytical document prepared under the National Environmental Policy Act that portrays potential impacts to the environment of a proposed action and its possible alternatives. An EIS is developed for use by decision-makers to weigh the environmental consequences of a potential decision.

employment: Labor input into a production process, measured in the number of person-years or jobs. A person-year is approximately 2,000 working hours by one person working yearlong or by several persons working seasonally. The number of jobs required to produce the output of each sector. A job may be one week, one month, or one year.

endangered species: Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior or endangered in accordance with the 1973 Endangered Species Act.

environment: The physical conditions that exist within the area that will be affected by a proposed project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. The sum of all external conditions that affect an organism or community to influence its development or existence.

EPA: Environmental Protection Agency – An agency of the Executive Branch of the Federal Government which has responsibility for environmental matters of national concern.

ephemeral stream: A stream or portion of a stream that flows only in direct response to precipitation or snow melt. Such flow is usually of short duration.

epoch: A term used to designate a length of geologic time.

erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents, including gravitation creep.

ERP: Emergency Response Plan.

entrained: In hydrogeology where fluid is entrapped in porous rock, sediment, or soil.

evaporation: Water vapor losses from water surfaces, sprinkler irrigation, and other related factors. Loss of water to the atmosphere. The process by which water is changed from a liquid into a vapor. Water from land areas, bodies of water, and all other moist surfaces is absorbed into the atmosphere as a vapor.

evapotranspiration: The quality of water transpired by plants or evaporated from adjacent soil surfaces in a specific time period. Usually expressed in depth of water per unit area. The combined processes of evaporation and transpiration.

exploration: The search for economic deposits of minerals, gas, oil or coal through the practices of geology, geochemistry, geophysics, drilling, shaft sinking, and/or mapping.

F

fault: Displacement of rock along a sheer surface or linear plane.

feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Final EIS: Means a detailed written statement as required by Section 102(2)(C) of the National Environmental Policy Act (40 CFR 1508.11). It is a revision of the Draft Environmental Impact Statement to include public and agency comments to the draft.

Finding of No Significant Impact (FONSI): A NEPA compliance document which affirms that an environmental assessment found that alternatives were evaluated and a proposed action would have no significant impact on the human environment.

fisheries habitat: Streams, lakes, and reservoirs that support fish populations.

fishery: All activities related to human harvest of a fisheries resource.

FLPMA: Federal Land Policy and Management Act.

fugitive dust: Dust particles suspended randomly in the air, usually from road travel, excavation, and /or rock loading operations.

full pool: Volume of water in a reservoir at normal water surface. The reservoir level that would be attained when the reservoir is fully utilized for all project purposes, including flood control.

G

game species: Any species of wildlife or fish for which season and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under state or federal laws, codes and regulations.

generator: Machine that converts mechanical energy into electrical energy.

geochemistry: The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and the study of the circulation of the elements in nature, on the basis of the properties of their atoms and ions.

geohydrology: Refers to the hydrologic or flow characteristics of subsurface waters. Often interchangeable with hydrogeology.

geologic basin A large, sometimes regional scale circular outcrop of rock I which strata dip inward toward the center. In geography, a broad area of land drained by a single river and its tributaries, or draining into a lake

geology: The science that deals with the physical history of the earth, the rocks of which it is comprised, and the physical changes which the earth has undergone or is undergoing.

geomorphology: Geological study of the configuration, characteristics, origin, and evolution of landforms and earth features.

gpd, ph, gpm: Gallons per day, gallons per hour, gallons per minute.

gravel surfacing: Layer of gravel spread over an area intended for vehicular or personnel traffic, such as roads and parking lots.

Ground water: Water found beneath the land surface in the zone of saturation below the water table.

growth media: All materials, including topsoil, specified soil horizons, vegetative debris, and organic water, which are classified as suitable for stockpiling and/or reclamation.

guidelines: An indication or outline of policy or conduct; (i.e., any issuance that assists in determining the course of direction to be taken in any planned action to accomplish a specific objective).

gullying: Small-scale stream erosion.

Guzzler: A stock water device used to capture and store rainfall.

H

habitat: A natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions. The place where an organism lives.

habitat capability: The estimated ability of an area, given existing or predicted habitat conditions, to support a wildlife, fish, or plant population. It is measured in terms of potential population numbers.

habitat effectiveness: Degree to which a physical wildlife habitat is free from man-caused disturbances, and therefore attractive to wildlife occupancy.

headcut. A vertical face or drop on the bed of a stream channel, occurring at a knickpoint.

herbicide: A compound, a man-made organic chemical used to kill or control plant growth.

HMMP: Hazardous Materials Management Plan.

Holocene: An epoch of the Quaternary period, from the end of the Pleistocene, approximately 8,000 – 10,000 years ago, to the present time.

horizontal drilling: **A** process of guiding a well to a predefined rock strata (like a coal seam), then realigning the well to track within or parallel to the strata.

human environment: Natural and physical environment and the relationship of people with that environment, including combinations of physical, biological, cultural, social, and economic factors in a given area.

hydraulic conductivity: A measure of the ability of rock or soil to permit the flow of groundwater under a pressure gradient; permeability.

hydraulic fracturing: A general term, for which there are numerous trade or service names, for the fracturing of rock usually in an oil or gas reservoir, but pumping in water (or other fluid) and sand under high pressure. The purpose is to produce artificial openings in rock to increase permeability.

hydric: Set of a habitat that has or required abundant moisture. In the case of soils, *hydric* means soils that are saturated with water or moisture.

hydrofracture: Involves injecting a sand/water slurry mixture under very high pressure through the injection well borehole into the target receiving formation creating open fractures, thus increasing the permeability of the formation. This practice allows for more water to be injected into the formation at less pressure.

hydrogeology: The science that deals with sub-surface waters (groundwater) and with related geologic aspects of surface waters (springs and seeps).

hydrologic system: All physical factors, such as precipitation, stream flow, snowmelt, groundwater, etc., that effects the hydrology of a specific area.

hydrology: Scientific study of water in nature: it's properties, distribution and behavior. The science that treats the occurrence, circulation properties, and distribution of the waters of the earth and their relation to the environment. The science dealing with the properties, distribution and flow of water on or in the earth.

hydrophytic vegetation: Vegetation growing in water, either submerged, emergent or floating. Vegetation that requires large quantities of water for its growth.

hydrostatic pressure: The pressure exerted by water. The hydrostatic pressure of ground water is generally due to the weight of water at higher levels in the zone of saturation.

I

ID Team: Interdisciplinary Team – The interdisciplinary team is comprised of a group of personnel with different training assembled to solve a problem or perform a task. The team will consider problems collectively, rather than separate concerns along disciplinary lines. The interaction is intended to insure systematic, integrated consideration of physical, biological, economic, environmental design arts and sciences.

impermeable: Property of a substance that inhibits passage of fluids through its mass.

impoundment: The collection and confinement of water in a reservoir or other storage area.

increment: The amount of change from an existing concentration or amount, such as air pollutant concentrations.

indirect impacts: Impacts which are caused by the action but are later in time or farther removed in distance, although still reasonably foreseeable.

infiltration: The movement of water or some other fluid into the soil through pores or other openings.

informal consultation: An optional process that includes all discussions, correspondence, etc., between the USDI Fish and Wildlife Service and another federal agency or the designated non-federal representative prior to formal consultation, if required.

infrastructure: The underlying foundation or basic framework; substructure of a community (i.e., schools, police, fire services, hospitals, water and sewer systems).

interdisciplinary approach: Using a variety of expertise to prepare analyses which ensure the integrated use of natural and social sciences and the environmental design arts. An interdisciplinary team is used as no single scientific discipline can adequately identify and resolve problems.

Interdisciplinary Team (IDT): A group of specialists assembled as a cohesive team with frequent interactions to solve a problem or perform a task. Note: Interdisciplinary teams are assembled because commonly, no one scientific discipline is sufficiently broad to adequately analyze a problem or proposed action.

intermittent stream: A stream that runs water in most months, but does not contain water year-round.

interstice: An opening or space, as in a rock or soil.

irretrievable: Commitments that are lost for a period of time.

irreversible: Commitments that cannot be reversed, except perhaps in the extreme long term.

irrigation: Act of supplying dry land with water in order to grow crops or other plants. Application of water to lands for agricultural purposes.

isotope: Either of two or more forms of a chemical element with the same atomic number but different numbers of neutrons.

issue: A point, matter, or question of public discussion or interest to be addressed or decided through a planning process.

J

jeopardy or jeopardize the continued existence of: Means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. A jeopardy opinion would result in the USDI Fish and Wildlife Service developing reasonable and prudent alternatives for the proposed action.

jurisdictional wetland: A wetland area delineated and identified by specific technical criteria, field indicators and other information for purposes of public agency jurisdiction. The U.S. Army Corps of Engineers regulate “dredging and filling” activities associated with jurisdictional wetlands. Other federal agencies that can become involved with matters that concern jurisdictional wetlands include the USDI Fish and Wildlife Service, the Environmental Protection Agency, and the Natural Resource Conservation Service.

K

kilovolt (kV): 1,000 volts.

knickpoint. Any interruption or break of slope, especially, a point of an abrupt change or inflection in the longitudinal profile of a stream or of its valley.

L

Lanceolate: spear-shaped, or shaped like a lance head, such as a leaf or prism that is much longer than broad, widening above the base and tapering to a point at the apex.

land management: The intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

land status: The ownership status of lands.

lead agency: In NEPA (40 CFR 1501.5), the agency(s) with main responsibility for complying with NEPA procedural requirements, such as supervising the preparation of an Environmental Impact Statement.

lease: A document through which interests are transferred from one party to another, subject to certain rights, obligations, and considerations.

listed species: Species that are listed as threatened or endangered under the Endangered Species Act of 1973 (as amended).

lithic: Pertaining to or made of stone, e.g. “lithic artifacts.”

long-term impacts: Impacts that normally result in permanent changes to the environment. An example is a topographic change resulting from tailings disposal in a drainage. Each resource, by necessity, may vary in its delineation of long-term.

M

macropore. A pore too large to hold water by capillarity.

management activity: An activity of man imposed on a landscape for the purpose of harvesting, traversing, transporting, or replenishing natural resources.

management area: An area with similar management objectives and a common management prescription.

management direction: A statement of multiple-use and other goals and objectives, and the associated management prescriptions, and standards and guidelines for attaining them. (36 CFR 219.3)

map: Usually a 2-dimensional representation of all or part of the earth’s surface showing selected natural or manmade features or data, preferably constructed on a definite projection with a specified scale.

MBTA: Migratory Bird Treaty Act.

mean: A statistical value calculated by dividing the sum of a set of sample values by the number of samples. Also referred to as the arithmetic mean or average.

Micron: A particle having a diameter of one millionth of a meter.

migratory: Moving from place to place, daily or seasonally.

migration: Migration includes: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance of operations during the life of the action; and, (e) compensating for the impact by replacing or providing substitute resources of environments (40 CFR 1508.20).

MOA: Memorandum of Agreement.

monitoring and evaluation: A watching, observing or checking, in this instance, a testing of specific environmental parameters and of project waste streams for purposes of comparing with permit stipulations, pollution control regulations, mitigation plan goals, etc. The periodic evaluation of management practices on a sample basis to determine how well objectives have been met.

MOU: Memorandum of Understanding – Usually documenting an agreement reached amongst federal agencies.

MSDA: Material Safety Data Sheet.

mulch: Material spread on the ground to reduce soil erosion and evaporation of water. Any substance spread or allowed to remain on the soil surface to conserve soil moisture and shield soil particles from the erosive forces of raindrops and runoff.

multiple use: The management concepts under which National Forest and BLM lands are managed. The management of the lands and their various resource values so they are utilized in the combination that will best meet the present and future needs of the American people.

N

NAAQS: National Ambient Air Quality Standards.

NADP: National Atmospheric Deposition Program.

NEPA (National Environmental Policy Act): An act declaring a national policy which encourages productive and enjoyable harmony between humankind and the environment, promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

NPDES (National Pollution Discharge Elimination System): A program authorized by Sections 3.18, 402 and 405 of the Clean Water Act, and implemented by regulations 40 CFR 122. NPDES program requires permits for the discharge of pollutants from any point source into Waters of the United States.

NRHP (National Register of Historic Places): A federally maintained register of districts, sites, buildings, structures, architecture, archaeology and culture.

NRCS: Natural Resources Conservation Service.

NSPS (New Source Performance Standards): Standards set by EPA defining the allowable pollutant discharge (air and water) and applicable pollution control for new facilities; by industrial category (Clean Air Act and Clean Water Act).

NEPA Process: Measures necessary to comply with the requirements of Section 2 and Title I of the National Environmental Policy Act.

non-consumptive water uses: Water uses that do not substantially complete water supplies, including swimming, boating, water skiing, fishing, maintenance of stream related fish and wildlife habitat, and hydro power generation.

non-game species: Animal species which are not hunted, fished, or trapped.

NO_x: Nitrogen oxides – A product of vehicle exhaust.

noxious weed: (from the 1974 Federal Noxious Weed Act) any living stage, such as seeds and reproduction parts, of any parasitic or other plant of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation, or the fish or wildlife resources of the United States or the public health.

O

O & M: Operations and maintenance.

objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

observation well: A whole used to observe ground water surface at atmospheric pressure within soil or rock.

organism: Any form of animal or plant life.

OSHA: Occupational Safety and Health Administration.

overland flow: That part of surface runoff flowing overland surfaces toward stream channels.

P

parent material: The unconsolidated material (mineral and/or organic) from which soils develop.

particulates: Small particles suspended in the air or generally considered pollutants.

peak flow: Maximum instantaneous flow in a specified period of time.

pedestalling: Undercutting rock or soil as a result of wind erosion and abrasion.

pedon: The smallest unit or volume of soil that represents or exemplifies all the horizons of a soil profile. The term is part of the soil classification system of the National Cooperative Soil Survey.

perennial stream: A stream that flows year-round.

performance bond: See “reclamation guarantee.”

permeability: The property or capacity of a porous rock, sediment, or soil for transmitting a fluid; it is a measure of the relative ease of fluid flow under unequal pressure.

pH: Symbol for the negative common logarithm of the hydrogen ion concentration (acidity) of a solution. The pH of 7 is considered neutral. A pH number below indicates acidity, and a pH value above 7 indicate alkalinity or a base.

piezometer: A device for measuring moderate groundwater pressure.

piezometric surface: Any imaginary surface coinciding with the hydraulic pressure level of the water in a confined aquifer, or the surface representing the static head of groundwater and defined by the level to which water will rise in a well. A water table is a particular piezometric surface.

planning records: The body of information documenting the National Environmental Policy Act decisions and activities which result from the process of developing environmental documents; also known as an administrative record.

plant communities: A vegetation complex unique in its combination of plants which occurs in particular locations under particular influences. A plant community is a reflection of integrated environmental influences on the site such as soils, temperature, elevation, solar radiation, slope aspects, and precipitation.

playa: A dry, vegetation-free, flat area at the lowest part of an undrained basin, underlain by stratified clay, silt or sand, and commonly by soluble salts. The term is also applied to the basin containing an expanse of playa, which may be marked by ephemeral lakes.

Pleistocene: An epoch of the Quaternary period, starting about two to three million years ago and lasting until the start of the Holocene some 8,000 – 10,000 years ago.

PM_{10}: Particulates of 10 microns in size or less, usually describing a source of air quality degradation.

point source: Stationary sources of potential pollutants.

policy: A guiding principle upon which is based a specific decision or set of decisions.

pollution: Human-caused or natural alteration of the physical, biological and radiological integrity of water, air, or other aspects of the environment producing undesired effects.

potable water: Suitable, safe, or prepared for drinking.

potentiometric surface: Surface to which water in an aquifer would rise by hydrostatic pressure.

ppm: Parts per million.

precipitation event: A quantity of water resulting from drizzle, rain, snow, sleet, or hail in a limited period of time. It may be expressed in terms of recurrence, interval, and duration.

prehistoric: Relating to the times just preceding the period of recorded history.

project: The whole of an action, which has a potential for resulting in a physical change in the environment. An organized effort to achieve an objective identified by location, timing, activities, outputs, effects, and time period and responsibilities for executions.

Proponent: Dudley & Associates, LLC.

proposed action: A description of the project as proposed by a project proponent in a plan of operations.

PSD: Prevention of Significant Deterioration – A specific permit procedure established in the Clean Air Act, as amended, used to ensure that economic growth occurs in a manner consistent with the protection of public health; preservation of air quality related values in national special interest areas; the opportunity for informed public participation in the decision-making process.

public land: Land administered by the Bureau of Land Management, Forest Service, or other government agencies.

public participation: Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about planning.

public scoping: Giving the public the opportunity for oral or written comments concerning the intentions, activity, or influence of a project on an individual, the community, and/or the environment.

pump: Mechanical device, components or pieces of equipment, that are powered by an engine or motor to create the flow of a fluid or viscous material.

pumping: Mechanical transfer of fluids.

Q

qualitative: Having to do with quality or qualities. Descriptive of kind, type or direction, as opposed to size, magnitude or degree.

quantitative: Having to do with quantity, capable of being measured. Descriptive of size, magnitude or degree.

Quaternary: A geological time period beginning approximately two to three million years ago and extending to the present. It consists of two grossly unequal epochs; the Pleistocene, up to about 8,000 – 10,000 years ago and the Holocene since that time.

R

raptor: Bird of prey, including eagles, hawks, falcons, and owls.

recharge: The processes involved in the absorption and addition of water to the zone of saturation.

recharge area: An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers.

recharge rate: The quantity of water per unit time that replenishes or refills an aquifer.

reclamation: Returning disturbed land to a productive form.

reclamation guarantee: A binding commitment payable to a government agency in the event that decommissioning and reclamation of an operation is not completed according to an approved plan or permit. See “bond.”

reservoir: A body of water impounded by a dam and in which water can be stored. Artificially impounded body of water. Any natural or artificial holding area used to store, regulate or control water. Body of water, such as natural or constructed lake, in which water is collected and stored for use.

resident: A species, which is found in a particular habitat for a particular time period (i.e., winter resident, summer resident, year-round) as opposed to those found only when passing through on migration.

rill: A very small eroded channel.

riparian: A type of ecological community that occurs adjacent to streams and rivers and is directly influenced by water. It is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

riparian zone: Terrestrial areas where the vegetation and microclimate are influenced by perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics; this habitat is transitional between true bottom land wetlands and upland terrestrial habitats.

riprap: A layer of angular rock placed together to prevent erosion on embankments and engineered channels.

riverine: Riparian; pertaining to a riverbank.

RMP: Resource Management Plan.

ROD: Record of Decision – A document separate from, but associated with, and Environmental Impact Statement which states the decision, identifies alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not (40 CFR 1505.2).

ROW: Right-of-way.

runoff: Precipitation that is not retained on the site where it falls, not absorbed by the soil; natural drainage away from an area.

S

saline: The condition of containing dissolved or soluble salts. Saline soils are those whose productivity is impaired by high soluble salt content. Saline water is that which would impair production if used to irrigate sensitive crops without adequate leaching to prevent soil salinization.

saline sodic land: Soil that contains soluble salts in amounts that impair plant growth but not an excess of exchangeable sodium.

saline water: Water that contains more than 1,000 milligrams per liter of dissolved solids.

salinity: The relative concentration of dissolved salts, usually sodium chloride, in a given water supply. A measure of the concentration of dissolved mineral substances in water.

saturated soils: Soil condition during which all the spaces between soil particles are filled with water.

scoping process: A part of the National Environmental Policy Act process; early and open activities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an Environmental Impact Statement (40 CFR 1501.7).

scour: Erosion in a stream bank, particularly if caused or increased by channel changes.

sediment: Any finely divided organic and/or mineral matter deposited by air or water in non-turbulent areas. Unconsolidated solid material that comes from weathering of rock and is carried by, suspended in, or deposited by water or wind.

sedimentary: Term used to describe rocks formed from material, including debris of organic origin, deposited as sediment by water, wind or ice and then consolidated by pressure.

sediment load: The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

sediment yield: The quantity of sediment transported through a stream cross-section in a given time.

seismicity: The phenomenon of earth movements.

semi confined aquifer: In hydrogeology where groundwater pressure is partially controlled by a confining layer and partially by atmospheric pressure.

sensitive species: Plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on an official state list, or that are recognized by the BLM as needing special management to prevent placement on federal or state lists.

sheetflow. See sheetwash.

sheetwash: An overland flow of downslope movement of water – taking the form of a thin, continuous film over relatively smooth soil or rock surface and not concentrated into channels larger than rills (also referred to as sheet flow).

SHPO: State Historic Preservation Office.

short-term impacts: Impacts occurring during project construction and operation, and normally ceasing upon project closure and reclamation. Each resource, by necessity, may vary in its definition of short-term.

significant: 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. The severity of an impact should be weighted along with the likelihood of its occurrence.

SO_2: Sulfur oxides, including sulfur dioxide (SO2). A product of vehicle tailpipe emissions.

socioeconomic: Pertaining to, or signifying the combination or interaction of social and economic factors.

Sodium Absorption Ratio (SAR): The ratio of the ions of sodium, calcium, and magnesium. High SAR levels can damage soil structure by binding up clay molecules and reducing water infiltration.

soil horizon: A layer of soil material approximately parallel to the land surface differing from adjacent genetically related layers in physical, chemical, and biological properties.

solid waste: Garbage, refuse, and/or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, agricultural, and community activities.

sound level (dBA): The sound pressure level in decibels as measured on a sound level meter using the A-weighing filter network. The A-weighing filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the responses of the human ear and gives good correlation with subjective reactions to noise.

SPCC: Spill Prevention Control and Countermeasure Plan – A plan which the EPA requires having on file within six months of project inception. It is a contingency plan for avoidance of containment of, and response to hazardous materials spills or leaks.

special-use authorization: A permit, term permit, lease, or easement that allows occupancy or use.

stable isotope: In physics, an isotope incapable of becoming a different isotope or element by radioactive decay. Often used in age dating of water.

standard: A model, example, or goal established by authority, custom, or general consent as a rule for the measurement of quantity, weight, extent, value or quality.

strata (stratum): Distinctive layers of stratified rock. A layer of sedimentary rock, visually separable from other layers above and below.

stream: Natural water course containing water at least part of the year. The type of runoff where water flows in a channel.

stream gradient: The rate of fall or loss of elevation over the physical length of a segment or total stream usually express in ft/ft (%).

strike (structural geology): The direction or trend taken by a structural surface, e.g. a bedding or fault plane, as it intersects the horizontal. A strike is at right angles to the line of dip.

structure (structural geology): The general disposition, attitude, arrangement or relative positions of the rock masses of a region or area. Structure can be influenced by deformational processes such as faulting and folding.

submersible pump: Pump designed to be totally submerged in the fluid it is pumping. Submersible pumps eliminate suction lift limitations, loss of prime, the need for suction hose, and noise.

subsidence: The sudden sinking or gradual downward settling of the ground's surface.

substantive comment: A comment that provides factual information, professional opinion, or informed judgment germane to the action being proposed.

succession: The gradual supplanting of one community of plants by another.

surface runoff: Precipitation, snowmelt, or irrigation in excess of what can infiltrate the soil surface and be stored.

suspended load (suspended sediment): Sediment that is supported by the upward components of turbulence in a stream and that stays in suspension for an appreciable length of time.

T

TDS: Total Dissolved Solids – Any finely divided materials (with a diameter smaller than a few hundred micrometers) suspended in liquids such as water.

terrace deposits: Sediments deposited along stream banks at high and low flow periods.

terrestrial: Of or relating to the earth, soil, or land; an inhabitant of the earth or land.

threatened species: Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future.

third-party contractor: An independent firm, usually contracted by a government agency, to perform work related to a proposed action or another organization; due to the financial and contractual arrangements governing such relationships, the third-party contractor has not financial or other interest in the decision to be reached on the project.

tiering: The coverage of general matters in a broad NEPA document with subsequent narrowly focused documents; helps to eliminate repetitive discussions and allows the site-specific documents to focus on specific issues.

topography: A configuration of a surface including its relief, elevation, and the portion of its natural and human-created features.

tpd: Tons per day.

tph: Total petroleum hydrocarbons.

transient equation: Time dependent mathematical equation that solves a problem for various time segments.

transmission: The act or process of transporting electric energy in bulk.

transmission line: Facility for transmitting electric energy at high voltage from one point to another point.

transmissivity: The ability of an aquifer to transmit water.

transpiration: The process by which water and plants is transferred into water vapor in the atmosphere. Evaporation of water through the leaves of plants.

Tritium: A radioactive isotope of hydrogen occurring naturally in trace amounts and having atomic mass 3 and a half-life of 12.3 years. An isotope deposited by surface testing of nuclear weapons and used as a tracer in age dating of water.

TSP: Total suspended Particulates – Any finely divided material (solid or liquid) that is airborne with an aerodynamic diameter smaller than a few hundred micrometers.

TSS: Total suspended solids – As it applies to sediments in streams.

turbidity: Reduced water clarity resulting from the presence of suspended matter.

two-track road: a lightly-used road formed in native vegetation by vehicles such as pick-up trucks.

U

unavoidable effects: Those effects which would occur from a project but cannot be eliminated or minimized by management requirements and mitigation measures.

unconfined aquifer: An aquifer containing water that is not under pressure; the water level in a well is the same as the water table outside the well. An aquifer that discharges and recharges with an upper surface that is the water table.

underground injection: Injection of fluids under high pressure through a well into a subsurface geologic horizon.

unconsolidated: In geology, not combined into a single or solid mass.

USDI: United States Department of the Interior.

USFWS: United States Fish and Wildlife Service – United States Department of the Interior.

USGS: United States Geological Survey – United States Department of the Interior.

V

vertical conductance: The property or capacity of porous rock, sediment, or soil for transmitting a fluid vertically up or down typically between different strata.

visitor use: Visitor use of recreation and wilderness resource for inspiration, stimulation, solitude, relaxation, education, pleasure or satisfaction.

volt (V): The unit of measurement of electromotive force. It is equivalent to the force required to produce a current of 1 ampere through a resistance of 1 OHM.

VRM: Visual Resource Management.

W

WAAQS: Wyoming Ambient Air Quality Standards.

WAPA: Western Area Power Administration.

water depletion: To permanently remove water from a system for a specific use. Loss of water from stream, river, or basin resulting from consumptive use.

water discharge: The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute, or cubic meters per second.

water diversion: Removing water from the natural course or location, or controlling water in its natural course or location, by means of a ditch, canal, flume, reservoir, bypass, pipeline, conduit, well, pump, or other structure or device.

water table: The surface of underground, gravity-controlled water. The level of ground water. The boundary in the ground between where the ground is saturated with water and where the ground is filled with water and air.

water management plan: A plan developed to help assure water quality compliance for both point and non-point pollution sources.

watershed: The entire land area that contributes water to a particular drainage system or stream.

water quality: The interaction between various parameters that determines the usability or non-usability of water for on-site and downstream uses. Major parameters that affect water quality include: temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, discharge, and fecal coliform.

WDOT: Wyoming Department of Transportation.

weathering: The process whereby larger particles of soils and rock are reduced to finer particles by wind, water, temperature changes, and plant and bacteria action.

well: A hole or shaft drilled into the earth to get water or other underground substances. A bored, drilled, or driven shaft, or dug hole, whose depth is greater than the largest surface dimension and whose purpose is to reach underground water supplies or oil, or to store or bury fluids below ground.

well field: Area containing one or more wells that produces useable amounts of water, oil or gas.

WET tests: Acute whole effluent toxicity (WET) tests. Laboratory tests where Fathead Minnows and Daphnia magna are placed in effluent water for up to 96 hours to determine survivability.

wetlands: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, etc. (See “jurisdictional wetlands.”)

WGFD: Wyoming Game and Fish Department.

wilderness: Land designated by Congress as a component of the National Wilderness Preservation System.

wind rose: A diagram showing the relative frequency of winds blowing from different directions.

withdrawal: Water removed from the ground or diverted from the surface water source for use. The process of taking water from a source and conveying it to a place for a particular type of use.

WNHP: Wyoming Natural Heritage Program.

WOGCC: Wyoming Oil and Gas Conservation Commission**.**

X

Y

yield: The quantity of water that can be collected for a given use from surface or ground water sources.

Z

zone of saturation: A subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere. Although the zone may contain gas-filled interstices, it is still considered saturated..

zoning: Identification of areas of specified uses or restrictions.

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APPENDICES

Appendix A

Proponent's Project Description

Appendix A – Proponent's Project Description

PREFACE

This document is the product of several years of geological exploration, reservoir engineering evaluation, economic feasibility studies, environmental investigations, as well as the preliminary results from the pilot project operations conducted by Dudley & Associates, LLC (Dudley) in Carbon County, Wyoming.

The planning process has sought to consistently balance the application of these professional disciplines. By working closely with a combination of government agencies and independent technical experts, Dudley believes this plan represents the best overall approach to coalbed natural gas development in the Hanna Basin.

This project description provides key background information for the National Environmental Policy Act (NEPA) work initiated by the Bureau of Land Management (BLM) for the Seminoe Road Gas Development (Seminoe Road) Project and includes discussion on the following items:

- General project description;
- Existing related projects;
- Pre-construction planning and site layout;
- Construction and drilling operations;
- Production and maintenance activities;
- Miscellaneous related operations;
- Reclamation and decommissioning;
- Water management;
- Power;
- Workforce;
- Transportation and traffic; and,
- Environmental mitigation and management measures.

Dudley notes that the design and planning of coalbed natural gas development is an evolving science. This project description represents the proponent's current proposal; however, modifications often result from the feasibility studies and design engineering processes. Any such material changes will, of course, be reflected in the forthcoming draft environmental impact statement (EIS), the permitting processes, as well as the final design for the approved plan of development.

LIST OF ACRONYMS AND ABBREVIATIONS

APD	Application for Permit to Drill or Reenter
BLM	Bureau of Land Management
CBL	Cement Bond Log
CFR	Code of Federal Regulations
CIG	Colorado Interstate Gas Company
Dudley	Dudley & Associates, LLC
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
NAAQG	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NOS	Notice of Staking
NPDES	National Pollutant Discharge Elimination System
PM	Principal Meridian
RMP	Resource Management Plan
ROW	Right-of-Way
SAR	Sodium Adsorption Ratio
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Control and Countermeasure
TDS	Total Dissolved Solids
USFWS	United States Fish & Wildlife Service
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission

Contents

Tables

1.0 GENERAL PROJECT DESCRIPTION (SUMMARY OF THE PROPOSED ACTION)

Dudley submits this project description to the BLM in preparation for the development and operation of a full-scale coalbed natural gas project identified as the Seminoe Road Gas Development (Seminoe Road) Project.

The Seminoe Road Project is situated in Townships 21, 22, 23 and 24 North, Ranges 84, 85 and 86 West, 6th Principal Meridian (PM), which lie in the northwest Hanna Basin, Carbon County, Wyoming. The project area is located approximately 20 miles northeast of the City of Rawlins, 18 miles north-northeast of the Town of Sinclair, and generally east of Carbon County Road 351 (Seminoe Road). See **Figure 1, General Location Map**.

Dudley is the project proponent and has identified potential well sites for as many as 1,240 coalbed natural gas wells on 785 drill pad locations. See **Table A-1, Preliminary Estimate of Surface Area Disturbance**.

The project area is approximately 137,600 acres (215 sections) in size and embraces a checkerboard ownership pattern of federal (>49%) and private (fee) (>49%), with some state surface. The BLM Rawlins Field Office manages the federal surface and mineral estates.

Dudley owns or controls oil and gas leasehold interests comprising approximately 83% of the project area. The BLM manages the balance of the leased and un-leased federal oil and gas interests in the project area.

Two discrete Cretaceous coal formations are found in the potential development area, each separated by several thousand feet of low permeability sand and shale--the deeper Mesaverde coals (more specifically, the Almond and Allen Ridge members) and the shallower Medicine Bow and Fox Hills coals (regional equivalents of the Lance formation). For the purposes of this document, the Mesaverde members may be commercially productive of coalbed natural gas at depths ranging from 500’ to 14,000’. Similarly, the overlying Medicine Bow and Fox Hills formations may produce commercial quantities of coalbed natural gas from 500' to 10,000' depths.

Table A-1, Preliminary Estimate of Surface Area Disturbance[1]

Facility	Initial Disturbance Area[2] (acres)	Area of Operations[3] (acres)
Drill Pads [4]	1,727	785
Access Roads[5]	2,854	1,427
Utilities[6]	1,427	0
Water Discharge Facilities[7]	79	79
Compressor Facilities[8]	30	30
Total Disturbed Area	6,117	2,321
Percentage Disturbance of Total Project Area[9]	4.5%	1.7%

Notes:

(1) This table presents the total area estimated by the Proponent to be disturbed within the Seminoe Road Gas Development Project during the projected 30-year life of the project.

(2) The initial disturbance represents the area disturbed as a result of drill pad construction, access roads, gas, water and utility rights-of-way, compressor stations, and treated water-handling systems.

(3) Part of the area initially disturbed by drilling operations would be reclaimed (~55%) shortly after each well is completed and equipped. The area not reclaimed would be used for ongoing operations. Once the gas resource is depleted, facilities would be removed and the balance of the drill pad would then be reclaimed.

(4) An estimated 785 drill pads would be created in the project area. The initial drill pad surface disturbance (i.e., the area needed for drilling operations) will average 2.2 acres apiece. Subsequent reclamation would reduce the drill pad size to approximately one (1) acre, the area needed for production operations.

(5) Each drill pad will require an estimated 0.6 miles of access road for which an estimated width of 50’ will be physically affected by the construction process. Fifty percent (50%) of the area initially disturbed by road construction (25%) will be reclaimed following construction activities. Access roads would remain in service for the life of the project.

(6) “Utilities” include gas and water collection pipelines, power lines and their ancillary facilities, and communications lines. Utilities corridors are ordinarily laid out parallel to and installed simultaneously with the access roads, initially utilizing an average width of 25’ and an average 0.6 miles length for each drill pad. Once utilities are installed and buried, the disturbed areas will be fully reclaimed.

(7) The measured surface disturbance at the Seminoe Road CBM Pilot Project for DS-1, DS-2 and DS-3 water treatment facilities is 1.26 acres serving 16 wells. Experience indicates that the construction, installation, and operation of water discharge facilities will entail a disturbance of 0.1 acres allocated to each drill pad. These facilities would remain in service for the life of the project.

(8) It is also presumed that three (3) compressor stations will be required to adequately serve the project, each requiring an estimated ten (10) acres, for a total projected disturbance of 30 acres.

(9) This percentage is based on a measured 137,000 acres within the EIS analysis.

The apparent duplication of producing horizons is due to the locally steep dip of the sedimentary section, which plunges east, into the basin, at 10° to 15° within the area of interest. Both sets of coals outcrop (i.e. intersect the surface) at different points along the western edge of the Hanna Basin and rapidly dip to over 30,000' only 25 miles east of that outcrop. The Hanna Basin is geologically unique in the Rocky Mountain oil and gas provinces in that it is both the smallest and the deepest such basin; it is only 50 miles across at its widest point but carries a stratigraphic interval 7¼ miles deep.

The Cretaceous coals of the western Hanna Basin are well-cleated (i.e. fractured), highly permeable, freshwater aquifers. Methane, commonly called natural gas, is the simplest of all hydrocarbon molecules (CH_4); it is physically bound to the coal by positive-negative ion attraction. The accepted theory is that methane is adsorbed onto the internal surface of the coal in a monolayer—a single layer of methane molecules stuck to the surface with no stacking. When the coal is fully saturated with methane molecules, the monolayer approaches what could be called a liquid, but it never reaches the solid phase.

Methane molecules are held in place by the hydrostatic head—the pressure exerted by the height of a column of water at a given depth. Freshwater has a hydrostatic gradient of 0.433 psi/ft; accordingly, the formation pressure at 6,000' is 2,598 psig (6,000' x 0.433 = 2,598).

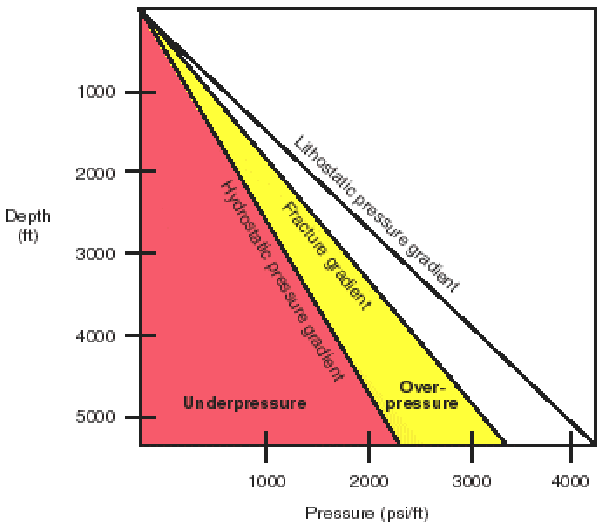
Coalbed reservoir temperature and pressure determine how much methane can be held in place (i.e. equilibrium). As the reservoir pressure is drawn down, the methane will try to equalize as CH_4 molecules in the matrix react to lower pressure in the cleats; eventually, the pressure differential grows large enough to break the physical bond, and the gas molecule peels off into the micropores inside the coal matrix. Gradually it diffuses through the coal micropore network and works its way toward the cleat. It enters the cleat as a gas, and since water in the cleat is already saturated with gas, it cannot accept any more methane into solution. These new methane molecules entering the system of coal cleats build gas saturation levels, which, in turn, increase the relative permeability of gas to the wellbore, and provide the inclining production trend.

In this hydraulically closed system, everything is at equilibrium, and pressure depletion can only occur by artificial means, ordinarily by drilling and casing a well and setting a pump to bring formation water to the surface. The rated pump capacity must exceed the rate of fluid entry from the coalbed for hydrostatic pressure to drop and lower the fluid level in the wellbore. The more the reservoir pressure drops, a “pressure sink” is created around each wellbore. As the radius of this “sink” enlarges, the formation pressures between multiple wellbores will interfere with each other, increasing the rate of depletion and hence, the rate of gas desorption.

Accordingly, it is critical that the pilot project yields sufficient data to develop models of the physical behavior of these several coal formations at different hydrostatic pressures. By determining the theoretical maximum gas storage capacity at a given pressure and temperature, a series of data points can be extrapolated called the “adsorption isotherm.” From that point, it’s possible to infer whether the coal is gas-saturated and how much pressure depletion must occur before coalbed gas will begin to desorb.

Simply put, the goal is to produce enough water, quickly enough, to lower the ambient formation pressure to the point where it intersects the isotherm curve.

Pressure versus depth plot



Dudley plans to request 160-acre drilling and spacing units across the project area. The shallower Medicine Bow and Fox Hills coalbed formations will be produced from separate, "twin" wellbores, so-called because they share a common drill pad with their Mesaverde counterparts to minimize the surface area disturbed by the development of both formations.

Field development will require construction of access roads, drill pads, gas gathering and water collection lines, electric utilities, water treatment and discharge facilities, equipment storage yards and compressor stations. It is estimated that 55% of the originally disturbed surface will be reclaimed as soon as is practicable following drilling, completing, testing and equipping operations. The aerial extent of surface disturbance for the Seminoe Road Project is estimated in **Table A-1, Preliminary Estimate of Surface Area Disturbance**.

The initial analysis of natural gas taken from Pilot Project (well UPLRC 4-35-24-85) producing from the Mesaverde coals indicates the presence of "pipeline quality" gas. Consequently, there appears to be no present need for nitrogen or CO_2 extraction facilities. An EA for a compressor facility, storage yard and a 20.3-mile high-pressure gathering pipeline was approved in 2002 to enable future delivery of produced gas to markets at interconnections near Walcott, Wyoming. Construction of these facilities, however, will await further production testing of the pilot project to confirm that coalbed natural gas can, in fact, be produced in paying quantities.

The surface discharge of water produced from coalbed natural gas wells is regulated under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Wyoming Department of Environmental Quality (WDEQ). Dudley currently monitors and discharges treated water from pilot project wells under NPDES Permit WYW 004-1807.

Applications for Permits to Appropriate Ground Water (Form U.W. 5) have been issued by the Office of the State Engineer for each of the pilot project wells. As and when additional wells may be drilled, similar ground water appropriation permits will be sought by application to the State Engineer.

Produced water pipelines will be constructed, as necessary, from well pad sites to water treatment and discharge facilities. Produced water quality will continue to be monitored in accordance with state and federal regulations.

Primary field development of the Mesaverde coals is anticipated to occur over the course of 6 to 8 years, with secondary, shallower objectives in the Medicine Bow and Fox Hills formations requiring an additional 3 to 4 years. Dudley plans to initiate field development in 2005 following satisfaction of NEPA requirements and receipt of certain federal, state, and local regulatory approvals.

The overall period of drilling, operating, and reservoir production to its economic limit, as well as the decommission and final reclamation stages of the project, can be estimated to last thirty (30) years, or more, if field development reaches the potential limits described herein.

In addition to the usual and customary federal, state and local regulatory requirements, the factors that will control the rate of field development and production operations include, but are not limited to: a.) the diminishing availability of qualified drilling contractors and, more particularly, equally qualified personnel to operate those rigs; b.) third-party services essential to drilling, logging, completing, testing and equipping processes; c.) oil and gas lease acquisitions, expiries, and attendant stipulations limiting the period for surface access; d.) contractual obligations; e.) weather; and, f.) access to capital and gas markets, and g.) fluctuating commodity prices.

2.0 ANCILLARY PROJECTS

The Seminoe Road Project has been preceded by the following activities:

- Pilot Project;
- Gas Gathering Pipeline and Compressor Facility EA; and,
- Pilot Project Water Handling and Treatment Facilities.

2.1 Pilot Project

The pilot project consists of 16 wells drilled, completed and produced to evaluate whether the objective formations have suitable reservoir characteristics for commercial development of coalbed natural gas. Two additional wells have been approved, but those locations have not yet been developed. The pilot project wells are drilled and spaced on 160-acre units; in each case the plug-back total depth (PBTD) penetrates through the Allen Ridge member of the Mesaverde formation (6,000').

The pilot project wells and associated roads lie in Townships 23 and 24 North, Range 85 West, 6th PM, Carbon County, Wyoming. See **Figure 4, General Layout Map**.

Details of the pilot project are discussed in the Environmental Assessment (EA) for the Seminoe Road Coalbed Methane Pilot Project (WY-030-EA00-288).

2.2 Interconnect Pipeline and Compressor Facility

Dudley received approval from the BLM in 2002 for the construction of a natural gas compressor facility and a 20.3-mile, 16" diameter, high-pressure gathering pipeline to move gas from the pilot project to markets located at a set of commercial interconnects near Walcott, Wyoming. The pipeline rights-of-way and associated facilities are shown on **Figure 4, General Layout Map**.

The design calls for relatively low-pressure wellhead gas from the pilot project wells to flow through an infield gathering system to the inlet of a centrally located dehydration and compressor site. From the compressor outlet, gas will be delivered to the Walcott interconnects in the high-pressure gathering pipeline. Detailed specifications for construction and development are set forth in the EA for the Seminoe Road Coalbed Methane Natural Gas Gathering Pipeline/Access Road and Compressor Station/Storage Yard/Access Road Project (WY-030-EA2-229).

2.3 Water Handling and Treatment Facilities

The water produced during pilot project operations has been collected through underground water gathering lines to two separate but identical treatment facilities (DS-2 and DS-3). Produced water is initially sprayed through nozzles into horizontal 400 bbl aeration tanks. The nozzles, resembling modified shower heads, are designed to mix air and produced water, which causes iron dissolved in the water to oxidize; that is, they turn to rust particles which tend to drop out of solution.

The aerated water flows by gravity to specially constructed fiberglass containers filled with both sand and gravel, a process that effectively “polishes” the aerated water by filtering total iron and manganese. See **Figure 11, Water Treatment Facilities Layout**.

As was mentioned in Section 1.0, General Project Description, Dudley has obtained an NPDES permit from the WDEQ specifying three (3) approved discharge points. Samples of water discharged from the pilot project are regularly collected, analyzed, and have consistently met water quality standards set by the NPDES permit.

3.0 PRE-CONSTRUCTION PLANNING AND SITE LAYOUT

Prior to the start of construction activities for each individual project phase, Dudley will submit site-specific APD plans for the drilling, testing, completing and equipping process, including, but not limited to location surveys showing the area to be disturbed for access roads, drill pads, topsoil piles, pits, drilling and all related downhole procedures (including safety plans) and any other information the operator or the BLM deems relevant to the process. Each individual project phase will include a group of wells.

The proposed development sites will be staked in the field and inspected by the BLM to ensure consistency with the application and that environmental resources are evaluated in such a way that proposed operations comply with the Great Divide Resource Management Plan (RMP) and any site-specific EIS decisions made for the Seminoe Road Project.

Two procedural options are available to the operator for securing approval to drill: a.) a Notice of Staking (NOS); and, b.) an Application for Permit to Drill or Reenter (APD). Although timeframes set forth in the regulations are the same for both options, they do contain individual advantages.

The NOS system, properly coordinated at the beginning of the action, may expedite final permit approval; however, the APD system is the most familiar to oil and gas operators and often requires less coordination effort at the start. The choice of which option to use is the decision of the operator.

Access roads and pipelines located on federal surface outside the leasehold or the unitized area require a right-of-way (ROW) for BLM lands. The NOS or APD for BLM land will be accepted as a ROW application for these off-lease facilities and the application should, therefore, detail the entire development proposal. At the NOS or APD onsite inspection, the operator will be provided the Form 2800-14 (ROW/Temporary Use Permit) containing standard terms and conditions, and Form 1323-2 (ROW cost recovery and fee determination record) for any ROWs involved on BLM land. Complete APDs involving a BLM ROW should include a signed form 2800-14 and any required ROW cost recovery fees. APD conditions of approval will also apply to ROW portions of the permit.

The applications will be revised as necessary per negotiations with the BLM. The BLM may approve or deny site-specific proposals and any such conditions of approval will be attached to and become a part of each permit. Upon receipt of final BLM approval, the operator could commence with proposed activities.

4.0 CONSTRUCTION ACTIVITIES

4.1 Roads and Well Pads

Construction activities on federal lands will follow procedures approved by the BLM each APD and any attached C*onditions of Approval*.

The operator will save and separately retain topsoil bladed from any excavation activity for the eventual revegetation of the location. Topsoil stockpiles, if any, will be segregated from subsoils, stockpiled, and stabilized until used for reclamation.

4.1.1 Road Construction

Dudley will obtain proper authorizations for access roads. When the proposed project requires roads to be built on or across federal and private surface, they will be constructed following guidelines specified in the BLM *Road Standards Manual*, Section 9113.

The plan for a typical road cross-section with parallel gas and water gathering lines is illustrated as **Figure 7, Typical Access Road**.

Exact locations of project access roads within the project area are not finalized, however, as noted above, these locations will become a part of APD and ROW applications to the BLM prior to any actual construction. Newly constructed roads will be situated for minimal surface disturbance and will avoid sensitive resources (e.g., raptor nests, cultural resource sites, etc.), and maximize transportation efficiency. Roads will be built and maintained to provide year-round access.

Surface disturbance for access roads will be contained within a requested 50-foot ROW. Actual disturbance created by road construction will vary with the topography. Wherever possible, existing roads will be upgraded to provide access to well sites; however, it is certain that new roads will need to be constructed.

Access roads within the project area will serve well sites and support facilities. Maintenance practices will include road surface grading and maintaining drainage. Roads will be surfaced with rock aggregate (gravel) to accommodate year-round use, to allow the transport of heavy loads, and to minimize dust generation.

Access roads will be reclaimed when the road is no longer needed. However, to satisfy possible requests by the BLM or the fee surface owner, an access road may be stabilized and allowed to revert to a two-track trail upon completion of the proposed project and/or need for the road.

4.1.2 Well Pad Construction

A typical drill pad will require approximately 2.2 acres for drilling operations. Each drill pad will include a level area for placement of the drilling rig and its ancillary equipment, as well as space for an earthen reserve pit, lined with impermeable fabric that will adequately contain drilling fluids and cuttings. See **Figure 8, Typical Well Pad Layout During Drilling Activities**.

Topsoil will be separately stockpiled for future use in reclamation. Drill pads will be leveled and/or contoured using standard surveys, construction techniques and machinery.

As previously addressed in Section 1.0, General Project Description, it is estimated that 785 drill pads would be constructed in the project area to adequately recover coalbed natural gas from the

Mesaverde coals. Dudley further surmises that 455 of these drill pads are also prospective for recovery of coalbed natural gas from the Medicine Bow and Fox Hills coals from a second well bore. After drilling activities and wellhead installations are completed the well pad site would be reclaimed, reducing disturbance from 2.2 acres to 1 acre.

Well pads will be constructed over time as graphically illustrated on **Figure 4, General Layout Map**.

4.2 Construction Staging and Laydown Areas

The proposed project will eventually require three compressor sites, which also serve as staging locations for construction. Such activity may include, but is not limited to pipe racks, pipeline storage, equipment security, dispatch and maintenance. See Section 6.3, Compressor Stations and **Figure 5, Projected Build-out Scenario (Mesaverde Formation)**. Truck transport will be used for moving equipment and supplies to and from the Seminoe Road Project. The compressor sites will double as equipment laydown and storage areas throughout the life of the project.

5.0 DRILLING OPERATIONS

5.1 General Description

Once access road and drill pad construction are completed, rotary rig components will be transported by trucks to the drill pad and assembled on site. This is ordinarily a 10 to 12 hour process, depending upon the size and nature of the rig. See **Figure 8, Typical Well Pad Layout During Drilling Activities**.

Cuttings and drilling fluids will be contained in the reserve pit, and drilling fluids will be recovered and reused as practical. The reserve pit will be lined, as specified in the APDs, to prevent loss of drilling fluids through seepage. If necessary, the reserve pit will first receive a sufficient layer of bedding material (e.g., sand) to prevent contact between the liner and any exposed rock. The reserve pit will be fenced to protect livestock and wildlife until the pit is backfilled and reclaimed.

In the unlikely event that undesirable materials (e.g., hydrocarbon liquids) are [reserve pits are designed and intended to receive oil and condensate which is often produced while drilling petroliferous formations] discharged into a reserve pit, the materials will be carefully separated, removed and discarded in accordance with WDEQ and WOGCC requirements. If oil is observed in the pit and if it is not possible or practical to immediately remove such oil, the pit will be covered by a net to prevent waterfowl use.

In the event that oil, gas or other noxious fluids are spilled during drilling, completing, testing or equipping operations, the operator will contact the BLM and such other regulatory agencies as are deemed necessary (or indicated in the APD) and will initiate clean-up procedures. Every reasonable effort will be made to confine equipment and vehicles to access roads, well pads, and ancillary facility areas specified in the approved APD. Dudley will prepare a spill prevention control & countermeasure plan and a Hazardous Materials Management Plan, which, will outline spill prevention and clean-up procedures.

No abnormal temperatures, pressures or hydrogen sulfide gas is likely to be encountered during drilling. Freshwater aquifers and minable coals will be adequately protected in accordance with good oilfield practice and WOGCC requirements. This common practice ordinarily entails setting and cementing adequate steel casing across the appropriate intervals to isolate the formation in question and eliminate the possibility of fluid or pressure communication between zones.

The quality of a primary cement job is evaluated by running a wire line acoustical geophysical log (cement bond log or CBL) through production casing after the cement has set. A favorable acoustic coupling occurs if there is adequate cement to fill the annular space between casing and wellbore. The resulting log signature evidences the degree of bonding across the cemented intervals. Dudley will use sufficient cement and make every reasonable effort to obtain full return of cement to the surface; however, a full return cannot always be obtained. For this reason, cement bond logs will be run in all wells completed for production.

If a partial or incomplete cement bond can be identified within 100' above or below a production zone, the casing will be perforated at the appropriate interval, and additional cement pumped into the casing-wellbore annulus, and a second CBL will be run to determine the effectiveness of the additional cementing. The procedure will be repeated as necessary to ensure an adequate cement bond.

5.2 Completion and Testing Operations

Production wells will be tested once casing and cementing activities are completed. Potentially productive coal seams will be perforated and tested to determine the ability of each to produce methane at commercially acceptable rates. Mesaverde, Medicine Bow, and Fox Hill coals typically average 2 to 12 feet in individual thickness. The interval between the coals in the Medicine Bow and Fox Hill formations averages between 40 and 70 feet.

During well production testing, the rig used to drill the well will be replaced with a smaller surface rig that operates primarily during daylight hours. Well testing will occur by perforating the steel casing across potentially productive zones. Smaller tubing will then be placed in the cased hole and pumping equipment is set below the perforated intervals.

Water will be pumped from the completed zone using progressive cavity or submersible pumps (see Section 6.0, Production Operations) until methane flow is established. This process may require 90 days or more of pumping to initiate diagnostic gas flow rates.

Gas flows will be measured at the surface, as required by the BLM and the WOGCC. Produced water will flow from the well pad through buried pipelines to treatment facilities and discharge points (see Section 9.0, Water Management).

Within 365 days of drilling and well completion activities, any remaining reserve pit liquids will be removed and disposed of at an approved waste disposal facility. If adverse weather conditions prevent removal of the fluids within 365 days, an extension will be requested of the BLM.

Upon well completion and after the liquid contents of the reserve pit have evaporated or been removed, the reserve pit will be reclaimed by filling it with the soil material removed during initial pit construction. The area will then be reseeded in accordance with BLM specifications. The portion of the well pad not needed for gas production facilities will also be reclaimed in the same manner as described above. This reclamation effort will result in a producing well pad size of approximately 1.0 acre.

5.3 Drilling Water

An average of approximately 7,000 42-gallon barrels of water will be required to drill each well (294,000 gallons of water per well). This water will be obtained from the water produced during drilling and existing dewatering operations. Water used to drill one well may be reused to drill subsequent wells. Maximum life-of-project water requirements are estimated to be approximately 365 million gallons (1,120 acre feet). See further discussion in Section 9.0, Water Management.

6.0 PRODUCTION OPERATIONS

Production will involve the following facilities:

- Well Pads (including well sites);
- Gas and Water Gathering and Treatment Systems;
- Compressor Stations; and,
- Gas Gathering Delivery and Terminal Facilities.

6.1 Well Pads (including well sites)

Well pads include well site production facilities, which will be installed after well completion to facilitate dewatering. This will occur even though commercial gas production may not occur until well testing has been completed. See **Figure 9, Typical Producing Well Layout**, and Section 9.0, Water Management.

A *Well Completion Report* will be filed with the BLM within 30 days of well completion, in accordance with 43 CFR 3164. This report will include a facilities/site security diagram. In addition, site security procedures will be implemented, as specified in the BLM's *Onshore Oil and Gas Order #3*.

Progressive cavity, or submersible pumps will be used to dewater the methane-bearing formations. Each well location may include a propane tank of approximately 1,000-gallon capacity for emergency operations in the event electric power is unavailable. See Section 11.0, Power.

Produced water and gas will be separated at the well site, located on each well pad. As discussed below, water from each well will be delivered to the water treatment facility and/or approved discharge point via an underground infield water gathering pipeline system. See Section 6.2, Gas and Well Gathering Systems, and Section 9.0, Water Management. Produced gas will be transported from the well through a separate gas gathering pipeline system installed beside the underground water gathering pipeline system to a nearby compressor station. See

Section 6.2, Gas and Well Gathering Systems, and Section 6.3, Compressor Station. These lines will run parallel to access roads to minimize surface disturbance.

6.2 Gas and Water Gathering Systems

6.2.1 Gas Lines

As mentioned above, produced gas from wells will be transported to a centralized compressor station via an underground pipeline gathering system. These infield gas-gathering pipelines will parallel access roads to minimize disturbance. Infield gas pipelines generally will be 3 to 6” in diameter, buried to depths of 4 to 6 feet, which is below expected frost zones, and located adjacent to the water lines, electric distribution lines and roads. The estimated total surface disturbance associated with gas gathering pipeline construction is set forth in **Table A-1, Preliminary Estimate of Surface Area Disturbance**.

6.2.2 Water Lines

As with the gas gathering pipelines, the water gathering lines will be installed within each well pad and adjacent to the gas water separator. Water will be piped via 3 to 6 inch diameter pipelines, buried at depths of 4 to 6 feet, which is below expected frost zones, and delivered to appropriate treatment and discharge systems (see Section 9.0, Water Management). Produced water pipelines will typically be located adjacent to the gas pipelines and roads. The estimated total surface disturbance associated with water pipeline construction is presented in **Table A-1, Preliminary Estimate of Surface Area Disturbance**.

6.3 Compressor Stations

The proposed project will eventually require three compressor stations, which also serve as staging locations for construction. Such activity may include, but is not limited to pipe racks, pipeline storage, equipment security, dispatch and maintenance. Relatively low-pressure wellhead gas from the wells will flow through the infield gathering system to the inlet of one of three centrally located dehydration and compressor stations. The purpose of the compressor station is to remove residual water vapor from the gas stream and compress the gas for placement into a high-pressure gas-gathering pipeline. From the compressor outlets, gas will be piped through the gas-gathering pipeline and delivered to the Walcott interconnects.

The three compressor stations will be installed as the gas field is developed. Each station will require approximately 10 acres. A planned layout for a compressor station is shown in **Figure 10, Compressor Station Layout**. Plans for building and operating the compressor station in Section 10, T23N, R85W were discussed in detail in an EA (WY-030-EA2-229) and has been approved for construction and operation by the BLM. See Section 2.2, Interconnect Pipeline and Compressor Facility. The location of the three compressor stations is shown on **Figure 4, General Layout Map**. The location of the compressor sites will be shifted to account for any sensitive wildlife species and to minimize visual impacts.

Equipment associated with each compressor station will include two 1,000 horsepower compressors and a single dehydration unit. See **Figure 10, Compressor Station Layout**. This equipment mostly likely will be housed in a metal, sound reducing building, with a stack anticipated no higher than 25 feet and will be painted to blend with the surrounding landscape, per BLM specifications. The storage yard will contain a small maintenance building, pipe racks for casing, tubing and rods, as well as additional storage space for pumping units, motors, separators, miscellaneous valves, fittings, poly pipe and other equipment.

A pigging launching facility for pipeline maintenance will likely be sited within each compressor station storage area. “Pigs” remove any free liquids from the pipeline by “pigging the line” regularly. This maintains line efficiency and controls corrosion.

Prior to the construction of the compressors and dehydration units, soil material will be removed from the site and stockpiled for later use in reclamation. The site will be graded for drainage and appropriately surfaced. High-use areas will be graveled. The compressor station site will be fenced with four-strand barbed wire and equipped with a locked gate.

A work building will be located at each compressor station location. This building will house an office, shop and warehouse. A vehicle-wash facility will be maintained at each site.

As previously mentioned, a portion of the compressor station site will be used for equipment and supply storage.

6.4 Pipeline Delivery and Terminal Facilities

A pig catcher, separator, dehydrator, and associated tanks will be constructed at the southern terminus of the high-pressure gas-gathering pipeline where it joins the commercial transmission/sale pipeline. Please refer to the related discussion the EA (WY-030-EA2-229) for further information.

7.0 MAINTENANCE ACTIVITIES

This section discusses maintenance activities on the following project features:

- Roads;
- Compressor Stations;
- Water Treatment Facilities; and,
- Coal Methane Extraction Wells.

7.1 Roads

Access roads (see Section 4.1.1, Road Construction) will be maintained to provide year-round access to the well pads, compressor stations, and ancillary facilities. Road maintenance will vary depending on road usage. Maintenance objectives will include maintaining drainages, resurfacing selected segments with gravel, and grading road surfaces. Road maintenance will typically involve applying surface materials and grading the roads during the summer and fall months. It will also include snow removal during the winter months. To minimize dust, speed limits will be set, roads will be surfaced with rock aggregate material (such as gravel), and water/chemical dust suppressants will be applied to roads, as appropriate and practical.

7.2 Compressor Stations

Compressor facilities will be designed, constructed, and operated to minimize maintenance requirements.

7.3 Water Treatment Facilities

Water treatment facilities will be designed, monitored and maintained to ensure their effective operation. The objective of such maintenance will be to ensure that discharged project water meets the requirements of the NPDES permit issued and enforced by the WDEQ. See Section 9.3, Water Treatment and Discharge**.**

7.4 Natural Gas Production Wells

All wells will be maintained regularly and periodic work-overs will be scheduled to maximize well production. Details are presented below.

7.4.1 Operations

Wells will be operated in a safe manner according to standard industry operating practices. Producing wells will require routine maintenance to maximize performance and to detect operational difficulties. Each well site will be routinely inspected to ensure operations are proceeding safely and efficiently. Inspections will include checking gauges, valves, fittings, and other on-site facilities. Routine on-site equipment maintenance will also be performed, as necessary.

7.4.2 Well Site Work-Overs

Periodic work-overs will be employed to correct any down-hole problems and to ensure that producing wells are operating properly. Work-overs will occur on an as-needed basis, to change or replace tubing, re-fracture producing formations, clear water and other debris from the wellbore and perforations, and/or re-complete a well in additional production zones. Wells will generally require several work-overs during the life of the project, with the last work-over being conducted when the well is abandoned (see Section 9.2.3, Well Abandonment and Sealing). Work-overs will normally take 3 to 5 days and occur during daylight hours.

8.0 RECLAMATION

The goal of reclamation is to return disturbed areas to a stabilized and productive condition, and to ensure area-wide long-term land and water resources protection. The purpose of interim reclamation programs are to stabilize disturbed areas annually following well completion, access road construction, water and gas pipeline installation, and electric utility distribution lines burial.

Reclamation practices, such as those addressed in this document, have been developed and successfully utilized for many other oil and gas operations in Wyoming, including The Seminoe

Road Coalbed Methane Pilot Project. These practices will mitigate impacts of the proposed gas development activities.

Dudley considers reclamation to be an integral component of the Seminoe Road Project. Reclamation will occur in two stages:

- Interim reclamation occurring after well completion, access road construction, infield water, gas pipeline and electric utility line installation; and,
- Final reclamation occurring when the project is decommissioned and wells are abandoned.

Specific Seminoe Road Project reclamation program objectives are as follows:

- Re-establish wildlife habitat;
- Re-establish livestock grazing;
- Protect water quality;
- Protect public, livestock, and wildlife by proper well abandonment; and,
- Protect recreational resources found in the area.

Dudley will prepare specific erosion control, restoration, and revegetation plans for specific areas within the Seminoe Road Project during the APD and ROW application process. These plans will be approved by the BLM prior to site disturbance.

8.1 Interim Reclamation

As part of the Seminoe Road Project road and well site construction activities, Dudley will undertake the following to ensure reclamation objectives are met:

- Remove and stockpile soil and cover material, as practicable;
- Implement concurrent reclamation and revegetation programs;
- Reduce well pad site size after drilling to accommodate well production;
- Implement drainage stabilization and erosion controls; and,
- Decommission and perform final reclamation of the project site.

8.1.1 Soil Removal and Stockpiling

Topsoil or soil suitable for revegetation will be removed from areas used for roads, well pads, or compressor station areas. This soil material will be stockpiled for future reclamation. Salvaged soil will be stockpiled either in windrows adjacent to the area of its place of origin or placed in nearby soil stockpiles.

Stockpiled soil will be protected as much as possible from wind, water, and other possible sources of erosion. During the first normal planting season following the development of a soil stockpile, the stockpile will be seeded with a mixture approved by the BLM.

8.1.2 Interim Stabilization and Revegetation

Following construction activities, areas such as cut and fill embankments, soil stockpiles, etc. will be reseeded to reduce the wind and water erosion potential. To minimize the potential for fire hazard, certain areas around compressor stations, storage areas, electrical substations, etc. will not be reseeded. Dudley will use a seed mixture approved by the BLM.

8.1.3 Well Site and Road Reclamation

After production equipment is installed, the well pad size will be reduced from 2.2 acres to 1 acre, the size necessary for production operations. Drilling and other fluids contained in reserve pits will be evaporated and covered in place, pursuant to requirements of the BLM and/or WOGCC. Material requiring removal will be extracted from the reserve pits and disposed of at an authorized location outside the project area (e.g., existing lined evaporation ponds, injector wells or landfills).

Reseeding will be performed on portions of roads, pipeline ROWs, and well pads which are not required for use during production. Those wells not brought into production will be plugged, abandoned and reclaimed as per requirements of the BLM and/or WOGCC.

8.2 Final Closure and Reclamation

At the time of final and permanent project closure, a number of reclamation steps will occur:

- Decommission facilities;
- Remove structures, facilities and roads;
- Abandon and seal wells;

- Recontour and regrade disturbed surfaces;
- Replace and mulch soils where necessary;
- Revegetate disturbed areas; and,
- Manage and monitor reclamation efforts.

8.2.1 Facilities Decommissioning

Following permanent closure of the operation, equipment, instrumentation, and/or unused chemicals and fuels will be removed from the site. The various pipelines will be purged of any combustible materials and retired in place.

8.2.2 Structures, Facilities and Roads Removal

Except where an ongoing beneficial use is identified, project-related structures, facilities and roads will be dismantled and removed from the site once the operation is closed permanently. Roads will be ripped to alleviate compaction, and adjacent culverts will be removed. Any salvageable structures will be sold. Unsalvageable structures, such as foundations, will be removed from the site and disposed of in an approved disposal facility.

8.2.3 Well Abandonment and Sealing

When Dudley is ready to abandon a well, an abandonment plan will be submitted to and approved by to the BLM, provided it is acceptable. BLM will authorize abandonment activities through a Sundry Notice. Wells will be plugged according to BLM Onshore Il and Gas Order #2 and/or WOGCC rules and regulations. See **Figure 18, Conceptual Schematic of Plugged and Abandoned Wellbore.**

8.2.4 Recontouring and Regrading

Disturbed areas, such as roads, and well pads, will be recontoured and regraded, as appropriate, to achieve acceptable post-operational topographical conditions. During this phase of project closure, high traffic areas, such as roads, will be ripped to alleviate compaction. Culverts will be removed from roads to re-establish natural surface drainage patterns.

8.2.5 Soil Replacement and Mulching

Following regrading activities, disturbed surfaces will be covered with topsoil material and, where necessary, mulched. Topsoil or other suitable material will be replaced to serve as a rooting zone for revegetation. Soil material will be applied and the surface will be left in a roughened configuration to resist wind and water erosion. This practice will also maximize water retention in the replaced soil. Surface manipulation treatments such as ripping and chiseling will be employed in heavily compacted areas. Contour furrows and/or contour terraces will be employed and/or constructed in areas likely to develop rills and gullies.

As necessary to initially stabilize the soil, erosion and sedimentation control materials such as wood fiber mulch, straw, or erosion control/mulch blankets will be applied in a separate step following seeding.

8.2.6 Permanent Revegetation

Disturbed sites will be reseeded with a seed mixture approved by the BLM using appropriate application methods, such as broadcast seeding, drill seeding, or hydroseeding.

8.2.7 Reclamation Management and Monitoring

Newly reclaimed areas will be managed consistent with reclamation goals outlined above. Reclaimed sites will be monitored during the first two years after revegetation to ensure erosion is prevented and plant species are being re-established. Site maintenance will occur during those two years as to ensure that the reclamation program succeeds.

9.0 WATER MANAGEMENT

Water management is a key component of the Seminoe Road Project. As explained in Section 5.0, Drilling Operations, and Section 6.0, Production Operations, water will be produced as a by-product of gas extraction.

The following water management considerations are discussed in this section:

- Water use;
- Dewatering operations;
- Water treatment; and,
- Water discharge.

9.1 Water Use

Seminoe Road Project water will be used for drilling operations, dust control, and livestock and wildlife watering.

Drilling operations require water either by itself, or mixed with barite (a natural clay) to make drilling mud. This fluid is pumped down the inside of the drill pipe and out through nozzles in the drill bit to cool the bit and lift the rock cuttings to the surface. The cuttings return to the surface by water or mud flowing up the annulus, which is the space between the outside of the drill pipe and the inside wall of the wellbore. The mud flows out onto a shale-shaker and into the mud pits where the cuttings drop out of solution and the mud is returned to the pump for another trip downhole. Water is often used by itself for drilling the large diameter hole for surface casing, as well as the smaller diameter wellbore.

Water will also be placed on roads during dry months to help control fugitive dust. Livestock and a variety of wildlife species will also use the water.

9.2 Dewatering Operations

The coals of the western Hanna Basin are water bearing, and the desorption (release) of methane gas occurs when the formation hydrostatic pressure is reduced by pumping water out of the coal formation through a wellbore. As hydrostatic pressure drops, the physical bond between the coal and methane molecules breaks, methane diffuses through the coal into the natural fractures and flows with the water stream towards the zone of lower pressure at the wellbore. Therefore, to create favorable conditions for the release of methane gas from the coal seams, water must be produced prior to and during methane extraction.

The water production rate from each well is expected to be 1,000 to 1,500 barrels per day (42,000 to 63,000 gallons per day or 29 to 44 gallons per minute or 0.06 to 0.10 cubic feet per second (cfs)). This range of expected production is derived from the performance of the pilot project, as well as technical data. The theoretical maximum, which was calculated from early well tests, is about 1,500 barrels per day. The pilot project results to date indicate that peak rates will most likely range from 1,000 to 1,200 barrels of water per day due to downhole pump limitations. These initial rates will remain constant for up to three months and thereafter decline at 10 to 15%

annually. Actual discharge from each borehole may be less, depending on geologic conditions, pumping equipment limitations, or interference from adjacent wells.

Produced water volumes will increase as new wells begin producing. While the amount of water discharged from individual wells will remain the same or decrease, well density increases will cause overall water discharge volumes to increase.

As with the pilot project operations, the initial pumping rate of 1,000 to 1,500 barrels of water per day (29 to 44 gallons per minute or 0.06 to 0.10 cfs) will remain constant for up to three months and decline thereafter at 10 to 15% annually. As a result, daily water production during the build-out will stabilize in the fourth or fifth year to a level of approximately 180,000 barrels of water per day (5.250 gallons per minute (gpm) or 12 cfs). This level is projected to remain constant for a period of nine to ten years then decline (because no additional wells will be established). At this point, water production will continue to decline for the remainder of the project life.

The pumping equipment used for the dewatering actions of the project will be the same type generally used by the petroleum industry to produce liquids. This equipment includes, but is not limited to progressive cavity pumps and electric submersible pumps.

Progressive cavity pumps are also commonly used, particularly in coalbed methane production. These pumps contain a rotor (metal road with corkscrew shape) inside a stator (hardened rubber with a corkscrew interior for the rotor) that rotates to work pockets of water from the bottom to the top.

Electric submersible pumps are less common in coalbed methane production applications, but they can handle greater water production rates if necessary to effectively dewater the coals.

Dudley will obtain all necessary dewatering permits, as well as any water right appropriations for produced waters, from the Wyoming State Engineer's Office.

9.3 Water Treatment and Discharge

The planned method for produced water disposal from the build-out will be similar to that currently employed by the pilot project. Dudley prepared a detailed Water Management Plan for the pilot project. This plan, revised April 2001, is on file with the BLM Rawlins Field Office. In addition, water produced from the pilot project wells is regulated under an NPDES permit issued from the

WDEQ (NPDES Permit WYW004-1807), as discussed in Section 1.0, General Project Description.

Currently, Dudley uses three approved discharge points, pursuant to the aforementioned NPDES permit. At the appropriate time during the proposed build-out, Dudley will seek to modify its NPDES Permit to allow for up to fifteen additional discharge points. The Wyoming DEQ could revise discharge standards on future discharge points.

Seminoe Road Project produced water will be transported from well locations via buried water pipelines that will generally be located parallel to the roads and placed in the same trench as the gas pipelines.

Dudley has collected water quality samples from wells since 2001 and analyzed water discharge from the pilot project since 2002. Discharges from the Pilot Project comply with the all applicable NPDES permit limits and conditions. The pilot project discharge water meets drinking water standards, and the quality of this water has improved during the sample period of record, particularly for barium and iron.

The discharge water type is sodium chloride, with a slightly alkaline pH and moderately elevated total dissolved solids (TDS) concentrations. The water has generally low concentrations of trace constituents, with the exception of chloride, iron, manganese, and barium. The water has a sodium adsorption ratio (SAR) that is higher than the Wyoming agricultural standard.

During the build-out, Dudley will install water treatment facilities similar to those presently utilized for the pilot project in a manner that ensures compliance with NPDES permit limits and conditions. A schematic of a typical water treatment facility (as is being used for the pilot project) is illustrated on **Figure 11, Water Treatment Facilities Layout**.

Produced water will be routed from the wells into aeration tanks, designed to remove dissolved iron from the water stream to prevent any iron staining downstream of discharge points. From the aeration tanks, water will be routed into filter tanks that trap and remove any iron and manganese particles. The filter tanks use a combination of sand and gravel to facilitate the filtration process. Once water passes through the filtration tanks, it will be routed to a discharge point. Outfall structures for the water discharge will consist of energy dissipaters and rock riprap to minimize erosion at the point of discharge.

Water treatment facilities and NPDES discharge points will be installed at strategic locations within the project area. See **Figure 12, Produced Water Discharge Points – Alternative B**. With one exception, water released at project discharge points will flow down various drainages, which are tributaries of the Seminoe Reservoir. The exception will be in the project area south of the Seminoe Reservoir, where discharge water will be routed into three closed basin playas. From here, the water will simply evaporate.

10.0 POWER

Presently propane-fired engines are used to run Pilot Project generators at individual wells. However, the Seminoe Road Project build-out plans call for eventual electrification of the entire field.

During the first two years of the build-out (2006-2007), Dudley will continue using propane or natural gas fired engines at the well sites. This is the anticipated time frame for substation construction and installation of buried electric distribution lines burial. These lines, occurring between the substation and well sites, will be placed in trenches alongside the roads and infield gas and water lines. Throughout the project build-out, there would be a need for propane or natural gas powered engines at out-lying well sites.

The electricity will come from the existing Western Area Power Authority (WAPA or Western) 115 kV transmission line located within the EIS analysis area (on the west side of Seminoe Road). Because WAPA is a part of the U.S. Department of Energy and is not a provider of retail electricity sales, Dudley will need to purchase the power from a local district distribution company (probably PacifiCorp).

A high-voltage substation will be constructed to accept power from the existing WAPA 115 kV transmission line. This substation will be located at the previously approved compressor station located in Section 10, Township 23 North, Range 85 West. See **Figure 4, General Layout Map**.

An approximate 8,000-foot overhead transmission line extension will be constructed from the WAPA 115 kV line to the substation. This extension line will be built using standard industry procedures and will follow guidelines established to prevent raptor electrocution.

Low-voltage substations will be installed at the other two proposed compressor sites. See **Figure 4, General Layout Map**. The electric distribution lines that feed the two low-voltage substations, as well as the electric distribution lines to the well pad sites will be buried next to access roads in the same right-of-way used for the gas and water pipelines.

Dudley will maintain up to five portable propane or natural gas fired engines on site to serve well pad operations during emergency situations where electric power is disrupted.

11.0 WORK FORCE

The construction and well development phases of the Seminoe Road Project will require a work force of 70 to 90 people. These phases are estimated to occur during the first 9 years of build-out. Work included in these phases involves pre-construction/site surveying, well pad and access road construction, well drilling and completion, and gas and water pipeline installation. Dudley will manage the construction and well development phases; however the actual work will be subcontracted to construction and drilling firms that specialize in this type of work. Dudley estimates that approximately 50% of this work force will be hired locally, within Carbon County.

As the project operations phase begins, Dudley will require a fulltime work force. This workforce will handle day-to-day operations, including routine maintenance. Dudley estimates that a peak operating and maintenance work force of approximately 40 to 60 people would be employed. This work force would be needed throughout the projected 30-year life of project term. Dudley estimates that approximately 80% of this work force will be hired locally within Carbon County.

Decommissioning and reclamation activities will require approximately 30 to 50 people. Dudley will manage this work using subcontractors that specialize in reclamation activities. Dudley estimates that approximately 95% of this work force will be hired locally within Carbon County.

12.0 TRANSPORTATION/TRAFFIC

Work force personnel will commute each workday to and from the site. They will do so from various locations (Rawlins, Sinclair, Hanna, etc). Dudley expects that approximately 50% of the work force will carpool to the site, with personnel being free to choose how they commute. Carpooling will result in less traffic.

Materials required for operations, including drilling supplies, piping and fuel will be delivered to the site by truck from various locations (Rawlins, Cheyenne, Rock Springs, and from outside the State of Wyoming). During peak drilling operations, Dudley expects there will be approximately 15 to 20 weekly trips required to deliver bulk materials, resulting in an estimated 3 to 4 truck trips per day.

Both work force and supply traffic will access the site via the Seminoe Road (Carbon County Road 351). This road is a two-lane, blacktop road that runs south from the project site approximately 18 miles to the Town of Sinclair, Wyoming. It has recently been widened and resurfaced. Interstate 80, runs adjacent to Sinclair and is a major four-lane federal highway that crosses southern Wyoming. The southern portion of the project area will be accessed at Walcott, Wyoming, from Interstate 80.

13.0 APPLICANT-COMMITTED MITIGATION AND MANAGEMENT MEASURES FOR ENVIRONMENTAL PROTECTION

For the pilot project, Dudley adopted a host of mitigation and management measures to ensure minimal environmental impacts. The following elements of an environmental impacts mitigation and management program will also be employed for the Seminoe Road Project. Dudley's adherence to this program will ensure that the project site remains productive for multiple uses both during and following final project closure and decommissioning.

Dudley will incorporate environmental management and mitigation measures into Seminoe Road Project operations. These measures will be employed with certain refinements evolving from the alternatives BLM selects at the end of this EIS process. Furthermore, BLM may identify additional site-specific mitigation/management measures during the APD and ROW application processes, which will occur subsequent to the Record of Decision on this EIS. Dudley will also be subject to additional operating requirements, including permit limits and conditions, emanating from other applicable regulations administered and enforced by other local, state and federal government agencies.

BLM may waive mitigation/management measures and design features identified in this document if, after thorough analysis, the agency determines that the resource(s) for which the measure was developed will not be impacted and/or alternative BLM-approved measures of guidance for protecting the resource(s) are developed.

Environmental mitigation and management program elements for the Seminoe Road Project are discussed in this section as follows:

- Pre-construction Planning and Design;
- Sewage, Trash and Other Waste Material;
- Cultural and Historic Resources;
- Paleontological Resources;
- Vegetation;
- Noxious Weeds;
- Road Construction and Transportation;
- Chemicals and Hazardous Materials;
- Air Quality;
- Topography and Physiography;
- Soils;
- Water Resources;
- Wetlands, Other Special Aquatic Sites, and Waters of the U.S.;
- Noise and Odor;
- Wildlife and Fisheries;
- Threatened, Endangered, Proposed, Candidate and Sensitive Species;
- Livestock and Grazing Management;
- Socioeconomics;
- Land Status, Use and Access;
- Recreation;
- Visual Resources; and,
- Health and Safety.

13.1 Pre-construction Planning and Design

Prior to construction, Dudley will submit a “Plan of Development” (POD) for each well pad, pipeline segment, and access road, or groupings of such project features. Well pad locations and the routing of associated access roads/pipelines/electric utilities will be selected and designed to minimize disturbance to areas of high wildlife habitat and/or recreational value, including riparian areas. In this effort, Dudley will work with both the BLM and the private landowners.

Following submittal of each POD representatives from Dudley and the BLM will conduct an on-site inspection of proposed disturbance sites (e.g., well pads, roads, pipelines, electric utility lines, etc.) to finalize site-specific recommendations and mitigation measures. BLM will consult with the Wyoming Game and Fish Department (WGFD), the U.S. Fish and Wildlife Service (USFWS), and the State Historic Preservation Office (SHPO), as appropriate, where construction activities might affect restricted areas and/or, when the timing of such construction activities might occur during periods of wildlife restrictions.

13.2 Sewage, Trash and Other Waste Material

Portable self-contained chemical toilets will be provided for human waste disposal. Upon completion of drilling activities, or as required, toilet holding tanks will be pumped and their contents disposed of at an approved sewage facility in accordance with applicable rules and regulations regarding sewage treatment and disposal.

Garbage and non-flammable waste materials will be collected in self-contained portable dumpsters or trash cages and hauled off site to an approved sanitary landfill. No trash will be placed in the reserve pit at the well pad locations, nor will any open burning of garbage and refuse be allowed on the project area. As soon as practical after removal of the drilling rig, debris and other waste material not contained in the trash cage or dumpsters will be cleaned up, removed from the well sites, and disposed of at an approved sanitary landfill. No potentially harmful materials or substances will be left on the project site.

13.3 Cultural and Historic Resources

Class III inventories will be conducted prior to disturbance on all federal lands and on state and private lands affected by construction and operations, unless private landowner denial for access is documented in writing.

Dudley and its contractors will inform their employees about relevant federal regulations protecting cultural resources. Dudley will adhere to the requirements of the National Historic Preservation Act of 1966 (as amended) and the Archaeological Resource Protection Act of 1979, in particular, specific BLM and SHPO recommendations prior to construction activities near known historic sites (e.g., cabins, grave sites, etc.) or any prehistoric sites within the project area.

Any objects of historic or cultural interest discovered during construction and operation will be brought to the attention of the responsible BLM official immediately. Dudley will halt construction activities in potentially affected areas in the event that previously undetected cultural resource properties are discovered during construction. The BLM will consult with the SHPO as necessary. Proper mitigation measures will be developed, and construction in the affected area will not resume until authorized.

13.4 Paleontological Resources

Any objects of paleontological interest discovered as a result of construction will be brought to the attention of the BLM. Construction activities in the affected area will cease immediately, until appropriate clearances are issued by the BLM.

13.5 Vegetation

Removal or disturbance of vegetation will be kept to a minimum by using previously disturbed areas wherever possible (including existing ROWs) and by limiting the area used by equipment/material storage yards and staging areas. Vegetation and soil removal will be occur in a manner that minimizes erosion and sedimentation. Disturbed areas will be stabilized and reseeded in accordance with BLM approved guidelines and/or private ownership specifications. See Section 8.0, Reclamation and Decommissioning.

13.6 Noxious Weeds

Dudley will be responsible for controlling noxious weeds along road ROWs, at well sites, and within any other areas disturbed by the project. The list of noxious weeds requiring control will be obtained from the BLM and/or the Carbon County Weed and Pest Office. Hand pulling/ digging, biological control (e.g. goats), and/or application of approved herbicides will be used for control of noxious weeds, as appropriate. Only BLM-approved herbicides will be used. Herbicide applications will be kept at least 500 feet from any known special status plant populations.

13.7 Road Construction/Transportation

Roads will be constructed specifically to support field development and operations, with the option of considering private landowner needs. Access road location and design will be considered and approved by BLM before any ground disturbing activities occur. Roads will be designed to minimize surface disturbance wherever possible. Existing roads will be used and upgraded where possible for the same reason. Roads that loop will be discouraged to minimize surface disturbance and vehicle traffic. Road access to well sites will be designed to maximize directness and shortness in length, wherever possible.

Standard BLM design and construction procedures as outlined in the BLM Manual, Section 9113 (Roads), and in the "Gold Book" *Oil and Gas Surface Operating Standards for Oil and Gas Exploration and Development, 3rd Ed.* for oil and gas access roads will be employed for road development, unless other identifiable and safe design options causing cause less surface disturbance are approved by BLM.

Available soil material (up to 12 inches) will be removed from road corridors prior to construction activities. This material will be windrowed or stockpiled for later redistribution on back slope areas of the borrow ditch. Borrow ditches will be reseeded in the first appropriate season after initial disturbance.

Roads will be constructed with adequate drainage and erosion control structures, such as relief culverts, drainage culverts, wing ditches, etc. Roads will be built, surfaced, and maintained to be safe. Roads in rough terrain or areas of high erosion potential will be designed and monitored during construction by a professional engineer. Areas disturbed for road construction will be minimized to reduce impacts and therefore the needs for reclamation. All road construction activities will be restricted to areas authorized in the approved ROWs.

Dudley will maintain roads in a safe, useable condition. A regular maintenance program will include activities such as blading, ditching, culvert and cattle guard maintenance/replacement, and re-surfacing, as needed. Dudley and its contractors will comply with existing federal, state, and county requirements and restrictions with regard to transportation. During drilling and operation, traffic will be restricted to Carbon County Road 351 and roads developed for the project. Off-road travel or use of unimproved roads will be allowed only in emergency situations.

Speed limits will be set commensurate with road type, traffic volume, vehicle types, wildlife stipulations and site-specific conditions, as necessary, to ensure safe and efficient traffic flows. As necessary, signs will be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. In addition, newly developed or improved roads through critical wildlife habitats will be gated and locked as directed by the BLM to prevent unnecessary wildlife disturbances.

Following permanent project closure and production activities, Dudley will close and reclaim roads.

Dudley and its contractors will comply with requirements of the Wyoming Department of Transportation and Carbon County for any oversize or over weight loads. Special arrangements will be made with the Wyoming Department of Transportation and/or Carbon County to transport any oversized loads to the project area.

13.8 Chemicals and Hazardous Materials

Dudley and its contractors will manage chemicals and hazardous materials in a manner that complies with applicable federal, state, and local regulations.

Dudley and its contractors will transport, locate, handle, store and use regulated hazardous materials in an appropriate manner that protects workers and the public, as well as preventing accidental releases to the environment.

Dudley will develop, and use as necessary, a Spill Prevention Control and Countermeasure Plan (SPCC) for the operation as required by the Federal Oil Spill Prevention regulation (40 CFR 112) as administered by the Environmental Protection Agency (EPA). In the SPCC, Dudley will identify a spill response program that includes overall management objectives, instrumentation and equipment needs, response actions, monitoring and reporting requirements, and general safety considerations for employees, contractors, and the general public. Copies of the SPCC plan will be given to appropriate Dudley personnel, contractors, and field personnel. This plan will also be kept on file at Dudley’s Denver, Colorado office.

13.9 Air Quality

Dudley will meet all applicable state and federal air quality standards. This will mean compliance with applicable Wyoming ambient air quality standards (WAAQS), National Ambient Air Quality Standards (NAAQS), permit requirements (including pre-construction, testing, and operating permits), and other applicable regulations, as required by the WDEQ, Air Quality Division.

13.10 Topography and Physiography

Areas with high erosion potential and/or rugged topography, such as steep slopes, stabilized sand dunes, floodplains, and unstable soils, will be avoided where possible. Special mitigation measures to control erosion will be applied to such areas if they are disturbed.

Upon completion of construction and/or production activities, Dudley will restore the topography to near pre-existing contours at well site locations, facilities, corridors, pipelines, and other facility sites.

13.11 Soils

Soil material will be removed during the construction operations in sufficient quantities to achieve reclamation plan objectives. Soil stockpiles will be seeded or otherwise protected to prevent erosion.

Dudley will restrict off-road vehicle activity by employees and subcontractors. Dudley will minimize project related travel during periods when soils are saturated and excess road rutting (e.g., greater than 6 inches) may occur. The area of disturbance will be kept to the minimum needed for drilling activities and subsequent production activities while still providing for safety. Pipelines will be located adjacent to roads or other pipelines to avoid creating additional areas of disturbance.

Cut and fill slopes for well pads and access roads will be designed to prevent soil erosion. Disturbed slopes will be revegetated, mulched, or otherwise stabilized to minimize erosion as soon as practicable following construction. Soil material will be replaced over disturbed surfaces prior to permanent revegetation.

13.12 Water Resources

Dudley will adhere to the limits and conditions contained in any NPDES permit issued by the WDEQ, Water Quality Division. Project actions will be conducted in compliance with this permit.

Dudley will limit disturbance within drainage channels, including ephemeral and intermittent draws, where practical. Surface disturbance to perennial surface water (and/or wetland and riparian areas) will be avoided, where practical. In addition, any crossings of ephemeral, intermittent and perennial streams will be made perpendicular to flow where practical.

Where riparian areas must be disturbed, the following measures will be employed:

- Construction across riparian areas will occur during dry conditions (i.e., late summer, fall, or dry winters).
- Riparian areas disturbed during project construction will be restored as near as practicable to pre-project conditions. If impermeable soils contributed to riparian area formation, soils will be compacted to re-establish that state.
- Riparian area topsoil will be selectively handled.
- Recontouring and BLM-approved plant species will be used to revegetate any disturbed riparian areas.
- Revegetation operations will begin on affected areas in the first appropriate season after completion of project activities.

Discharge of water will conform to the rules and regulations of the BLM, WOGCC, and the WDEQ, Water Quality Division. Current water uses on and adjacent to the project area will be protected, and project activities will be conducted to prevent adverse effects on water quality and quantity.

The casing and cementing criteria for wellbore plugging, as established by the BLM and WOGCC, will be implemented to protect subsurface water bearing zones in accordance with standard oil field practices.

13.13 Wetlands, Other Special Aquatic Sites, Other Waters of the U.S.

Wetlands and Other Waters of the U.S. are regulated under Section 404 of the Clean Water Act. Dudley will avoid these sensitive areas wherever practical. If wetlands or other special aquatic sites, riparian areas, streams, and WDEQ Section 401, Ephemeral/Intermittent Stream Channels are likely to be disturbed, Dudley will obtain the necessary Section 404 permits and authorizations and apply appropriate mitigation measures.

13.14 Noise and Odor

Internal combustion engines associated with the Seminoe Road Project will be maintained and muffled to minimize noise and odor.

13.15 Wildlife and Fisheries

Reserve pits or other project-related impoundments potentially hazardous to wildlife will be adequately protected (e.g., fenced or netted) to prohibit wildlife access and to ensure protection of migratory birds and other wildlife, as directed by BLM.

Dudley will implement policies designed to control poaching and littering and will notify all employees and subcontractors that conviction of a major game violation may result in disciplinary action. Contractors will be informed that any intentional poaching or littering within the project area may result in dismissal.

Proposed disturbance within 0.5 mile of identified raptor nests will require survey by a qualified biologist to determine nest activity status prior to commencement of drilling and construction during the raptor-nesting period. If an active raptor nest is identified within 0.5 mile (depending on species and line of sight) of a proposed site, Dudley will restrict construction during the critical nesting season for that species.

Known active sage grouse leks and adjacent (2-mile radius from lek centers) public land areas will be avoided during the breeding and nesting season (March 1 – June 30). No construction activities will occur on public lands within 0.25 mile of known active sage grouse lek sites. Construction activities on public lands in sage grouse nesting habitat and within 2.0 miles of active sage grouse leks will not occur without a BLM-approved biologist first surveying for sage grouse nests. If a nest is found, the area will be avoided until after nesting is complete.

13.16 Threatened, Endangered, Proposed, Candidate and Sensitive Species

Dudley will implement requirements outlined in the USFWS Biological Assessment (BA) for any threatened, endangered, proposed, or candidate species found in the project area. Similarly, Dudley will implement any BLM requirements concerning BLM sensitive species.

13.17 Livestock/Grazing Management

Dudley will coordinate project activities with ranching operations to minimize conflicts with livestock movement or other ranch operations. Dudley will maintain fences, cattle guards, and other existing livestock related structures. In areas of high livestock use, Dudley will fence reclaimed areas, as necessary, to ensure successful revegetation.

13.18 Socioeconomics

Dudley will implement hiring practices that encourage the use of local contractors and workers, using the local job service center, as necessary, and only going outside the region to hire if an adequate pool of candidates cannot be generated.

13.19 Land Status Use/Access

Dudley will minimize disturbance by maintaining as compact an operation as possible. Roads, power lines, and pipelines will be located adjacent to existing compatible linear facilities where practical. All abandoned wells will be plugged utilizing BLM, WOGCC, and WDEQ procedures designed to protect subsurface aquifers.

13.20 Recreation

Only authorized travel will be allowed into the project area. No unauthorized vehicles, personnel, or firearms will be permitted on the site. Plans will be implemented to control public access, such as fencing, gate locking or notice posting to prohibit unauthorized entry. Dudley will also inform their employees, contractors, and subcontractors that long-term camping (greater than 14 days) is prohibited on federal lands or at federal recreation sites.

13.21 Visual Resources

Seminoe Road Project surface facilities will be designed to preserve the view shed from the Seminoe Road and Seminoe Reservoir; and to conform to standards for applicable BLM visual resource management requirements. External lighting will be kept to the minimum required for safety and security purposes. Facilities will be painted to blend with the surrounding landscape.

13.22 Health and Safety

Dudley will consider worker safety as the highest priority of Seminoe Road Project construction and operation. Well and pipeline installations will meet reliability and safety standards set by federal, state and local government agencies. Adherence to such standards will minimize or prevent hazards to Dudley's employees, contractors, and the public and ensure a high level of system reliability.

Appendix B

The NEPA Process

Contents

Appendix B – The NEPA Process [1]

1.0 Introduction

Congress passed the National Environmental Policy Act (NEPA) in 1969 as the "National Charter for the Protection of the Environment" (40 CFR 1500.1). BLM management activities are subject to the provisions set forth in the law.

NEPA is "intended to help public officials make decisions that are based on an understanding of environmental consequences." Projects requiring a permit from a federal agency must meet NEPA requirements.

There are three levels of project analysis available to deciding officials:

(1) Categorical Exclusions

(2) Environmental Assessments

(3) Environmental Impact Statements

Categorical exclusions (CE) are used for routine projects with little risk of environmental effects, and in some emergency situations. Environmental assessments (EA) are used to determine if a proposed project may have **significant** environmental effects. If the significance finding in an EA is positive, an environmental impact statement (EIS) must be prepared.

The BLM determined the proposed Seminoe Road Project might have significant environmental effects as defined under the NEPA; therefore, the BLM decided to prepare an EIS for the Seminoe Road Project.

A discussion of the responsibilities of the BLM, as well as other federal, state, and local agencies, with regard to coalbed methane extraction activities, is set forth in **Appendix D, Agency Jurisdictions (Permits and Approvals)**.

1 This appendix was included to assist individuals and organizations with an overview of NEPA. During the scoping process, there were many questions and misunderstandings about NEPA, its process, and how this law would be applied to the Seminoe Road Project.

2.0 The EIS Process

The environmental analysis actions leading to a final EIS are prescribed by NEPA and consist of the following:

- Scoping;
- Analysis Actions;
- Documentation; and
- Implementation, Mitigation and Monitoring.

2.1 Scoping

The scoping process determines the extent of the environmental analysis necessary for a decision on a project. Elements of the scoping process include the following:

- Describe the proposed action;
- Collect existing data and information about the project and general area;
- Initiate public participation in the EIS process;
- Determine the type and extent of analysis to be used in EIS preparation;
- Identify and initiate contact with involved government agencies and the appropriate responsible officials from each agency;
- Prepare plans for the preparation of the draft and final EIS, including selection of a formal organization for the document;
- Develop a tentative schedule for EIS completion and publication; and,
- Narrow the scope of the EIS to key issues.

As part of scoping, the BLM often cultivates discussions with private citizens, concerned and special interest groups, and government agencies regarding the proposed project.

On March 13, 2003, a Notice of Intent (NOI) to prepare an EIS for the Seminoe Road Project was published in the *Federal Register*; this notice officially began the 60-day scoping period for the project. In addition, the BLM placed notices in local papers and mailed "interested parties" letters to its Rawlins NEPA mailing list announcing the preparation of an EIS for the Seminoe Road Project. See Section 5.0, Rawlins BLM NEPA Mailing List.

The BLM further hosted public scoping "open house" meetings in Hanna, Wyoming on May 7, 2003 and in Rawlins, Wyoming on May 8, 2003, and the following individuals attended:

May 7, 2003 – Hanna, Wyoming

Dwight France

B.J. Kristanson

Bill Nation

Margo Dally

Fred Kelly

May 8, 2003 – Rawlins, Wyoming

Art Zeiger

Jeff Matney

Bill Nation

Bill Shaffer

Tim Mullen

Scott Burgess

Steve Olsen

Jessie Spehar

Ed Griebel

Glendon Merrell

John France

The BLM received eighteen comment letters on the Seminoe Road Project from the following agencies, organizations, and individuals:

- U.S. Department of Health & Human Services – Public Health Service
- USDA Forest Service – Bridger Teton National Forest
- U.S. Department of Energy – Western Area Power Administration
- U.S. Fish & Wildlife Service
- Environmental Protection Agency
- Office of the Governor – State of Wyoming

- Wyoming Game & Fish Department
- Wyoming Department of State Parks & Cultural Resources
- Wyoming DEQ - Air Quality Division
- Southern Ute Indian Tribe
- Petroleum Association of Wyoming
- Biodiversity Conservation Alliance – Wyoming Outdoor Council
- Miller Estate Company
- Anadarko E & P Company LP
- Dwight H. France
- Barbara Parsons

The comments from these letters were used to help identify the issues listed in Chapter 1, Purpose of and Need for Project, of the this EIS.

2.2 Analysis Action

Based on the scoping efforts, the BLM analyzed the nature and significance of the physical, biological, and socioeconomic effects of the proposal and reasonable alternatives.

2.2.1 Collection and Interpretation of Baseline/Background Information

Data collection and interpretation for the Seminoe Road Project was focused on the present and expected physical, biological, and socioeconomic conditions affecting or affected by the proposal. The BLM reviewed and analyzed environmental data and information to ensure adequacy and accuracy.

2.2.2 Development of Alternatives

Besides the proposed action, an EIS must address a No Action Alternative and consider other alternatives.

2.2.2.1 No Action Alternative

NEPA requires that a "No Action" Alternative be considered in EIS documents. This alternative serves as the baseline for estimating the effects of action alternatives. The baseline for the Seminoe Road EIS is the existing condition of the environment today. This accounts for the existing Seminoe Road Pilot Project and the approved transport pipeline. Under this alternative, the proposed coalbed methane "build-out" project on federal lands would be denied.

2.2.2.2 Action Alternatives

As part of the EIS process, alternatives are reviewed. Social and environmental issues, concerns, and opportunities are considered in this review. In developing project alternatives for consideration in the EIS, numerous location, operational methods, and mitigation measures are examined. The type and range of alternatives are determined from public comments and key issues that have been identified during the scoping process, by reviewing the purpose of and need for development, and determining unresolved conflicts involving alternate uses of available resources.

The actual analysis of alternatives is included in the draft EIS and includes a discussion of environmental protection measures, mitigation requirements, and operational constraints. Review of alternatives and understanding of key issues serve as the foundation to meeting the mandate of NEPA.

In 40 CFR 1500.1(b), it is stated:

> *NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the actions in question, rather than amassing needless detail.*

The BLM gathers both public and government input as part of the scoping process. The Record of Decision from the BLM must be based on input from the public and numerous federal, state, and local governmental authorities.

2.2.3 Estimate of Effects of Each Alternative

Direct, indirect, and cumulative effects of the proposed actions are considered. Effects are described in terms of changes in the physical, biological, and socioeconomic environment. These changes are also described by the magnitude, duration, frequency, reversibility, and significance of the effects.

2.2.4 Evaluation of Alternatives

Alternatives are compared on the basis of its impacts on the environment and socioeconomic considerations. This evaluation provides a means of identifying the preferred alternative. Evaluation methods include the use of environmental controls and operational technology as mitigation measures and management considerations to the proposed action.

2.3 Documentation

The BLM documents the EIS process by maintaining an administrative record. Documentation includes the Notice of Intent to prepare the EIS, scoping information, Notices of Availability for the draft and final EIS, the draft and final EIS documents, the Record of Decision, and supporting reference materials.

2.4 Implementation, Mitigation and Monitoring

The BLM reviews input and comments on the draft EIS from the public and interested federal, state, and local government authorities prior to publishing a final EIS.

Proposed development within a project area on public lands is subject to a finding that such development is consistent with the current BLM resource management plan (RMP) for the region.

Although the Seminoe Road Project area is presently being managed under the 1990 Great Divide RMP, this 1990 RMP is currently being revised under the title of Rawlins RMP. The Seminoe Road Project EIS and the Rawlins RMP revision have overlapping schedules; therefore, where possible, the information and analyses needed for these planning efforts are being used for both EIS documents.

Based on comments received on the Seminoe Road Project draft EIS process, the Proponent may elect to modify their proposal before release of the final EIS in order to respond to certain concerns. In addition, the BLM may modify an action alternative or create a new alternative for analysis in the final EIS.

Once alternatives analysis is completed in the final EIS, a Record of Decision (ROD) would be published by the BLM for the project and would render a decision on the project. The ROD is the findings document for the EIS. The ROD would include specific monitoring and mitigation stipulations for the project. If an action alternative is approved in the ROD, the BLM and other federal agencies will consider the final EIS when specific approvals and permits are being considered and may attach additional approval conditions or stipulations designated to further mitigate possible environmental impacts.

In addition, based on the analysis of the EIS and findings in the ROD, environmental monitoring programs may be developed and/or stipulated to respond to site-specific conditions. However, natural gas operations are monitored by various federal, state and local agencies to ensure that environmental safeguards are implemented and maintained.

3.0 Public's Role in the Process

Public involvement and scrutiny are important parts of the scoping and the environmental analysis process. A key component of NEPA is the opportunity for the public to actively participate by commenting during scoping as well as on the draft EIS. This public involvement is typically focused during the scoping process and during the review of the draft EIS.

4.0 Role of Government Agencies and Private Entities

The organization and preparation of the EIS document is developed by the lead agency (BLM) and is based on legal requirements. EIS responsibilities are characterized by the following interrelated entities:

- Lead Agency;
- Cooperating Agency;
- Project Proponent;
- Independent Third Party Contractor; and,

- Interested Agencies.

4.1 Lead Agency

For the preparation of the Seminoe Road Project EIS, the BLM is the federal lead agency.

The BLM has several levels of responsibility established in order to fully meet its NEPA obligations. The Wyoming State Director of the BLM is the NEPA authorized officer for the project and will decide whether of not to allow natural gas development on public lands in the project area. The Wyoming State Director is also directly responsible for NEPA compliance regarding the scope and content of the EIS. The Director will make decisions to approve or disapprove natural gas development on public lands once the EIS is finalized.

The BLM assigned Mr. David Simons as the EIS project lead to oversee the various aspects of the EIS effort including study design, public involvement, review of data collection and analysis, and the final content of the EIS. Mr. Simons is serving as the primary liaison among the BLM, the third-party contractor, and other agencies and organizations.

The BLM has selected specialists for the Interdisciplinary (ID) Team for the Seminoe Road EIS. The primary responsibilities of the ID Team are to help develop the scope of work, furnish guidance to the third-party contractor, and participate in the evaluation and presentation of data leading to the final EIS and the Record of Decision. They are also be responsible for working with the technical specialists of the third-party contractor, miscellaneous other interested government agency personnel, and various other organizations in the area of their expertise.

4.2 Cooperating Agencies

The Saratoga-Encampment-Rawlins Conservation District (SERCD) is a cooperating agency with the BLM on the Seminoe Road Project EIS. As such, SERCD officials provided input into the EIS process and documents.

4.3 Project Proponent

Dudley & Associates (Dudley) is the project proponent.

During the summer of 2001, Dudley completed construction of the Seminoe Road Pilot Project, which consisted of sixteen pilot production wells and one pressure observation well. For this Pilot Project, the BLM prepared an environmental analysis for the Seminoe Road Coalbed Methane Pilot (Seminoe Road Pilot) Project (WY-030-EA00-288).

When many of these Pilot Project wells began to show the promise of gas production, Dudley pursued and received approval for a gas compressor facility and a gas-gathering pipeline that could deliver gas to a commercial gas transmission pipeline. The BLM prepared an environmental analysis for the Seminoe Road Coalbed Methane Natural Gas Gathering Pipeline/Access Road and Compressor Station/Storage Yard/Access Road (Seminoe Road Pipeline) Project (WY-030-EA2-229). The construction of these facilities is pending.

Dudley continued to analyze Pilot Project results, and, in September of 2002, the company notified the BLM Rawlins Field Office of its desire to expand drilling, develop coalbed methane natural gas wells, and install associated facilities within the firm's lease holdings in the area. It was this notification that triggered the preparation of an EIS.

As a result of their role as project proponent for the development and operation of coalbed methane extraction from their leases in the project area, Dudley has been responsible for preparation of project development and operational plans. In addition, Dudley is providing the BLM and other appropriate regulatory agencies with environmental information and data required to address the environmental impacts of potential development on their leases.

Dudley is also responsible for funding an independent consulting firm to assemble the EIS and related documents. The BLM conducts the assessment and prepares the documents with the assistance of a contractor.

4.4 Independent Third-Party Contractor

The independent third-party contractor for the Seminoe Road EIS is S. Edwards Inc. (SEI) and assists the BLM in the preparation of the EIS. The contractor obtains data, assists in alternative development, and documents the analysis leading to the final EIS. An SEI project manager acts as the liaison with the BLM. This manager oversees his own group of resource and technical specialists who are assisting the BLM in analyzing data, estimating effects, recommending mitigation measures, and developing the technical sections of the draft and final EIS documents.

4.5 Interested Agencies

The BLM has contacted the following federal, state, and local agencies regarding the Seminoe Road EIS:

- Environmental Protection Agency;
- U.S. Fish and Wildlife Service;
- U.S. Forest Service;
- U.S. National Park Service;
- U.S. Army Corps of Engineers;
- U.S. Department of Energy – Western Area Power Administration;
- U.S. Bureau of Reclamation;
- Wyoming Department of Environmental Quality – Air Quality Division;
- Wyoming Department of Environmental Quality – Water Quality Division;
- Wyoming Department of Environmental Quality – Land Quality Division;
- Wyoming State Engineer's Office;
- Wyoming Game & Fish Department;
- Wyoming Department of State Parks & Cultural Resources;
- Wyoming State Historical Preservation Office;
- City of Rawlins; and,
- Carbon County.

The participation of these agencies on the EIS is based upon their interest, their legal requirements involved with potential future permitting responsibilities, and their expertise. The BLM has submitted a draft EIS to these agencies to solicit their comments and to ensure that relevant issues are addressed.

5.0 EIS Mailing List

The BLM Rawlins Field Office maintains a NEPA mailing list of agencies, organizations, and individuals to whom NEPA notices are mailed.

Appendix C

Great Divide Resource Management Plan Analysis

Appendix C – Great Divide Resource Management Plan Analysis

A January 14, 2005 review of the Wyoming Oil & Gas Conservation Commission (WOGCC) database for the Rawlins Field Office (RFO) revealed a total of 3,292 wells on state, federal and privately held surface in the RFO that are active (this includes dormant wells [43], completed wells [2,951], notices of intent to abandon [57], and spuds [241]). The number of spuds are those wells where applications to permit drilling (APD) are approved and notice has been received that drilling has been initiated, but there is no report yet of the wells being completed or plugged and abandoned. The total count of 3,292 wells goes back to the beginning of oil and gas production within the RFO in 1911. From the Great Divide Resource Management Plan (RMP) EIS (Assumptions for Analysis, Chapter 4, page 220), the number of wells existing at the time the RMP draft EIS (USDI-BLM 1987) was 3,671 wells drilled in the planning area on all ownership; and, of these, 1,896 wells were dry and abandoned. That left 1,775 wells (3,671 minus 1,896) active prior to the RMP. Subtracting this figure from the 3,292 wells currently in the RFO according to the WOGCC leaves 1,517 active producing wells since the RMP EIS. **See Table C-1, Well Status Summary-Rawlins Field Office.**

Table C-1, Well Status Summary – Rawlins Field Office[1]

Status	Federal	Fee or State	Total	Wells Present
Plugged & Abandoned	1,355	1,634	2,989	
Dormant Wells	20	23	43	43
Completed Wells	1,433	1,518	2,951	2,951
Monitoring Wells	0	0	0	
Notice of Intent to Abandon	19	38	57	57
Spuds	118	123	241	241
Expired Permits	788	455	1,243	
Permits to Drill	423	232	655	
Permits Issued	4,161	4,023	8,184	
Total	**4,151**	**4,025**	**8,176**	**3,292**

Notes:
1. Information in this table was obtained from WOGCC on January 14, 2005.

Plugged and abandoned (P&A) wells are well pads that were drilled and at some point abandoned. To enter into P&A status, the wells must be plugged, abandoned, reclaimed and subsequently inspected and accepted as reclaimed by the BLM. Wells in the status of “notice of intent to abandon” (NOIA) fit into two categories: (1) plugged, abandoned, and awaiting final reclamation or (2) plugged, abandoned, reclaimed and awaiting acceptance by the BLM or applicable land manager. For the purposes of this analysis, no NOIA wells are considered reclaimed.

Analysis of 26 wells drilled under the Desolation Flats (DFPA) interim drilling program as of January 2004 shows that long-term disturbance has averaged 6.3 acres/well. This includes well pads and roads. This comes from actual experience from the DFPA. This figure contrasts with the simple average of 3.0 acres of long-term disturbance projected from the five natural gas projects listed in **Table C-2, Long-Term Disturbance Figures for Existing Oil and Gas Development NEPA Documents**.

Table C-2, Long-Term Disturbance Figures for Existing Oil and Gas Development NEPA Documents

Project Title	Wells Approved to Drill[1]	Wells Drilled to Date[1]	Authorized Wells Remaining	Average Disturbance Per Well[2] (acres)	Authorized Disturbance Remaining (acres)
Sierra Madre	46	38	8	1.95	16
Continental Divide / Wamsutter II	1,200	964	236	2.9	684
South Baggs	50	15	35	2.03	71
Desolation Flats[3]	250	31	219	6.5	1,424
Atlantic Rim	113	86	27	1.9	52
Totals			**525**	**NM**	**2,247**

Notes:
1. Dormant, completed, notice of intent to abandon, and wells spud combined
2. Estimate from environmental analysis document.
3. Desolation Flats at 6.5 acres is considerably larger than the other. This is due to the exploratory nature of the play as compared to the other projects. 1.5 miles of new road per well were projected.

To convert the current number of wells (1,517) to current acres disturbed long-term, the well number was multiplied by 6.5 acres disturbed per well. 1,271 wells x 6.5 acres per well = 9,861 acres of long-term disturbance to date within the RFO under the Great Divide RMP.

Currently, there are five projects in the RFO where drilling and production activities are authorized but not yet completed. These wells and associated disturbances need to be considered before a determination of the number of wells remaining under the RFD scenario described in the RMP can be made. Simply adding in the acres of disturbance approved would double count wells already constructed and listed in the WOGCC database read-out. See **Table C-2, Long-Term Disturbance Figures for Existing Oil and Gas Development NEPA Documents**, for a summary of the oil and gas development projects with wells authorized but not completely drilled.

Table C-2, Long-Term Disturbance Figures for Existing Oil and Gas Development NEPA Documents, shows that approximately 525 wells and 2,247 acres of disturbance remain to be completed under existing authorizations for these projects. The well count for wells remaining to be drilled was taken on January 14, 2005 from the WOGCC on-line database.

The total disturbance then for existing and authorized (but not yet drilled) wells is 2,247 acres plus 9,861 acres = 12,107 acres of long-term disturbance either existing or authorized. Reasonably foreseeable development for oil and gas activity within the RFO administrative area as described in the Great Divide RMP (BLM 1988a) was projected to include 1,440 new wells (16,092 acres of long-term disturbance) over a 20-year period (1986-2005). As stated above, 12,107 acres of disturbance are either existing or authorized within the RFO. Long-term disturbance acreage available for future, as yet unauthorized oil and gas related disturbance within the RFO area would be 3,985 acres (16,092 minus 12,107).

Wells that are drilled but not successful are short-term disturbance that would be completely reclaimed following plugging and abandonment. Successful wells would have short-term disturbance during construction and drilling, and long-term disturbance over a smaller area during the operational phase of their life.

Appendix D
Agency Jurisdictions
(Permits and Approvals)

Contents

Tables

Appendix D– Agency Jurisdictions (Permits and Approvals)

1.0 Introduction

Coalbed natural gas development and operations in Wyoming require a number of federal, state and local permits and approvals. See **Table D-1, List of Tentative Permits and Approvals for Coalbed Methane Operations**.

Preparation of an environmental impact statement (EIS) and the actual permitting processes are related but distinctively separate. An EIS is designed to explore alternatives and discuss environmental impacts, but the EIS is not a permit nor does an EIS constitute an approval for a particular project. See **Appendix B, The NEPA Process**.

The permitting or approval processes give individual federal government decision makers the authority to grant, conditionally grant, or deny individual permit applications. Permits may be granted with requirements and conditions to eliminate and/or mitigate specific adverse impacts pursuant to their individual regulations and guidelines.

2.0 Bureau of Land Management Responsibility

The Bureau of Land Management (BLM) typically serves as the lead agency in EIS processes that assess large-scale coalbed natural gas development and operational activities on the public lands that are administered by the BLM.

In the case of the Seminoe Road Project EIS, the BLM Wyoming State Director is responsible to ensure that the National Environmental Policy Act (NEPA) is implemented correctly and is the responsible official for selecting an alternative, defining mitigation measures, outlining any monitoring tasks and issuing the Record of Decision (ROD) for any development and operation.

Prior to the start of any drilling activities on BLM-administered lands, an applicant must submit to the BLM site-specific plans for the drilling, testing, completing and equipping process including but not limited to location surveys showing the area to be disturbed for access roads, drill pads, topsoil piles, pits, drilling and related down hole procedures (including safety plans) and any other information the applicant or the BLM deems relevant to the process.

Table D-1, List of Tentative Permits and Approvals for Wyoming Coalbed Methane Operations

Agency	Permit, Approval, or Action	Authority
Federal Government		
Bureau of Land Management (BLM)	Permit to drill, deepen, or plug back on BLM-managed land (APD process)	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 C.F.R. 3162)
Bureau of Land Management (BLM)	ROW grants and temporary use permits for pipelines on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 185); Onshore Oil and Gas Unit Agreements: Unproven Areas, as amended (43 C.F.R. 3180)
Bureau of Land Management (BLM)	ROW grants for access roads on BLM-managed land	*Federal Land Policy and Management Act* (43 U.S.C. 1761-1771); Right-of-Way, Principles and Procedures, as amended (43 C.F.R. 2800)
Bureau of Land Management (BLM)	Authorization for flaring and venting of natural gas on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 C.F.R. 3162)
Bureau of Land Management (BLM)	Plugging and abandonment of a well on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 C.F.R. 3162)
Bureau of Land Management (BLM) (Continued)	Antiquities and cultural resource permits on BLM-managed land	*Antiquities Act of 1906*, as amended (16 U.S.C. 431-433); *Archaeological Resources Protection Act of 1979*, as amended (16 U.S.C. Sections 470aa-47011); Preservation of American Antiquities, as amended (43 C.F.R.3)
Bureau of Land Management (BLM) (Continued)	Approval to dispose of produced water on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Special Provisions, as amended (43 C.F.R. 3164); Onshore Oil and Gas Order No. 7, as amended (58 Fed. Reg. 47,354)
U.S. Army Corps of Engineers	Section 404 permits and coordination regarding placement of dredged or fill material in area waters and adjacent wetlands	Sections 404 of the *Clean Water Act of 1972*, as amended (33 U.S.C. 1344); Section 404(b)(1) Guidelines for Specification so f Disposal Sites for Dredged or Filled Material, as amended (40 C.F.R. 230)
U.S. Bureau of Reclamation	Right-of-use authorization	Regulations @43 CFR 429
U.S. Fish and Wildlife Service (USFWS)	Coordination, consultation and impact review on federally listed threatened and endangered (T&E) species	*Fish and Wildlife Coordination Act* (16 U.S.C. 661-666c); Section 7 of the *Endangered Species Act of 1973*, as amended (16 U.S.C. 1536); *Bald Eagle Protection Act* (16 U.S.C. 668-668dd)
U.S. Fish and Wildlife Service (USFWS)	Migratory bird impact coordination	*Migratory Bird Treaty Act* (16 U.S.C. 704)

Agency	Permit, Approval, or Action	Authority
U.S. Department of Transportation	Control pipeline maintenance and operation	Transportation of Natural and Other Gas by Pipeline, Annual Reports, Incident Reports, and Safety Related Condition Reports, as amended (49 C.F.R. 191); and Transportation of Natural and Other Gas by Pipeline: Minimum Safety Standards, as amended (49 C.F.R. 192)
State Government		
Wyoming Department of Environmental Quality – Water Quality Division	Permits to construct settling ponds and waste water systems, including groundwater injection and disposal wells	*Wyoming Environmental Quality Act,* Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311)
Wyoming Department of Environmental Quality – Water Quality Division (Continued)	Regulate disposal of drilling fluids from abandoned reserve pits	*Wyoming Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311)
	NPDES permits for discharging produced water and storm water runoff	WDEQ-WQD Rules and Regulations, Chapter 18, *Wyoming Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311); Section 405 of the *Federal Water Pollution Control Act (Clean Water Act)* (codified at 33 U.S.C. 1345): EPA-administered Permit Programs: NPDES, as amended (40 C.F.R. 122); State Program Requirements (40 C.F.R. 123): EPA Water Program Procedures for Decision-making, as amended (40 C.F.R. 124)
	Administrative approval for discharge of hydrostatic test water	*Wyoming Environment Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311)
Wyoming Department of Environmental Quality – Air Quality Division	Permits to construct and permits to operate	*Clean Air Act*, as amended (42 U.S.C. 7401 et seq.); *Wyoming Environmental Quality Act*, Article 2, Air Quality, as amended (W.S. 35-11-201 through 35-11-212)
Wyoming Department of Environmental Quality – Land Quality Division	Mine permits, impoundments, and drill hole plugging on state lands	*Wyoming Environmental Quality Act*, Article 4, Land Quality, as amended (W.S. 35-11-401 through 35-11-437)
Wyoming Department of Environmental Quality – Solid Waste Division	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations	*Wyoming Environmental Quality Act*, Article 5, Solid Waste Management, as amended (W.S. 35-11-501 through 35-11-520)
Wyoming Department of Transportation	Permits for oversize, over length, and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
	Access permits to state highways	Chapter 13 of the Wyoming Highway Department Rules and Regulations
Wyoming Oil and Gas Conservation Commission / Wyoming Board of Land Commissioners / Land and Farm Loan Office	Approval of oil and gas leases, ROWs for long-term or permanent off-lease / off-unit roads and pipelines, temporary use permits, and developments on state lands	Public Utilities, W.S. 37-1-101 et seq.

Agency	Permit, Approval, or Action	Authority
WOGCC	Permit to drill, deepen, or plug back (APD process)	WOGCC Regulations, Chapter 3, Operational and Drilling Rules, Section 2 Location of Wells
	Permit to use earthen pit (reserve pits)	WOGCC Regulations, Chapter 4, Environmental Rules, including Underground Injection Control Program Rules for Enhanced Recovery and Disposal Projects, Section 1, Pollution and Surface Damage (Forms 14A and 14B)
	Authorization for flaring or venting of gas	WOGCC Regulations, Chapter 3, Operational and Drilling Rules, Section 45 Authorization for Flaring or Venting of Gas
	Permit for Class II underground injection wells	Underground Injection Control Program: Criteria and Standards, as amended (40 C.F.R. 146); State Underground Injection Control Programs, State-administered program – Class II Wells, as amended (40 C.F.R. 147.2551)
	Well plugging and abandonment	WOGCC Regulations, Chapter 3, Section 14, Reporting (Form 4); Section 15, Plugging of Wells, Stratigraphic Tests, Core, or Other Exploratory Holes (Form 4)
	Change in depletion plans	*Wyoming Oil and Gas Act*, as amended (W.S. 30-5-110)
Wyoming State Engineer's Office	Permits to appropriate ground water (use, storage, wells, dewatering)	W.S. 41-3-901 through 41-3-938, as amended (Form U.W. 5)
Wyoming State Historic Preservation Office	Cultural resource protection, programmatic agreements, consultation	Section 106 of *National Historic Preservation Act of 1966*, as amended (16 U.S.C. 470 et seq.) and Advisory Council Regulations on Protection of Historic and Cultural Properties, as amended (36 C.F.R. 800)
Local Government		
Carbon County		
	Construction/use permits	County Code and Zoning Resolution
	Conditional use permits	County Code and Zoning Resolution
	Road use agreements/oversize trip permits	County code
	County and crossing/access permits	County Code/Engineering Department
	Small wastewater permits	County Health Department
	Hazardous material recordation and storage	County Code
	Zone changes	Zoning Resolution
	Filing fees	County Code
	Noxious weed control	County Code

The proposed development sites must be staked in the field and inspected by the BLM to ensure consistency with the application and that the environmental resources are evaluated in such a way that the proposed operations comply with the Resource Management Plan for the specific drilling area, as well as any site-specific EIS decisions made for the project.

Two procedural options are available to the applicant for securing approval to drill:

- A Notice of Staking (NOS)
- An Application for Permit to Drill or Re-enter (APD)

The NOS system, properly coordinated at the beginning of the action, may expedite final permit approval; however, the APD system is the most familiar to oil and gas operators and often requires less coordination effort at the start. The choice of which option to use is the decision of the applicant.

Access roads and pipelines located on federal surface outside the leasehold or the unitized area require a right-of-way (ROW) for BLM-administered lands. The NOS or APD for BLM land will be accepted as a ROW application for these off-lease facilities and the application should detail the entire development proposal.

At the NOS or APD on site inspection, the operator will be provided the Form 2800-14 (ROW/Temporary Use Permit) containing standard items and conditions, ad Form 1323-2 (ROW Cost Recovery and Fee Determination Record) for any ROWs involved on BLM-administered land. Complete APD applications involving a BLM ROW should include a signed Form 2800-14 and any required ROW cost recovery fees. APD conditions of approval will also apply to ROW portions of the permit.

The NOS, APD, and ROW applications will be revised as necessary per negotiations with the BLM. The BLM may approve or deny site-specific proposals and any such conditions of approval will be attached to and become part of each permit. Upon receipt of final BLM approval, the operator could commence with proposed activities.

3.0 U.S. Army Corps of Engineers' Responsibilities

The Corps of Engineers is responsible for issuing permits under Section 404 of the Clean Water Act which requires permits for the "discharge of dredged or fill material into navigable waters." Guidelines promulgated by the Environmental Protection Agency (EPA) under Section 404(b)(1) generally prohibit the discharge of dredged or fill materials into "Waters of the United States" unless it can be shown that the discharge is the least environmentally damaging practicable alternative to achieve the basic purpose of the proposed project.

The term "Waters of the United States" is broadly defined as waters that are or could be used in interstate or foreign commerce. In addition to territorial seas and interstate waters, this includes other waters such as lakes, mud flats, sloughs, and wetlands, which are or could be used in interstate or foreign commerce. To the degree that they impact "Waters of the United States," various activities associated with coalbed methane operations, such as road construction or upgrades, well pad site development and construction, staging area construction sites, compressor station sites, etc., may require a Section 404 Permit.

The Corps of Engineers must comply with Executive Orders 11990 and 11998 with respect to impacts to the nations wetlands and/or floodplains. The "no net loss" wetlands policy is outlined in an agreement between Corps of Engineers and the EPA. The policy goal of the no net loss to wetland acreage or function is implemented primarily through permit review.

Two types of permits apply to wetland fill proposals. These are nationwide permits and individual permits. Nationwide permits can be authorized for a number of low-impact actions, but these permits carry a number of standard mitigation measures. If the affected area is not isolated wetlands or wetlands above the headwaters, or if the proposed activity would affect more than 0.5 acres of jurisdictional wetlands, an individual permit is required.

In reviewing Section 404 permit applications, the Corps of Engineers must evaluate whether the benefits from the project outweigh the predicted environmental impacts. This is called a "public interest review." Factors considered during the public interest review include the following:

- Basic project purpose and need;
- Water dependency;

- Availability of practicable alternatives, taking into consideration cost, logistics, and technology; and,
- Environmental impacts.

The Corps of Engineers evaluate whether the proposal is the least environmentally damaging practicable alternative. It may be necessary to include mitigation measures that will reduce impacts to the aquatic environment to an acceptable level. These measures may include avoiding fills to reducing the area of fill, creating or restoring aquatic environments, and/or enhancing the value of an existing aquatic area.

4.0 Environmental Protection Agency Responsibilities

NEPA documents, such as the Seminoe Road Project draft EIS, the final EIS, and the ROD completed by the BLM will be filed with the Environmental Protection Agency (EPA).

In addition to its NEPA oversight responsibilities, the EPA has responsibilities involved with the following:

- Clean Water Act; and
- Clean Air Act.

4.1 Clean Water Act

The Clean Water Act has established the following surface water programs, which may concern coalbed natural gas operations:

- The NPDES permit program regulating the point source and storm water discharge of pollutants, including sediment;
- The Section 404 permit program regulating the discharge of dredged or fill material; and,
- The Section 311 program regulating spills of oil and hazardous substances.

EPA established the National Pollutant Discharge Elimination System (NPDES) program for regulating surface water quality. The Federal Water Pollution Control Act Amendments of 1972 and supplement amendments and re-authorization principally established this program. In its amended and re-authorized form, this statute as a whole is now generally referred to as the Clean Water Act.

Section 402 of the Clean Water Act establishes the NPDES permit program. The Wyoming Department of Environmental Quality is the permitting authority in the state of Wyoming for the issuance of NPDES permits pursuant to Section 402 of the Clean Water Act.

Section 404 of the Clean Water Act authorizes the Corps of Engineers to issue permits "for the discharge of dredged or fill materials into navigable waters." These permits are addressed under 14.2, U.S. Army Corps of Engineers Responsibilities. The EPA is responsible for reviewing the consistency of any proposed 404 action with Section 404(b)(1) guidelines.

Section 311 of the Clean Water Act establishes requirements relating to discharges or spills of oil or hazardous substances. Discharges or spills of oil in "harmful quantities" are prohibited. The EPA has established a requirement for the preparation of a spill prevention control and countermeasure (SPCC) plan by facilities that handle substantial quantities of oil.

4.2 Clean Air Act

In addition to water quality oversight, the EPA also maintains control over the air resources as outlined in the Clean Air Act. The Clean Air Act's most basic goals are to protect public health and welfare. The EPA can comment on, but is not responsible for, a new source (air quality) construction permit issued by the Wyoming Department of Environmental Quality.

5.0 U.S. Fish and Wildlife Service Responsibilities

The U.S. Fish and Wildlife Service administers the Endangered Species Act, as re-enacted in 1982, and the Bald Eagle Protection Act of 1940, as amended.

On coalbed methane projects, the BLM must consult with the U.S. Fish and Wildlife Service regarding any federally listed threatened or endangered species that might be impacted by proposed operations. This is known as the Section 7 Consultation.

If needed, a biological assessment will be prepared by the BLM for any federally listed threatened or endangered species, and this document will be submitted to the U.S. Fish and Wildlife Service. If adverse impacts to threatened or endangered species are projected, specific design measures to protect the affected species may need to be developed.

6.0 Bureau of Reclamation Responsibilities

The U.S. Bureau of Reclamation manages dams, hydro-electric power stations, canals and reservoirs in seventeen western states, including Wyoming. These include the Seminoe, Kortes and Pathfinder dams on the North Platte River. See **Appendix E, Regional Activity**.

In compliance with 43 CFR 429, government agencies, corporations and the public may submit an application for right-of-use authorization to use Bureau of Reclamation Lands or the surfaces of any project body of water. Consideration of Applications to use Bureau of Reclamation project lands and water surfaces is completely discretionary, and the Bureau of Reclamation reserves the right to refuse authorization of any use which may be incompatible with the federally-authorized purposes of the Bureau of Reclamation project or interferes with the Bureau's rights or operations.

7.0 Advisory Council on Historic Preservation Responsibilities

A copy of both the draft EIS and final EIS documents must be filed with the Advisory Council on Historic Preservation. This agency works in an advisory role to assist the BLM with compliance with the National Historic Preservation Act and the American Indian Religious Freedom Act. In addition, the Wyoming Department of State Parks & Cultural Resources, Wyoming State Historic Preservation Office will give concurrence with any agency determined cultural impacts. The Advisory Council on Historic Preservation would be available to serve in an advisory role if requested by the Wyoming agency. The Advisory Council on Historic Preservation may also review state program activities and determine relative compliance to the previously mentioned National Historic Preservation Act.

8.0 Wyoming Department Of Environmental Quality – Air Quality Division Responsibilities

The Wyoming Department of Environmental Quality, Air Quality Division has review and approval authority over new source construction or additions or modifications to existing sources for releasing contaminants into the air. The Air Quality Division has regulatory responsibility for the permits to construct, operate and prevent significant deterioration of air resources.

8.1 Permit to Construct

This permit requires the applicant to submit an emissions inventory listing sources and amounts of air pollution released, an analysis of best available control technology, and a demonstration that ambient air quality standards, including levels for toxic air pollutants will not be exceeded. The statutory authority for new source construction approval is the Wyoming Environmental Quality Act, Article 2, Air Quality Act and subsequent regulations.

8.2 Permit to Operate

The Wyoming DEQ Air Quality Division has a comprehensive air operating permit program, which is consistent with the requirements of Title V of the Federal Clean Air Act. Facilities will be required to obtain operating permits within six months of the issuance of construction activities.

8.3 Prevention of Significant Deterioration

The basic objective of the prevention of significant deterioration (PSD) air quality program is to prevent substantial degradation of air quality in areas that are in compliance with national ambient air quality standards, while maintaining a margin for future growth. As part of the new source review, PSD applicability is determined.

Criteria that trigger the requirements for a PSD permit vary depending on the type of facility. Pollutants can include both particulate (dust) and gaseous (SO_2, CO_2, NO_x, and HC) emissions.

Specific information on PSD requirements can be found in 40 CFR 52.221.

9.0 Wyoming Department Of Environmental Quality – Water Quality Division Responsibilities

Under authority delegated by the EPA, and requirements in the Wyoming Environmental Quality Act, Article 3, Water Quality, the Wyoming DEQ, Water Quality Division regulates the discharge of pollutants into Wyoming's surface waters through the NPDES and stormwater runoff permit programs.

An application for an individual NPDES permit requires information on water supply volumes, water utilization, waste water flow characteristics and disposal methods, planned improvements, storm water treatment, plant operation, materials and chemicals used, production, and other related information.

Operations for which EPA has not promulgated storm water effluent limits are required to obtain coverage under a general storm water permit issued by the Wyoming DEQ, Water Quality Division.

10.0 Wyoming State Engineer's Office Responsibilities

The State Engineer's office considers coalbed natural gas production different than traditional natural gas production, given the necessity for water production to allow the release of the gas resource. The intentional production (or appropriation) of groundwater for coalbed natural gas production lead to the designation of coalbed natural gas as a beneficial use of water and, subsequently, to a requirement for a permit to appropriate the groundwater.

Prior to drilling a well for the purpose of extracting natural gas from coalbeds, a groundwater (well) permit must be obtained from the Wyoming State Engineer. The proponent for the coalbed natural gas wells will need to file Form U.W.5 with the State Engineer. The beneficial use of this water, as stated on the application form, is water produced in the production of coalbed natural gas. Unless specified in the well permit, there is no other beneficial use of this produced water authorized by the issuance of the well permit. In addition, unless specified in the groundwater permit, coalbed natural gas produced water has no other implied use and is considered to be unappropriated waters of the State of Wyoming. If the coalbed natural produced water is discharged and not used for any other beneficial purposes, the Wyoming State Engineer requires no further groundwater permitting.

If the coalbed natural produced water is used for purposes other than coalbed methane production, these uses must be specified in the well application at the time of filing. If the produced water is to be stored in an impoundment, surface water reservoir filing procedures must be followed unless there are no other beneficial uses of the water and the impoundment is located off the channel of a natural water course. Under these specific conditions, the Wyoming Oil and Gas Conservation Commission (WOGCC) rules apply. See Section 12.0, Wyoming Oil and Gas Conservation Commission.

Coalbed natural proponents seeking to store produced water or put produced water to some beneficial use should consult the April 26, 2004 revised interim policy memo issued by the Wyoming State Engineer's office detailing permitting requirements for water produced during the recovery of coalbed natural.

11.0 Wyoming Department Of State Parks And Cultural Resources – Division Of State Parks & Historic Sites Responsibilities

The Wyoming State Historic Preservation Office also must be consulted when projects are subject to review under Section 106 of the National Historic Preservation Act of 1966. This act requires that all federal agencies take into account the effect of their actions on historic properties. The Wyoming State Historic Preservation Office should be consulted to determine if the site has been surveyed, if there are identified historic resources on site, and if the property is listed or eligible for listing on the National Register of Historic Places. If the project will adversely affect property that meets the National Historic Register criteria, the Wyoming State Historic Preservation Office will recommend ways to avoid or mitigate that adverse affect. Also see **Appendix M, Cultural Resources Management Plan.**

12.0 Wyoming Department Of Transportation Responsibilities

The Wyoming Department of Transportation is responsible for compliance with Wyoming state requirements for road design and construction. This agency's responsibilities include review and approval of applications for any upgraded road access permits. The Wyoming Department of Transportation also monitors traffic loads on highways to ensure that proper maintenance is completed and that any future highway expansions to handle traffic are budgeted.

13.0 Wyoming Oil And Gas Conservation Commission

The WOGCC has jurisdiction and authority to promote the responsible development of Wyoming's oil and gas natural resources. This agency's responsibilities include approval of oil and gas leases, granting ROWs for long-term or permanent off-lease/off-unit roads, permits to drill, deepen or plug back wells (APD process), permits for Class II underground injection wells, and eventual well plugging and abandonment. See **Table D-1, List of Tentative Permits and Approvals for Wyoming Coalbed Methane Operations**.

The WOGCC has overall responsibility for a number of activities, including:

- The efficient exploration, development, production, and conservation of Wyoming's oil and natural gas resources;
- The protection of public health, safety and welfare, the environment, and mineral owners correlative rights;
- The coordination with and maintenance of working relationships with those having an interest in Wyoming's oil and natural gas resources; and,
- The responsibility to provide information to support oil and natural gas decision-making activities within the State of Wyoming.

The WOGCC maintains a staff to implement its permitting, approval, oversight, and informational mandates.

14.0 Saratoga-Encampment-Rawlins Conservation District

The Saratoga-Encampment-Rawlins Conservation District (SERCD) is serving as an EPA cooperating agency with the BLM on the Seminoe Road Project EIS

The SERCD is a member of the Wyoming Association of Conservation Districts whose mission incorporates the following principles:

- Conservation of soil and water resources;
- Control of soil erosion;
- Protection of water quality;
- Reduction of siltation of stream channels and reservoirs;
- Wise use of water and all other natural resources;
- Preservation and enhancement of wildlife habitat;
- Protection of tax base; and,
- Promotion of the health, safety and general welfare of citizens through a responsible conservation ethic.

15.0 Carbon County

Carbon County has zoning requirements, which are overseen by the Carbon County Planning Department and County Commissioners. No special use permit is required for this project.

Carbon County does require permits to construct permanent buildings. The applications for building permits require detailed plans for structures including electrical plans, plumbing plans, floor layout, sewage facilities, drainage plans, size and shape of the buildings, access, size and shape of the foundation walls, beams, air vents, window access, and heating and cooling mechanical aspects. Permits are issued upon approval of the plans. The county may inspect the buildings during construction.

Appendix E

Regional Activity

Contents

Tables

Figures

Appendix E – Regional Activity

1.0 Introduction

A number of activities have, are, or will occur in the areas within and adjacent to the Seminoe Road Project. These activities involve oil and gas activities, coal mining, power generation from hydro-electric generating power stations, electric transmission, recreation, and agricultural activities. See **Figure 19, Regional Activity**.

2.0 Oil and Gas Activities

Oil and gas production, development and exploration continue in Wyoming. A listing of oil and gas projects previously and currently under review by the BLM in southern Wyoming are set forth in **Table E-1, Projects Analyzed Under NEPA in Southern Wyoming**.

3.0 Oil Refining

The Sinclair Oil Refinery is located in Sinclair, Wyoming. The Sinclair Oil Corporation purchased the refinery from Pasco Corporation in 1976. The refinery is capable of processing approximately 54,000 barrels of crude oil per day into fuels and asphalt.

4.0 Oil and Gas Pipelines

Two major pipelines presently exist in the area within and adjacent to the Seminoe Road Project. Another major new natural gas transmission pipeline that would parallel I-80 across southern Wyoming is under consideration.

4.1 Conoco Pipeline

Conoco Oil and Refining Company owns and operates a refined oil pipeline which traverses through the Seminoe Road Project. This pipeline is part of the Seminoe pipeline system which connects refineries in Billings, Montana and Sinclair, Wyoming (about 335 miles).

Table E-1, Projects Analyzed Under NEPA in Southern Wyoming

Project	Date ROD/DR Signed	Number of Wells Existing When EIS/EA Was Written	Number of Wells Allowed by ROD/DR	Number of Wells Drilled Since ROD/DR[2]	Dry Hole, Depleted or Plugged & Abandoned[2]	Completed but not Production[(2)]	Producing Wells	Remaining Wells That Can Still Be Drilled (RFD)[1]
Riley Ridge	1/25/84	10	238	19	5	1	23	224
Burley	6/7/94	15	32	19	3	0	31	16
Jonah II Field	4/27/98	88	450	41	0	0	129	321
Coordinated Activity Plan Area	8/16/91	1,080	500	409	354	0	1,135	445
Soda Unit	4/12/89	4	17	0	1	0	3	18
Castle Creek	10/24/83	2	16	6	0	0	8	10
Moxa Arch	3/7/97	849	1,325	163	62	0	947	1,227
Hickey Mountain	5/13/87	16	70	19	9	10	26	50
Road Hollow	9/83	1	9	8	5	0	4	6
Fontenelle	8/16/96	907	1,292	151	6	6	1,052	1,141
Stagecoach	9/27/95	5	72	8	1	9	9	59
East LaBarge	5/29/92	83	28	19	1	83	19	9
Bird Canyon	6/25/93	6	14	6	0	6	6	8
Essex Mountain	8/4/95	0	3	0	0	0	0	3
Bravo Unit	7/20/95	3	10	6	1	3	7	4
Mulligan Draw	9/23/92	11	40	12	3	11	17	23
Creston Blue Gap	10/4/94	202	200	100	3	7	234	175
Dripping Rock/Cedar Break	4/3/85	11	58	20	2	11	24	34
Sierra Madre	9/21/87	16	46	27	2	16	30	16
Hay Reservoir	6/24/92	36	26	20	2	20	40	2
Jack Morrow Hills	Pending	66	110[4]	NA	14	20	46	110
Continental Divide/Greater Wamsutter	7/20/95	845	3,000[4]	277	13	0	328	2,685
Pinedale Anticline	7/27/2000	41	700[3]	105	1	0	85	616
South Baggs	Pending	17	90[4]	NA	13	1	16	90
Upper Green River – USFS MA 72	Pending	23	17[4]	NA	23	0	0	10
Hoback Basin – USFS MA 21	Pending	8	87[4]	NA	8	0	0	10
Bitter Creek Shallow Gas Project Area	Pending	14	NA	NA	64	6	14	NA
Pacific Rim Shallow Gas	Pending	0	150	NA	0	0	0	NA

Project	Date ROD/DR Signed	Number of Wells Existing When EIS/EA Was Written	Number of Wells Allowed by ROD/DR	Number of Wells Drilled Since ROD/DR[2]	Dry Hole, Depleted or Plugged & Abandoned[2]	Completed but not Production[(2)]	Producing Wells	Remaining Wells That Can Still Be Drilled (RFD)[1]
Copper Ridge	Pending	0	89	NA	0	0	0	NA
Vermillion Basin	8/15/02	0	56	NA	0	0	0	NA
Jonah Infill	Pending	0	1,250	NA	0	0	0	NA
Desolation Flats	Peding	0	385	NA	0	0	0	NA
South Piney	Pending	0	210	NA	0	0	0	NA
Lower Bush Creek	Pending	0	22		0	0	0	NA
Seminoe Road	Pending		1,240					
Atlantic Rim	Pending 7/26/02 6/26/02		2,000					
Wolverine/Shell			3	2				
Little Monument	Pending	31	31?					
Total		**4,359**	**13,886**	**1,053**				**7,396**

Notes:

1. Reasonably foreseeable development that could take place within the next 10 to 15 years within southwestern Wyoming
2. As of 12/98
3. 700 pads – not wells
4. No ROD available – pending completion of EISs and EAs

4.2 Proposed Natural Gas Transmission Pipeline

The construction and operation of another major natural gas transmission pipeline that would essentially parallel to I-80 from Rock Springs to Cheyenne, Wyoming is under consideration.

5.0 Mining Activities

Coal mining has and continues to occur within and surrounding the Seminoe Road Project area.

5.1 Shoshone Mine

The Shoshone Mine is located approximately 4 miles north of Hanna, Wyoming, and was operated until 2001 as both a surface and an underground coal mine. Final reclamation activities, including the removal of surface facilities and the coal loadout, were completed in 2002. Reclamation is currently being monitored by officials from the Wyoming Department of Environmental Quality (DEQ), Land Quality Division. Such monitoring will continue for up to 10 years, as required by Wyoming DEQ regulations, to ensure that revegetation has met permit specifications.

5.2 Seminoe I and II Mines

The Seminoe I Mine was operated as a surface coal mine. This operation is now closed and has been reclaimed.

The Seminoe II Mine, which is approximately 6 miles northeast of Hanna, Wyoming, has been operating since 1973. This mine is owned and operated by Arch Coal, Inc. The mine is permitted by the Wyoming DEQ, Land Quality Division, to produce 2 million tons of coal per year, but, in recent years, this mine has produced less than 300,000 tons of coal per year. The Seminoe II Mine is reported to have additional coal resources; however, the mine is now in temporary cessation. Future economics will determine if these resources are economically minable.

5.3 Medicine Bow Mine

The Medicine Bow Mine is a surface coal mine with a production capability of approximately 2 million tons of coal per year. This mine is owned and operated by Arch Coal, Inc. and is located approximately 6 miles west of Hanna, Wyoming, on U.S. Highway 30. Historical production at the mine has reached 1.8 million tons of coal per year; however, 2003 production was less than 400,000 tons per year. The mine is now in temporary cessation. Future economics will determine if production is to resume.

6.0 Union Pacific Railroad

The main routing of the Union Pacific Railroad is located south of the Seminoe Road Project. This rail line roughly parallels Interstate 80. Rail spurs have been constructed near the Town of Hanna to serve the coal mines in the area. See Section 5.0, Mining Activities.

7.0 Highways

Interstate 80 is a federal four-lane interstate highway, which transects southern Wyoming. This major interstate highway experiences about 12,000 trucks per day of freight movement from the west coast to Midwest markets.

Seminoe Road (County Road 351) is a two-lane asphalt road that basically bisects the Seminoe Road EIS analysis area. This highway was recently upgraded from the Town of Sinclair to Seminoe State Park. The upgrade work included widening and paving of the road and was completed in early 2003. Refer to Section 3.12, Transportation for a description of all other roads within and adjacent to the Seminoe Road Project.

8.0 Dams

The Bureau of Reclamation operates the following three dams on the North Platte River north of the Seminoe Road Project:

- Seminoe Dam
- Kortes Dam
- Pathfinder Dam

Details about these facilities are set forth in **Table E-2, Dam Statistics**.

Table E-2, Dam Statistics

	Seminoe Dam	Kortes Dam	Pathfinder Dam
County in Wyoming	Carbon	Carbon	Natrona
Location	31 miles northeast of Rawlins	60 miles southwest of Casper	47 miles southwest of Casper
Dam Type	Concrete Medium-Thick Arch	Concrete Gravity	Cyclopean Masonry Arch Gravity
Watercourse	North Platte River	North Platte River	North Platte River
Reservoir	Seminoe	Kortes	Pathfinder
Original Construction	1936-1939	1946-1951	1905-1909 (Modified 1910-12; 1915; 1919-22; 1931; 1949-50; 1958-61; 1996-97)
National ID Number	WY01297	WY01294	WY01296
Drainage Area (square miles)	7,210	0	14,600
Total Storage (acre-feet)	1,017,279 @ Elevation 7,358 ft	4,739 @ Elevation 6,142 ft	1,016,500 @ Elevation 5,858.1 ft
Outlet Works (cfs)	3,000 @ Elevation 6,357 ft	NA	3,000 @ Elevation 5,858.1 ft
Crest Elevation (ft)	6,361	6,169	5,858.1
Structural Height (ft)	295	244	214
Hydraulic Height (ft)	206	200	192
Crest Length (ft)	530	440	432
Crest Width (ft)	15	24	10.9
Base Width (ft)	85	193	96.5
Volume of Concrete (cubic yards)	210,000	147,000	65,700
Power Plant	Yes	Yes	No
Service Date	August 1939	June 1950	-
Capacity (kW)	51,750	36,000	-

9.0 Hydro-Electric Generating Power Stations

Electric power is generated from two hydro power plants on the North Platte River north of the Seminoe Road Project.

9.1 Seminoe Power Station

The Seminoe Power Station is located at the Seminoe Dam and is operated by the U.S. Bureau of Reclamation. The power plant is located at the base of the Seminoe Dam and has a rated head of 166 feet. The plant contains three units, each composed of a 1,015-kilowatt generator driven by a 20,800 horsepower turbine. The Seminoe Dam and associated power plant were constructed between 1936 and 1939. The original capacity of the plant was 32,400 kilowatts; however, the plant was upgraded in the mid 1970s to its current installed capacity of 45,000 kilowatts.

9.2 Kortes Power Station

The Kortes Power Station is located at Kortes Dam, downstream of the Seminoe Dam. This electric power generating facility is also operated by the U.S. Bureau of Reclamation. Power generation from the Kortes Power Plant is coordinated with that from the Seminoe Power Plant. The reinforced concrete power house at the Kortes Power Plant occupies the entire width of the Platte River Canyon at the toe of the Kortes Dam. This plant has three 18,500 horsepower turbines and three 12,000-kilowatt generators with a combined capacity of 36,000 kilowatts. The Kortes Power Plant is used as a peaking plant except when lower water years restrict outflow. The power plant was originally constructed in 1941. Unit 2 was reworked in 1973; Units 1 and 3 were reworked in 1985.

10.0 Electric Transmission Lines

Western Area Power Administration (WAPA or Western) owns and operates a series of 115 kV electric transmission lines that originate from the Kortes and Seminoe hydro power stations. One of these 115 kV transmission lines crosses the Seminoe Road EIS analysis area.

11.0 Reservoirs

Two large reservoirs are located within and north of the Seminoe Road Project area. They are the Seminoe Reservoir and the Pathfinder Reservoir.

11.1 Seminoe Reservoir

The Seminoe Reservoir is approximately 20 miles north of the Town of Sinclair and can be accessed via Carbon County Road 351. The reservoir encompasses an estimated 20,300 acres and offers recreational opportunities such as boating, fishing, water skiing, and wildlife and waterfowl observation. The predominate fish species caught in the reservoir are trout and walleye.

11.2 Pathfinder Reservoir

The Pathfinder Reservoir is located on the North Platte River approximately 10 miles north of the Seminoe Reservoir. This reservoir encompasses an area of approximately 26,600 acres. Only 80 of these acres have been developed for public use. All 117 miles of shoreline are available for recreation, including primitive campsites. Water in the Pathfinder Reservoir is used for drinking and irrigation needs. The predominate fish species caught in the reservoir include brown trout, cutthroat trout, rainbow trout, and walleye.

12.0 Recreation

Recreational areas and opportunities within and adjacent to the Seminoe Road EIS analysis area include boating, fishing, camping, hiking, hunting, four wheeling, picnicking, horseback riding, and general sight seeing.

No developed recreation facilities are operated by the BLM or private interests within the boundaries of the Seminoe Road EIS analysis area; however, the project area does cover the southern end of the Seminoe Reservoir. This reservoir provides boating and fishing opportunities with public access to the reservoir at Seminoe State Park. North of Kortes Dam is a 5-mile stretch of the North Platte River, which is accessed by fisher people along the riverbanks; this stretch of river is known as the “Miracle Mile,” which is a world class fishery. The Miracle Mile is located approximately 10 miles north of the northern boundary of the Seminoe Road EIS analysis area.

12.1 Seminoe State Park

Seminoe State Park encompasses the northern half of the Seminoe Reservoir. The southern boundary of the State Park coincides with the northern boundary of the Seminoe Road EIS analysis area. Numerous campsites, picnic areas and boat launching facilities are located within the Seminoe State Park.

12.2 North Platte River

The North Platte River originates within the Mount Zirkel Wilderness Area in northern Colorado, passes through the Seminoe Road EIS analysis area, and flows through southeastern Wyoming into Nebraska, where it eventually joins the Missouri River.

Three dams have been constructed on the North Platte River north of the Seminoe Road Project area. See Section 8.0, Dams.

12.3 Miracle Mile

The North Platte River is renowned for its trout fishing, in particular, a 5-mile stretch of the river located below Kortes Dam. This stretch of the river is referred to as the “Miracle Mile.” The Miracle Mile is a year-round fishery that can be productive during any month of the year, although it may be difficult to access this stretch of the river during winter months. Brown, rainbow and cutthroat trout are prevalent in the Miracle Mile.

12.4 Seminoe-Alcova Backcountry Byway

The BLM has designated a 64-mile stretch of County Road 351 between Sinclair and Alcova, Wyoming as a scenic backcountry byway.

13.0 Wilderness Areas

No wilderness areas are located within or immediately adjacent to the Seminoe Road Project area. Wilderness areas in the broader general region include:

- Mount Zirkel Wilderness Area
- Savage Run Wilderness Area
- Platte River Wilderness Area
- Huston Park Wilderness Area
- Encampment River Wilderness Area

Wilderness areas are shown on **Figure 20, Air Quality Modeling Domain**, and are briefly described in the following sections.

13.1 Mount Zirkel Wilderness

Mount Zirkel Wilderness is located in northern Colorado in the Routt National Forest and encompasses approximately 160,000 acres. Elevations within this wilderness range from 7,000 feet to 12,180 feet at the top of Mount Zirkel. The wilderness is accessible from U.S. Highway 40 and Colorado State Highway 15 and numerous Forest Service roads, mainly Forest Service Roads 129 and 60. There are an estimated 150 miles of hiking trails within Mount Zirkel Wilderness.

13.2 Savage Run Wilderness

Savage Run Wilderness is located in southeast Wyoming in the Medicine Bow National Forest and encompasses approximately 14,900 acres. Elevations in this wilderness range from 8,000 to 10,000 feet. The Savage Run Wilderness is accessed by Wyoming State Highway 230 and various Forest Service roads.

13.3 Platte River Wilderness

Platte River Wilderness is located in southeast Wyoming, mainly in the Medicine Bow National Forest, approximately 30 miles southeast of Saratoga. This wilderness encompasses about 23,500 acres, with approximately 750 of these acres in northern Colorado. The Platte River Wilderness is accessed by Wyoming State Highway 230 and Forest Service roads. Elevations in this wilderness area range from about 6,000 to 9,000 feet

13.4 Huston Park Wilderness

Huston Park Wilderness is located in southern Wyoming in the Medicine Bow National Forest, approximately 25 miles south/southwest of Saratoga and encompasses about 30,600 acres. This wilderness area is accessed from Wyoming State Highway 70 and Forest Service roads. Elevations in Huston Park Wilderness range from approximately 6,000 to 10,000 feet.

13.5 Encampment River Wilderness

Encampment River Wilderness is located in southern Wyoming in the Medicine Bow National Forest, approximately 25 miles south of Saratoga, and encompasses about 10,100 acres. Access to this wilderness area is from Wyoming State Highways 70 and 230 and Forest Service roads. Elevations in this wilderness range from about 6,000 to 10,000 feet.

14.0 Wilderness Study Areas

No Wilderness Study Areas (WSA) are located within or immediately adjacent to the Seminoe Road EIS analysis area. The WSAs in the broader general area include:

- Adobe Town
- Encampment River Canyon
- Farris Mountains
- Prospect Mountain
- Bennett Mountains

14.1 Adobe Town

The Adobe Town WSA is located 80 miles southwest of Rawlins and contains an estimated 85,700 acres. Approximately 11,000 acres of this WSA were recommended for actual Wilderness status in a 1992 BLM report to Congress.

14.2 Encampment River Canyon

The Encampment River Canyon WSA is located 2 miles south of the town of Encampment and contains approximately 4,600 acres. This entire WSA was recommended as suitable for wilderness status in a 1992 BLM report to Congress.

14.3 Ferris Mountains

The Farris Mountains WSA is located 45 miles north of Rawlins and contains approximately 22,300 acres. The entire WSA was recommended as suitable for wilderness designation in a 1992 BLM report to Congress.

14.4 Prospect Mountain

The Prospect Mountain WSA is located about 15 miles southeast of the town of Encampment, adjoin the U.S. Forest Service’s Platte River Wilderness and contains approximately 4,350 acres.

This entire WSA was recommended suitable for wilderness designation in a 1992 BLM report to Congress.

14.5 Bennett Mountains

The Bennett Mountains WSA is located northeast of the Seminoe Reservoir, about 32 miles northeast of Rawlins and approximately 4 miles north of the northern boundary of the Seminoe Road EIS analysis area. This WSA contains approximately 6,000 acres; however, this WSA was not recommended as suitable for wilderness status in the 1992 BLM report to Congress.

15.0 Agricultural Activities

Livestock grazing has historically been and continues to be a part of the Carbon County economy. Cattle grazing occurs on both federal and private lands within and surrounding the Seminoe Road EIS analysis area. There is no irrigated agricultural land within and surrounding the EIS analysis area; hay production is typically confined to stretches along the North Platte River near the Town of Saratoga, which is upstream of the Seminoe Road EIS analysis area.

16.0 Housing Development

The Town of Rawlins is the region’s main population center. No major housing development is expected to occur in the areas within or immediately surrounding the Seminoe Road Project area.

A small development known as Miller Estates is platted along the North Platte River as shown on **Figure 19, Regional Activity**. To date, only one building and well permit has been submitted for this development.

The “boat club” is a small un-incorporated area north of the EIS analysis area on private land adjacent to the Seminoe Reservoir. This “boat club” is an area which contains mobile homes and is primarily used for summer recreational activities on the reservoir.

17.0 Historic Sites

Fort Steele is an historic site located east of the Town of Sinclair, near where Interstate 80 crosses the North Platte River. This site was originally established in June 1868 by the U.S.

government to protect the Union Pacific Railroad from Indian attacks. See also Section 3.10, Cultural Resources.

18.0 Other Potential Projects

A Texas company (Houston-based DKRN Energy LLC) has announced a proposal for a plant to process coal into diesel, electricity and other products. DKRW Energy is contemplating the construction of this coal gasification and liquefaction facility on the Medicine Bow River Ranch in Carbon County, Wyoming.

Appendix F

Reclamation Plan

Contents

Appendix F – Reclamation Plan

1.0 Introduction

The purpose of reclamation is to return disturbed areas to a stabilized and productive condition following natural gas development and production activities and to protect long-term land, water and air resources in the area. Bureau of Land Management (BLM) reclamation policies are to ensure the return of disturbed lands to productive uses consistent with land management policies.

Each Application to Permit Drilling (APD) approval would require a reclamation plan acceptable to the BLM, and one that would conform to other appropriate federal, state and Carbon County regulations and guidelines. The reclamation plan would describe measures to reduce long-term impacts with the goal of returning the land to a productive state similar to that which existed on the site prior to natural gas development and production.

The BLM understands that reclamation practices and technology are ever evolving and improving. Although reclamation practices have become an integral component of activities such as coal mining, highway construction, and oil and gas exploration and development activities, and existing measures have proved to be successful, it is expected that there will be future improvements in reclamation planning as techniques are refined or expanded. The BLM would work with the Proponent to take advantage of opportunities to explore new reclamation techniques and new methods for erosion control.

2.0 Reclamation Goals and Objectives

The current land use within the Seminoe Road Project EIS analysis area is primarily for rangeland for cattle grazing and wildlife habitat. The emphasis of the reclamation plan would be to create habitats similar to what currently exists.

The reclamation plan would incorporate the following basic goals:

- Establishment of stable surface, topographic and drainage conditions that are compatible with the surrounding landscape and that control erosion, water quality and air quality impacts from the operation;

- Establishment of surface soil conditions that are conducive to regeneration of a stable vegetative community through removal, stockpiling, and reapplication of topsoil material;
- Revegetation of disturbed areas using species adapted to site conditions and approved by the BLM in order to establish long-term productive self-sustaining, biotic communities compatible with future land uses and comparable to what currently exists on the site;
- Consideration of public, livestock and wildlife safety including proper plugging of abandoned drill holes and removing production structures or facilities that could constitute future hazards; and,
- Retaining access roads across the EIS analysis area where desired by the BLM and the private landowners.

The post mining land uses on BLM administered lands would be managed for grazing, wildlife habitat, and dispersed recreation, or other land use emphasis developed for the area through the BLM's resource management planning.

3.0 Reclamation Schedule

Reclamation measures would be incorporated into design work at the start of the Seminoe Road Project and would be an integral part of APD permitting and project development and operations.

Three types of reclamation would be scheduled and implemented at the Seminoe Road Project. These are:

- Interim reclamation
- Concurrent reclamation
- Final reclamation

During the life of the Seminoe Road Project, interim reclamation would occur to reduce erosion and the potential for water quality degradation. Interim reclamation refers to reclamation efforts on lands disturbed during the course of the construction and development activities and is intended to temporarily stabilize an area prior to concurrent or final reclamation. Interim reclamation would include revegetation to reduce erosion and sediment. Topsoil would probably not be applied to interim revegetatated area. Mulch would be applied, as appropriate, following seeding. The areas which would require interim reclamation include temporary road cuts/embankments and topsoil stockpiles.

Concurrent reclamation refers to reclamation activities which can be implemented at the same time as ongoing construction activities and drilling operations. Concurrent reclamation activities would be initiated as soon as practical after construction activities and drilling operations in a particular area are completed, thus minimizing erosion and sedimentation problems. Such areas would include road outslopes (cuts and fills) for permanent roadways, areas disturbed during installation (burial) of electric utility lines and water and gas pipelines, and areas at well pad sites no longer needed for operational drilling activities.

Final reclamation activities would be completed upon cessation of natural gas production from the Seminoe Road Project. The areas to undergo final reclamation upon project closure would include well pad sites, access roads (those not needed for long-term land use purposes), compressor site facilities, and water treatment facilities.

In general, reclamation activities (whether interim, concurrent and/or final) would be timed to take advantage of optimal climatic conditions. Seedbeds would be prepared and seeding would be completed generally in the late summer or fall months to take advantage of winter and spring moisture.

4.0 Construction and Interim Reclamation

As part of construction activities (roads, well pads, and gas, water and electric utility installations), the following reclamation steps would be undertaken:

- Topsoil would be removed and stockpiled (or reapplied as part of concurrent reclamation activities);
- Erosion and sediment control would be implemented and installed; and
- Interim reclamation would be implemented.

4.1 Topsoil Removal

Topsoil suitable for revegetation would be salvaged and stockpiled prior to any construction activities. Topsoil salvage would be conducted using dozers, front-end loaders, scrapers, haul trucks, and other equipment, as appropriate. The salvage stockpile would be placed in designated stockpiles; this could include “windrowing” topsoil adjacent to roads and utility line installations. Stockpiled topsoil would be revegetated with an interim seed mixture to reduce the potential of wind and water erosion.

4.2 Erosion and Sediment Control

Erosion and sediment control would be an important component of construction activity. These practices would be implemented to eliminate excess surface runoff across disturbed areas and to avoid sedimentation and erosion outside of those areas needed for natural gas operations and production. Erosion and sediment control practices include the following measures:

- Disturbed areas would be kept to a minimum at any given time through phased disturbance and concurrent reclamation.
- Appropriate drainage structures would be installed as part of access road construction. These would include side ditching, water bars, culverts and sediment traps.
- Rapidly developing vegetation species would be planted as part of interim reseeding to promote rapid stabilization.
- Seeding would occur in the first appropriate season after topsoil stockpiling and/or redistribution.
- Mulches would be applied to aid in erosion control and moisture retention.
- Interim seeding would be used to stabilize inactive and disturbed areas.
- Roads and water control structures would be maintained periodically as needed.
- Reclamation grading would be conducted to minimize erosion potential.
- Reclaimed areas would be inspected after major storm events. Any rills or gullies greater than 6 inches deep that develop would be stabilized and revegetated.
- Sediment control measures (side ditches along roads, culverts, etc.) would be maintained until reclamation efforts are completed and such sediment control structures are no longer needed.

4.3 Interim Revegetation

Stockpiled soil would be protected from wind and water erosion. During the first normal planning season following development of soil salvage, soil stockpiles would be seeded with an interim seed mixture.

In addition, following construction activities, areas such as cut and fill embankments along roads should also be seeded to reduce the potential of wind and water erosion.

Certain areas around electric substations, storage areas, compressor buildings, producing wellheads, etc., would not be re-seeded in order to reduce potential fire hazard to these areas. Areas not revegetated following construction activities should be covered with gravel to reduce aesthetic impacts and limit erosion potential. These areas include roads, production well pad areas, sites around buildings and electric substations.

4.4 Noxious Weed Control

Necessary control measures utilizing various mechanical, biological, cultural and chemical control techniques would be implemented to prevent and restrict the spread of noxious weeds.

5.0 Concurrent Reclamation

Because the Seminoe Road Project would be a phased operation, opportunities for concurrent reclamation exist. As mentioned earlier, concurrent reclamation refers to those reclamation activities that can be implemented at the same time as ongoing production and development activities. Concurrent reclamation activities would be conducted on well pad sites not needed for operational production, utility corridors (water and gas pipelines, buried electric lines) have been buried, and along road right of ways. Concurrent reclamation would be essentially final reclamation, as there would be no need to re-enter these areas once reclamation activities are complete. Concurrent reclamation would follow the procedures outlined in Section 6.0, General Reclamation Practices.

6.0 General Reclamation Practices

The general steps used in reclaiming disturbed areas are as follows:

- Decommissioning and Removal of Facilities

- Recontouring and Regarding
- Topsoil Replacement
- Topsoil Sampling and Fertilization
- Mulching
- Revegetation
- Reclamation Management and Monitoring

6.1 Decommissioning and Removal of Facilities

The following permanent cessation of production operations, salvageable equipment, instrumentation and furniture would be removed from the Seminoe Road Project site. The BLM does not anticipate any ongoing beneficial use for structures and facilities following project closure; however, the BLM would coordinate with the Proponent and any private landowners regarding possible beneficial use. Assuming there is no ongoing beneficial use, any structures and facilities on site would be dismantled and removed at the time of permanent operational closure. This would include well site production facilities (including separator building and well head infrastructure), compressor buildings, electric substations, any overhead electric transmission lines, maintenance and storage buildings, and water treatment facilities.

Salvageable equipment would be moved to another natural gas project, sold or properly disposed of off site. Unsalvageable portions of any buildings and facilities, such as foundations, would be broken up and buried on site. Well bores (drill holes) would be abandoned and plugged in accordance with BLM and Wyoming Oil and Gas Commission (WOGC) regulations, standards and guidelines. The underground gas gathering pipelines, water pipelines, and electric distribution lines would be left buried in place.

6.2 Recontouring and Regrading

Disturbed areas would be recontoured and regraded to blend into surrounding topography. Compacted areas such as road and well pads would be ripped and or disced prior to replacing topsoil material. Any recontouring and regrading program would also involve removal of culverts and restoration of surface water channels to handle flows through the area.

6.3 Topsoil Replacement

Following regarding activities, disturbed sites would be covered with topsoil. Topsoil would be respread by scraper and/or bulldozer, possibly in combination with front-end loaders and trucks. Stockpiled topsoils would be reapplied to regraded areas in a uniform thickness, approximately 6 to 12 inches in depth. Topsoil would serve as the rooting zone for revegetation.

6.4 Topsoil Sampling and Fertilization

Following replacement, topsoil samples would be analyzed for pH, nitrogen, phosphorous and potassium to determine its fertility status. In the event that soil amendments or fertilizers are needed, they would be applied at levels recommended by the BLM prior to revegetation.

6.5 Mulching

If determined necessary to aid in initial stabilization and erosion control, wood fiber mulch, straw, or erosion control/mulch blankets would be applied to reduce initial erosion and sedimentation, promote stabilization and enhance seed germination.

6.6 Revegetation

Seeding would be conducted by either drilling or broadcast seeding. Seeding would generally be conducted in the late summer or fall of the year to take advantage of winter and spring moisture. Seed mixtures used for permanent revegetation would be based upon recommendations of the BLM and other public sources for reclamation work in south-central Wyoming.

6.7 Reclamation Management and Monitoring

Newly reclaimed areas would be managed and monitored by the Proponent consistent with reclamation goals and BLM revegetation success criteria outlined in future APD approvals. Reclaimed sites would be examined periodically during the first several years after revegetation to determine the effectiveness of the reclamation program. The success of revegetation would be monitored during this time to assure erosion has been prevented, invasion by noxious weeds prevented and appropriate species re-establishment has been occurring. Maintenance would be conducted on site as necessary to ensure establishment of appropriate vegetation species.

Appendix G

Hazardous Materials Management Plan

Appendix G – Hazardous Materials Management Plan

Contents

Tables

1.0 Introduction

Numerous local, state and federal laws, regulations and guidelines oversee the use, transport, and disposal of hazardous materials. The agencies involved include:

- Bureau of Land Management (BLM) through Instruction Memorandums #WY-93-344 & WY-94-059
- Environmental Protection Agency (EPA) through the Resource Conservation and Recovery Act (RCRA), Superfund Amendments and Reauthorization Act of 1986 (SARA), Clean Water Act, Toxic Substances Act (TSCA), and Clean Air Act
- U.S. Department of Transportation (DOT)
- U.S. Occupational Safety and Health Administration (OSHA)
- Wyoming Department of Environmental Quality (WDEQ)
- Wyoming Department of Transportation (WDOT)

2.0 Hazardous or Extremely Hazardous Materials

A listing of possible hazardous and extremely hazardous materials (hazardous materials) that could be present on site during construction, development, production and reclamation activities at the Seminoe Road Project are set forth in **Table G-1, List of Hazardous and Extremely Hazardous Materials**. Hazardous materials are those substances listed in EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA-1986)*. Extremely hazardous materials are those substances listed in 40 CFR 355.

Examples of hazardous materials that could be present at the Seminoe Road Project include fuels, lubricants, solvents, antifreeze, drilling muds, borehole plugging materials, and fracturing substances.

2.1 Fuels

Gasoline and diesel fuel would be used to power employee vehicles, transport vehicles, drill rigs, and construction equipment.

2.2 Lubricants/Solvents

Lubricants include motor oil, greases, hydraulic and transmission fluids, and other lubricating oils. Solvents are substances like acetone and methanol used to clean equipment parts.

2.3 Antifreeze

Antifreeze keeps engines from overheating in the summer and freezing in the winter. Ethylene glycol is a common chemical compound used for antifreeze.

2.4 Drilling Muds

Drilling rigs use water-based “muds,” known as drilling fluids that lubricate the drill hole and cool the drill bit. Common drilling fluids include barite and bentonite.

2.5 Cementing/Plugging

Drill holes must be abandoned in accordance with BLM and state regulations. This includes plugging with materials such as bentonite, cement, and diatomaceous earth.

2.6 Fracturing

Fracturing is a method of formation stimulation, typically used to improve formation permeability, which would increase oil and gas production. In fracturing, fluids are pumped under pressure into the wellbore. These fluids can include quantities of methanol, sand and naphthalene.

2.7 Miscellaneous Materials

Various miscellaneous materials can be present at an oil and gas operation; these include batteries, cleaners, fertilizers, herbicides, lubricants, paints and starting fluids.

3.0 Spill Prevention and Control Countermeasure Plan

EPA requires that a spill prevention and control countermeasure plan (SPCC) be maintained and available for review on site. A SPCC will describe the facilities and processes that would be used to prevent, handle and/or control spills of petroleum products and hazardous materials.

4.0 Emergency Response Plans

Oil and gas product projects require an emergency response plan (ERP), which would outline the basic procedures to be followed in the event of an emergency that might involve a fire, explosion, major spill or dangerous weather condition. An emergency response coordinator must be identified in an ERP, along with emergency phone numbers, which should also be displayed at key locations throughout the project site and in project vehicles.

5.0 Hazard Communication Program

Material Safety Data Sheets (MSDS) must be available on site for any hazardous materials stored, used or disposed of on site. MSDS describe the hazardous materials common name, chemical and physical makeup, health effects from exposure, and recommended first aid, if exposed to the material.

Table G-1, List of Hazardous and Extremely Hazardous Materials

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Drilling Material		
Barite	Barium compounds	
	Fine mineral fibers	
Bentonite	Fine mineral fibers	
Caustic Soda	Sodium hydroxide	
Glutaraidehyde	Isopropyl alcohol	
Lime	Calcium hydroxide	
Mica	Fine mineral fibers	
Modified Tannin	Ferros sulfate	
	Fine mineral fibers	
Phoephaza Esters	Methanol	
Polyacrylamides		Acrylamide
	PAHs	
	Petroleum distillates	
	POM	
Retarders	Fine mineral fibers	
Anionic Polyacrylamide		Acrylamide
Polyanionic Cellulose	Fine mineral fibers	
Cementing/Plugging		
Bentonite	Fine mineral fibers	
Anti-foamer	Glycol ethers	
Calcium Chloride Flake	Fine mineral fibers	
Cellophane Flake	Fine minerals fibers	
Cements	Aluminum oxide	
	Fine mineral fibers	
Chemical Wash	Ammonium oxide	
	Glycol ethers	
Diamaceous Earth	Fine mineral fibers	
Extenders	Aluminum oxide	
	Fine mineral fibers	

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Fluid Loss Additive	Acrylamide	
	Fine mineral fibers	
	Napthalene	
Friction Reducer	Fine mineral fibers	
	Napthalene	
	PAHs	
	POM	
Mud Flash	Fine mineral fibers	
Retarder	Fine mineral fibers	
Salt	Fine mineral fibers	
Silica Flour	Fine mineral fibers	
Fracturing Materials		
Biocides	Fine mineral fibers	
	PAHs	
	POM	
Breakers	Ammonium persulphate	
	Ammonium sulphate	
	Copper compounds	
	Ethylene glycol	
	Fine mineral fibers	
	Glycol ethers	
Clay Stabilizer	Fine mineral fibers	
	Glycol ethers	
	Isopropyl alcohol	
	Methanol	
	PAHs	
	POM	
Crosslinkers	Ammonium chloride	
	Methanol	
	Potassium hydroxide	
	Zirconium nitrate	
	Zirconium sulfate	
Foaming Agency	Glycol ethers	
Gelling Agent	Benzene	
	Ethylbenzene	
	Methyl tert-butyl ether	
	Napthalene	
	PAHs	
	POM	
	Sodium hydroxide	
	m-Xylene	
	o-Xylene	
	p-Xylene	
pH Buffers	Acetic acid	
	Benzoic acid	
	Fumeric acid	
	Hydrochloric acid	
	Sodium hydroxide	
Sands	Fine mineral fibers	
Solvents	Glycol ethers	

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Surfactants	Glycol ethers	
	Isopropyl alcohol	
	Methanol	
	PAHs	
	POM	
Corrosion Inhibitor		
Production Products		
Natural Gas	n-Hexane	
	PAHs	
	POM	
Produced Water/Drill Cuttings		
Fuels		
Diesel Fuel	Benzene	
	Cumene	
	Ethylbenzene	
	Methyl tert-butyl ether	
	Naphthalene	
	PAHs	
	POM	
	Toluene	
	m-Xylene	
	o-Xylene	
	p-Xylene	
Gasoline	Benzene	
	Cumene	
	Cyclohexane	
	Ethylbenzene	
	n-Hexane	
	Methyl tert-butyl ether	
	Naphthalene	
	PAHs	
	POM	
		Tetraethyl lead
	Toluene	
	m-Xylene	
	o-Xylene	
	p-Xylene	
Natural Gas	n-Hexane	
	PAHs	
	POM	
Propane	Propylene	
Pipeline Materials		
Coating	Aluminum oxide	
Cupric Sulfate Solution	Cupric sulfate	
	Sulfuric acid	
Diethanolamine	Diethanolamine	
LP Gas	Benzene	
	n-Hexane	
	Propylene	
Molecular Sieves	Aluminum oxide	
Pipeline Primer	Naphthalene	
	Toluene	
Potassium Hydroxide Solution	Potassium hydroxide	

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Rubber Resin Coatings	Acetone	
	Coal tar pitch	
	Ethyl acetate	
	Methyl ethyl ketone	
	Toluene	
	Xylene	
Emissions		
Gases	Formaldehyde	
		Nitrogen dioxide
		Ozone
		Sulfur dioxide
		Sulfur trioxide
Hydrocarbons	Benzene	
	Ethylbenzene	
	n-Hexane	
	PAHs	
	Toluene	
	m-Xylene	
	o-Xylene	
	p-Xylene	
Particulate Matter	Barium	
	Cadmium	
	Copper	
	Fine mineral fibers	
	Lead	
	Manganese	
	Nickel	
	POM	
	Zinc	
Miscellaneous Materials		
Acids	Acetic anhydride	
	Formic acid	
	Sodium chromate	
	Sulfuric acid	
Antifreeze, heat control, and dehydration agents	Acrolein	
	Cupric sulfate	
	Ethylene glycol	
	Freon	
	Phosphoric acid	
	Potassium hydroxide	
	Sodium hydroxide	
	Triethylene glycol	
Batteries	Cadmium	
	Cadmium oxide	
	Lead	
	Nickel hydroxide	
	Potassium hydroxide	
	Sulfuric acid	
Biocides	Formaldehyde	
	Isopropyl alcohol	
	Methanol	
Cleaners	Hydrochloric acid	

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Corrosion Inhibitors	4-4' methylene dianiline	
	Acetic acid	
	Ammonium bisulfite	
	Basic zinc carbonate	
	Diethylamine	
	Dodecylbenzenesulfonic acid	
	Ethylene glycol	
	Isobutyl alcohol	
	Isopropyl alcohol	
	Methanol	
	Napthalene	
	Sodium nitrite	
	Toluene	
	Xylene	
Emulsion Breakers	Acetic acid	
	Acetone	
	Ammonium chloride	
	Benzoic acid	
	Isopropyl alcohol	
	Methanol	
	Napthalene	
	Toluene	
	Xylene	
	Zinc chloride	
Lead-free Thread Compound	Copper	
	Zinc	
Lubricants	1,2,4-trimethylbenzene	
	Barium	
	Cadmium	
	Copper	
	n-Hexane	
	Lead	
	Manganese	
	Nickel	
	PAHs	
	POM	
	Zinc	
Methanol	Methanol	
Motor Oil	Zinc compounds	
Paints	Aluminum	
	Barium	
	n-Butyl alcohol	
	Cobalt	
	Lead	
	Manganese	
	PAHs	
	POM	
	Sulfuric acid	
	Toluene	
	Triethylamine	
	Xylene	
Paraffin Control	Carbon disulfide	
	Ethylbenzene	
	Methanol	
	Toluene	
	Xylene	
Photoreceptors	Selenium	

Source	Hazardous Substances[1]	Extremely Hazardous Substances
Scale Inhibitors	Acetic acid	
	Ethylene diamine tetra	
	Ethylene glycol	
	Formaldehyde	
	Hydrochloric acid	
	Isopropyl alcohol	
	Methanol	
	Nitrilotriacetic acid	
Sealants	1,1,1-trichlorethane	
	n-Hexane	
	PAHs	
	POM	
Solvents	1,1,1-trichloroethane	
	Acetone	
	t-Butyl alcohol	
	Carbontetrachloride	
	Isopropyl alcohol	
	Methyl ethyl ketone	
	Methanol	
	PAHs	
	POM	
	Toluene	
	Xylene	
Starting Fluid	Ethyl ether	
Surfactants	Ethylene diamine	
	Isopropyl alcohol	
	Petroleum naphtha	

Notes:
1. PAH = polynuclear aromatic hydrocarbons, POM = polycylic organic matter

GENERAL AIR QUALITY MITIGATION INFORMATION
(This information has been provided by Wyoming BLM State Office in Cheyenne)

Type of Mitigation	Estimated Cost of Mitigation	Environmental Cost	Environmental Benefit	Potential Limitations
NO_x and CO Mitigation Measures				
Utilize selective catalytic reduction on compressors.	Relatively expensive as compared to non-selective catalysts. Typical costs are $125/horsepower (EPA Cost Control Manual January 2002).	Requires the use and storage of ammonia, which presents health and safety issues. Results in increased ammonia emissions which may contribute to the formation of ammonium sulfates and increased visibility degradation.	NO_x emission rate reduced to 0.1 g/hp-hr. Reduced ammonium nitrate formation and resulting visibility impacts.	Not applicable for 2-stroke engines.
Application of non-selective catalytic reduction.	$5,000 to $25,000 per unit.	Regeneration/disposal costs for catalysts.	As a result of the BACT process, average NO_x emission rates for Wyoming engines 100 hp or greater is 1.0 g/hp-hr. The application of non-selective catalysts may reduce the NO_x emission rate to 0.7 g/hp-hr for some types of engines.	Not applicable for lean-burn or 2-stroke engines.
Utilize compressors driven by electrical motors.	Capital costs equal 40% of gas turbine costs. Operating cost dependent upon the location of high voltage power lines.	Displaced air emissions from compressor units to electrical power plant.	May potentially relocate emissions away from sensitive Class I areas.	Requires high voltage power lines.
Increased diameter of sales pipelines.	With larger diameter sales pipelines, capital costs increase while operating costs decrease.	Slightly more surface disturbance.	Lower pipeline pressures resulting in lower compression hp requirements.	
Utilize wind generated electricity to power compressors.	Capital costs are very large.	Visual impacts from generation equipment. Increased mortality of birds including raptors.	Reduced use of fossil fuels and associated emissions.	Location of wind generation facilities is critical. Requires consistent strong winds for economic operation. Also requires high voltage transmission lines between generation facility and compressor stations.

Type of Mitigation	Estimated Cost of Mitigation	Environmental Cost	Environmental Benefit	Potential Limitations
Increased monitoring.	Unknown.	None.	The WDEQ-AQD currently has an emission tracking agreement with the BLM. The *Amended Letter of Agreement for Tracking Nitrogen Oxide Emissions* dated April 2000 calls for annual reports tracking changes in NO_x emission beginning January 1, 1996.	The monitoring of emission sources provides improved information for estimating impacts, but does not reduce the magnitude of the impacts.
Phased development.	Short-term loss of state and federal royalties.	Emissions generated at a lower rate averaged over a longer period.	Peak emissions and associated impacts reduced.	Administration / jurisdiction limitations – The WDEQ-AQD is the regulatory authority for air quality within the state of Wyoming. Therefore, the BLM cannot limit or otherwise restrict development based upon potential air quality impacts. Economic limitations – A minimum production rate is required to cost effectively develop the resource while maintaining the processing and transportation infrastructure.
Particulate Matter Mitigation Measures				
Increase water application rate to achieve greater than 50% fugitive dust control.	Varies with the source of the water and the trucking distance.	None.	Can achieve fugitive dust control rates up to 95%.	Diminishing returns per gallon of water applied. Water must be applied at much greater rates to achieve control efficiencies greater than 75%.
Unpaved road dust suppressant treatments.	$2,400 to $50,000 per mile.	Treatment chemicals have the potential to negatively impact water quality.	Estimated 20% to 100% reduction in fugitive dust emissions.	
Administrative control of speed limits.	Relatively low costs for installation of signs and enforcement.	None.	Slower speeds may provide 20% to 50% reduction in dust emissions.	State or county may retain authority for determining speed limits on primary roads.

Type of Mitigation	Estimated Cost of Mitigation	Environmental Cost	Environmental Benefit	Potential Limitations
Installation of remote telemetry.	Approximately $13,000 per well.	None.	Reduction in vehicle miles traveled and associated vehicle emissions during production operations. No benefit for construction operations which generate the greatest amount of PM.	Effective only for the production phase of the operations. Would have no impact upon construction activities which generate the greatest amount of particulate matter.
Gravel roads.	Approximately $9,000 per mile.	None.	Estimated 30% reduction in fugitive road dust.	
Pave roads.	Approximately $11,000 to $60,000 per mile.	None.	Estimated 90% reduction in fugitive road dust.	
Phased development.	Short-term loss of state and federal royalties.	Emissions generated at a lower rate averaged over a longer period.	Peak emissions and associated impacts reduced.	Administration / jurisdiction limitations – The WDEQ-AQD is the regulatory authority for air quality within the state of Wyoming. Therefore, the BLM cannot limit or otherwise restrict development based upon potential air quality impacts. Economic limitations – A minimum production rate is required to cost effectively develop the resource while maintaining the processing and transportation infrastructure.

Appendix H

Air Quality Information

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Appendix H – Air Quality Information

1.0 INTRODUCTION

The Bureau of Land Management (BLM) decided that a joint far-field (cumulative) air quality impact assessment should be prepared to encompass both the Seminoe Road Gas Development (Seminoe Road) and the Atlantic Rim Gas Development (Atlantic Rim) projects. Both of these coalbed natural gas projects are located in south-central Wyoming and are tracking on similar development schedules.

In conjunction with the joint far-field assessment, the BLM further decided that separate near-field air quality analyses should be assembled for each project to assess localized impacts within and immediately surrounding their individual development areas.

Government air quality specialists from the BLM, the U.S. Environmental Protection Agency (EPA), the Wyoming Department of Environmental Quality (DEQ) Air Quality Division, the U.S.D.A. Forest Service (Forest Service), and the U.S.D.I. National Park Service worked together as “stakeholders” on this air quality impact assessment.

Air quality experts from TRC Environmental Consultants (TRC) and Compliance Partners Inc. (CPI) were retained to assist in the development of detailed study protocol and to perform the actual modeling work. The two project proponents, Anadarko Resources Inc. (Anadarko) of the Atlantic Rim Project and Dudley & Associated L.L.C. (Dudley) of the Seminoe Road Project, provided development data and operational information and data to the stakeholders and funded the efforts of TRC and CPI.

A detailed study protocol was prepared for this air quality impact assessment (TRC 2004a). This protocol identified the study domain boundaries and the methodologies to be used to quantify potential air quality impacts from the two projects. A series of meetings and conference calls were held in 2003 and 2004 amongst the stakeholders to assure agreement with the protocol. These discussions lead to joint concurrence about the study domain, the modeling approach, the various input data, the impact computation methods, and the results of the modeling.

The protocol dictated that air quality impacts be analyzed based on air emissions from project sources, coupled with emissions from other non-project sources within the far-field study domain, which was established by the stakeholders and included portions of Wyoming, Idaho, Utah, and Colorado. See **Figure 20, Air Quality Modeling Domain**.

The non-project sources incorporated into the modeling effort included both permitted and reasonably foreseeable future action and development sources identified within the study domain.

Subsequent to protocol acceptance, the following tasks were completed:

- Development of construction and production emission inventories for each project;
- Compilation of a cumulative emissions inventory within the study domain that included non-project sources permitted between January 1, 2001 and March 31, 2004, as well as other reasonably foreseeable future action and development sources
- Separate assessment of near-field ambient impacts for each project;
- Assessment of project-related and cumulative air emission impacts at EPA-designated Class I and sensitive Class II Prevention of Significant Deterioration (PSD) areas within the study domain.

Following the completion of air emissions modeling, TRC prepared and released a comprehensive technical support report that presented the details and results of the air emissions near-field and far-field modeling work (TRC 2004b). This report, entitled Air Quality Technical Support Document, Atlantic Rim Natural Gas Project and the Seminoe Road Gas Development Project, is available for review at the BLM State Office in Cheyenne, Wyoming and the BLM Rawlins Field Office in Rawlins, Wyoming. The report is also available for review on the BLM Rawlins Field Office website.

2.0 PROTOCOL DEVELOPMENT PROCESS

On August 14, 2003, an initial "kick-off" meeting amongst individuals from the BLM, Anadarko, Dudley, TRC, and CPI was held in Cheyenne, Wyoming, to discuss the air quality aspects of the Seminoe Road and Atlantic Rim projects.

At this August 2003 meeting, it was decided that a joint air emissions assessment should be completed for the Seminoe Road and Atlantic Rim projects, and that effort should begin with the development of a comprehensive air quality impact assessment study protocol. It was also decided that air quality specialists from EPA, Wyoming DEQ Air Quality Division, Forest Service, and National Park Service (collectively with the BLM to be identified as the "stakeholders") should be invited and encouraged to participate in the review of the protocol and the actual air impact modeling work.

Subsequent to this August 2003 meeting, conference calls amongst the BLM, Anadarko, Dudley, TRC, CPI, SEI and Holsan & Associates were conducted on September 24, 2003 and October 8, 2003. The purpose of these ensuing discussions was to determine the status of the preliminary draft protocol, clarify certain project plans and details, and ascertain the timing for submitting a preliminary draft protocol document to the invited stakeholders.

On November 4, 2003, a preliminary draft protocol was issued to stakeholders for review, and the first formal stakeholders meeting was held on November 24, 2003 in Cheyenne, Wyoming. Other stakeholder meetings and conference calls followed in 2004, and a final protocol document was released on August 23, 2004. This protocol is presented as TRC 2004a.

3.0 EMISSION INVENTORY

Emissions inventories were developed for both the Atlantic Rim and Seminoe Road projects, and for other existing and reasonably foreseeable regional sources within the study domain. Criteria pollutant and hazardous air pollutant (HAP) emissions were inventoried for construction and production activities and for ancillary facilities for use in the near-field air quality analysis.

Criteria pollutants include nitrogen oxides (NO_X), carbon monoxide (CO), sulfur dioxides (SO_2), volatile organic compounds (VOC), and particulate matter. Particulate matter is further classified by its size; PM_{10} refers to particulate matter less than 10 microns in diameter, and $PM_{2.5}$ refers to particulate matter less than 2.5 microns in diameter. HAP includes n-hexane, BTEX (benzene, toluene, ethylbenzene, and xylenes), and formaldehyde. Emission calculations were completed in accordance with Wyoming DEQ Oil and Gas Guidance, EPA's AP42 emission factor compendium, and other accepted engineering methods (TRC 2004a).

3.1 Project Emission Inventory

The Seminoe Road Project would involve the development of an estimated 1,240 natural gas wells on up to 785 well pad sites, which are spaced at approximately one well pad site every 160 acres. Vehicle traffic, well pad construction, well drilling and completion activities, pipeline and utilities installations, and other project-related development and production activities would cause particulate and gaseous emissions. These actions and activities formed the basis for the air quality assessment for the Seminoe Road Project. A similar assessment was completed for the Atlantic Rim Project.

3.1.1 Construction Emissions

Construction-related emissions would result from well pad and access road construction and traffic, drill rig moving, drilling and associated traffic, pipelines and electric utility line installations and associated traffic, and general wind erosion from exposed areas disturbed during construction activities. Well pad and access road emissions would include fugitive PM_{10} and $PM_{2.5}$ emissions from construction activities and traffic to and from the construction sites. Other criteria pollutant emissions would occur from diesel combustion in large supply trucks and other heavy construction equipment. Use of gravel on Seminoe Road Project area roads would reduce the “silt content” of the roads, thereby reducing particulate emissions. The use of water or chemical dust suppressant on the graveled roads was not considered as part of the emissions inventory for the Seminoe Road Project; however, these measures, if used, would further reduce traffic-related emissions from roads.

When sufficient well pad sites are available and access to these sites has been established, drill rig movement and operation could commence. Emissions from these drill rig equipment mobilization and actual drilling activities would include fugitive particulate matter from travel to and from the drilling site on unpaved (but graveled) access roads within the project area and combustion emissions from diesel drilling engines. Drilling engine emissions were calculated using manufacturer’s emission data. Emissions from the well completion phase, which follows the drilling phase, would also include fugitive PM_{10} and $PM_{2.5}$ emissions from traffic and emissions from diesel combustion in supply trucks and completion drill rigs.

A summary of the estimated construction emissions for a single well is shown in **Table H-1, Single Well Construction Emissions Summary**. Emission factors, input parameters, and assumption details used in estimating emissions are provided in TRC 2004b.

Table H-1, Single Well Construction Emissions Summary

Pollutant	Well Pad and Access Road Construction		Rig Move and Drilling		Completing and Testing		Pipeline Construction		Total	
	Lb/Hr	Tons/ Well	Lb/Hr	Tons/ Well	Lb/Hr	Tons/ Well	Lb/Hr	Tons/ Well	Lb/Hr	Tons/ Well
NO_X	4.37	0.041	17.12	3.49	4.59	0.183	4.16	0.031	30.23	3.748
CO	1.20	0.011	2.94	0.60	0.99	0.040	1.55	0.010	6.69	0.66
SO_2	0.47	0.0045	1.82	0.37	0.30	0.012	0.41	0.0031	3.0053	0.39
PM_{10}	29.79	0.59	3.34	0.58	2.24	0.071	7.48	0.14	42.85	1.39
$PM_{2.5}$	6.38	0.12	2.16	0.43	0.61	0.022	2.03	0.036	11.18	0.61
VOC	0.40	0.0039	0.49	0.10	0.37	0.015	0.43	0.0031	1.70	0.12

3.1.2 Production Emissions

Coalbed natural gas well field production equipment and operations would also be a source of criteria pollutants.

For the Seminoe Road Project, two alternatives were considered:

(1) An electric power option with minimal use of natural gas power during phased build-out, mostly at isolated well pad locations (this alternative is proposed by Dudley, the project proponent); and,

(2) A complete natural gas (non-electric) power option, where natural gas powered compressors and well pad engines would be a source of criteria pollutants and HAP.

For both of the above alternatives, pollutant emission sources during field production would include the following:

- Travel on access roads to and from well sites within the project area;
- Diesel combustion emissions from supply and gravel-hauling trucks;
- Wind erosion from well pad disturbed areas (areas where vegetation and soil have been removed);
- Natural gas-fired reciprocating internal combustion compressor engines (under the non-electrified option);
- Natural gas-fired down-hole pumps installed at each well outside of the field electrification boundary (under the Proponent's proposed action); and

- Natural gas-fired down-hole pumps installed at each well, which would be used for entire project life of the well (under the non-electrified option).

Fugitive PM_{10} and $PM_{2.5}$ emissions would occur from road travel and wind erosion from well pad disturbances. NO_X, CO, VOC, and $PM_{10}/PM_{2.5}$ emissions would occur from diesel combustion in large supply and gravel-hauling trucks traveling in the field during construction and production.

Three compressor stations would be used during the operational life of the Seminoe Road Project. One of these compressor stations is currently permitted under Wyoming Permit Number CT-2833. Under this existing permit, the compressor is approved using natural gas.

Under the Proponent's proposed action, the three compressor stations would be powered with electricity. There would be no gaseous emissions from these electrified stations.

Under the non-electric alternative, emissions for the remaining two compressor stations are assumed to be identical to the presently permitted compressor station. Each compressor station would have two compressor engines (1,340 hp Caterpillar 3516 LE or equivalent) and one 20 MMSCFD glycol dehydration unit. Natural gas powered compressor station engines would be a source of NO_X, CO, VOC, and formaldehyde. Natural gas powered dehydrators would be a source of NO_X and CO; however, only minor amounts of HAP would be emitted from the dehydrators.

The Seminoe Road Project coalbed natural gas wells would be developed in a "ring-like progression" outward from the existing Pilot Project as shown on **Figure 5, Projected Build-out Scenario (Mesaverde Formation)**, and **Figure 6, Projected Build-out Scenario (Medicine Bow and Fox Hills Formations).** Each year, the majority of the wells would be drilled within that year's designated development area.

Under the Proponent's proposed action, these wells would be electrified and would have no emissions from the installed down-hole pumps. As mentioned previously, however, there would be a small number of isolated wells drilled each year outside of the electrification "boundary". These wells would use natural gas-fired down-hole pumps until the electric "grid" is extended outward to their locations.

Under the non-electric alternative, down-hole well pumps would be powered with natural gas.

Total production emissions of criteria pollutants and HAP occurring from a single electrified well and from a single non-electrified well are presented in **Table H-2, Single Well Production Emissions Summary.** Production emission calculations showing emission factors, input parameters, and assumptions are provided in detail in TRC 2004b.

Table H-2, Single Well Production Emissions Summary

Well Configuration	Pollutant	Traffic Emissions Single Well (tons/year)	Production Emissions Single Well (tons/year)	Total Emissions Single Well (tons/year)
Electrified Well	NO_X	0.00032	--	0.00032
	CO	0.00041	--	0.00041
	SO_2	8.85E-06	--	8.85E-06
	PM_{10}	0.28	--	0.28
	$PM_{2.5}$	0.043	--	0.043
	VOC	0.00016	--	0.00016
	Formaldehyde	--	--	0.000
	Benzene	--	--	0.00
	Toluene	--	--	0.00
	Ethylbenzene	--	--	0.00
	Xylenes	--	--	0.00
	n-hexane	--	--	0.00
Non-Electrified Well	NO_X	0.00032	1.00	1.00
	CO	0.00041	2.98	2.98
	SO_2	8.85E-06	--	8.85E-06
	PM_{10}	0.28	--	0.28
	$PM_{2.5}$	0.043	--	0.043
	VOC	0.00016	1.00	1.000
	Formaldehyde	--	0.050	0.050
	Benzene	--	--	0.00
	Toluene	--	--	0.00
	Ethylbenzene	--	--	0.00
	Xylenes	--	--	0.00
	n-hexane	--	--	0.00

3.1.3 Total Field Emissions

Estimated annual emissions in the Seminoe Road Project area under the proposed action and non-electric scenario are shown in **Table H-3, Estimated Annual In-Field Emissions Summary**. Emissions assume construction and production occurring simultaneously in the field and include one year of maximum construction emissions plus one year of production at maximum emission rates. Construction emissions were calculated based on the number of wells constructed per year and the type of well constructed. Production emissions were calculated based on the total number of producing wells in the field. Total producing wells were equal to the difference in number of wells proposed and the number of wells constructed per year.

Table H-3, Estimated Annual In-field Emissions Summary

Alternative/ Pollutant	Wells Developed	Annual Construction Emissions (tons/year)	Total Proposed Wells	Total Producing Wells	Wells Outside Electrification Boundary	Annual Production Emission[1] (tons/year)	Total Annual Emissions (tons/year)
Proposed Action[2]							
NO_x	129	309.39	1,240	71,111	9	9.35	318.74
SO_2		42.15				0.0098	42.16
PM_{10}		199.54				315.77	515.31
$PM_{2.5}$		73.75				47.27	121.02
VOC		20.87				9.17	30.05
Non-Electric Case[3]							
NO_x	129	309.39	1,240	1,111	1,111	1,111.35	1,420.74
SO_2		42.15				0.0098	42.16
PM_{10}		199.54				315.77	515.31
$PM_{2.5}$		73.75				47.27	121.02
VOC		20.87				1,111.17	1,132.05

Notes:
(1) Production emissions are taken from an average of the three most active years, 2008-2010.
(2) Includes emissions from wells outside electrification boundary in year 2009.
(3) Includes down-hole pump emissions at all producing wells.

3.2 Regional Emissions Inventory

Industrial sources, including oil and gas wells and associated infrastructure facilities, permitted between January 1, 2001 and March 31, 2004 through state air quality regulatory agencies and state oil and gas permitting agencies were identified for the modeling study domain (TRC 2004b). Those sources (or portions thereof) that had begun operations on or before March 31, 2004 were classified as "state-permitted sources", while those sources not yet in operation were classified as reasonably foreseeable future actions. Wyoming industrial sources proposed under NEPA analyses were also included within the regional emissions inventory.

When expansion was proposed for an existing industrial (oil and gas project), it was assumed that the developed portions of those existing industrial sources were either included in monitored ambient background or included in the state-permitted source inventory. The undeveloped portions of projects proposed under a NEPA study were classified as reasonable foreseeable development. These included (1) NEPA-authorized but not yet developed projects and (2) presently unauthorized NEPA projects for which air quality analyses were in progress.

The inventory methodologies used to compile the regional source emissions inventory for the Atlantic Rim and Seminoe Road projects are provided in TRC 2004b. This document provides a description of the data collected, the period of record for the data collected, inclusion and exclusion methodology, stack parameter processing methods, and the state-specific methodologies utilized to distinguish the differences in the content and completeness of data obtained from each state. Values presented in **Table H-4, Summary of Regional Inventory Emissions Changes from January 1, 2001 to March 31, 2004** represent the change in emissions between January 1, 2001 (the inventory start date) and March 31, 2004 (the inventory end-date).

Table H-4, Regional Inventory Summary of Emissions Changes from January 1, 2001 to March 31, 2004

Source/Category	Number of Included Sources	NO_X (tons/year)	SO_2 (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)
Colorado					
Excluded	353	--	--	--	--
RFD(1)	0	--	--	--	--
RFFA(2)	0	--	--	--	--
State Permitted	35	495.0	16.1	218.7	116.5
Idaho					
Excluded	53	--	--	--	--
RFD(1)	0	--	--	--	--
RFFA(2)	0	--	--	--	--
State Permitted	3	94.73	93.67	13.62	13.62
Utah					
Excluded	437	--	--	--	--
RFD(1)	0	--	--	--	--
RFFA(2)	0	--	--	--	--
State Permitted	12	257.6	4.8	(283.6)	(283.6)
Wyoming					
Excluded	1369	--	--	--	--
RFD(1)	44	6,224.2	55.5	48.1	48.1
RFFA(2)	164	4,568.8	(1,394.3)	(833.6)	(330.0)
State Permitted	91	2,020.72	3.6	36.6	20.4
Total					
Excluded	2,212	--	--	--	--
RFD(1)	44	6,224.2	55.5	48.1	48.1
RFFA(2)	164	4,568.8	(1,394.3)	(833.6)	-330.0
State Permitted	141	2,868.0	118.2	(14.8)	(133.1)

Notes:
(1) RFD=Reasonably Foreseeable Development
(2) RFFA=Reasonably Foreseeable Future Actions

4.0 NEAR-FIELD MODELING

A near-field ambient air quality impact analysis was performed to quantify the maximum criteria pollutant (PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and Ozone [O_3]) and HAP (benzene, toluene, ethylbenzene, xylenes, n-hexane, and formaldehyde) impacts that could occur within and near the Seminoe Road Project area. These impacts would result from emissions associated with construction and production activities, and the projected impacts are compared to applicable ambient air quality standards and significance thresholds. Modeling analyses were performed in accordance with TRC 2004a.

EPA's AERMOD model was used to assess near-field impacts of criteria pollutants PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2, and to estimate short-term and long-term HAP impacts. The AERMOD model utilizes the PRIME building downwash algorithms, which are the most recent “state of science” algorithms for modeling applications. One year of Rawlins meteorological data was used with the AERMOD dispersion model to assess these pollutant impacts.

Ozone impacts were estimated using a screening methodology developed by Scheffe (1988) that utilizes NO_X and VOC emissions ratios to calculate ozone concentrations. NO_X and VOC emissions would typically be highest during production activities, and these emissions were used to estimate ozone impacts.

4.1 Particulate Matter Near-Field Modeling Results

Maximum localized PM_{10} and $PM_{2.5}$ impacts would occur from well pad construction, access road construction, and wind erosion. The modeling scenario examined the construction of a 2.2-acre well site pad and two miles of access road per well pad. Model receptors were placed beginning 200 meters from the edge of the well pad and road and at 50-meter intervals along the first row and at 100-meter intervals out to 1 kilometer. Flat terrain was assumed.

Volume sources were used to represent emissions from well pads and access roads. Hourly emission rate adjustment factors were applied to account for daylight construction emissions, and modeling was conducted for the period of March 1 through October 31 to reflect an expected eight months of annual construction activities.

Maximum predicted concentrations of PM_{10} and $PM_{2.5}$ are presented in **Table H-5, Maximum Modeled PM_{10} and $PM_{2.5}$ Impacts**. These modeled concentrations would be less than the Wyoming ambient air quality standards (WAAQS) and National ambient air quality standards (NAAQS) for PM_{10} and proposed standards for $PM_{2.5}$, even after combined with representative background concentrations.

Table H-5, Maximum Modeled PM_{10} and $PM_{2.5}$ Impacts

Pollutant	Averaging Time	Direct Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Predicted ($\mu g/m^3$)	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	20.4	33	53.4	150	150
	Annual	3.5	16	19.5	50	50
$PM_{2.5}$	24-hour	7.1	13	20.1	65	65
	Annual	1.0	5	6.0	15	15

4.2 SO_2 Near-Field Modeling Results

Maximum SO_2 emission concentrations would occur during well drilling activities. The modeling scenario developed included a drilling rig at the center of the 2.2-acre well pad, with model receptors beginning 200 meters from the edge of the well pad at 50-meter intervals along the first row and at 100-meter intervals out to one kilometer. Drilling rigs were modeled as point sources.

Maximum modeled SO_2 emission concentrations are set forth in **Table H-6, Maximum Modeled and SO_2 Impacts**. These modeled SO_2 concentrations, even when added to representative background concentrations, are below applicable Federal and Wyoming standards.

Table H-6, Maximum Modeled SO_2 Impacts

Pollutant	Averaging Time	Direct Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Predicted ($\mu g/m^3$)	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO_{10}	3-hour	15.4	132	147.4	1,300	1,300
	24-hour	7.6	43	50.6	260	365
	Annual	2.8	9	11.8	60	80

4.3 NO_2 and CO Near-Field Modeling Results

Emissions from non-electrified production activities (well site pumps and compression facilities) would represent the maximum near-field NO_2 concentrations. An analysis was performed to quantify the maximum NO_2 impacts that could occur within and nearby the project area using the emissions from the non-electrified scenario. Proposed well emissions include those from down-hole pumps and supply, gravel and work-over trucks. The three compressor stations were included.

NO_X emissions provided for down-hole pumps and trucks were modeled using a single source polygon that spanned the entire project area. Receptors were placed throughout the project area at 1-kilometer intervals, increasing to 2-kilometers outside the project area boundary.

Point sources were used to model the compressor station emissions. Refined receptor grids were placed around each of the three compressor stations, beginning 200 meters from the compressor station at 50-meter intervals along the compressor site perimeter and at 100-meter intervals from the compressor site perimeter outward to one kilometer.

AERMAP was used to determine receptor height parameters from a 30-meter digitized elevation map (DEM) data. Aerodynamic building downwash parameters were considered for each compressor station.

The AERMOD model was used to predict maximum NO_X impacts for the modeled scenario. The maximum modeled concentrations occurred near the center of the project area. Maximum predicted NO_2 concentrations were determined by multiplying maximum predicted NO_X concentrations by 0.75 in accordance with EPA's Tier 2 NO_X to NO_2 ambient ratio conversion method.

The modeled NO_2 concentrations for the Seminoe Road Project would be below the PSD Class II Increment for NO_2. Even when combined with the representative background NO_2 concentrations, the ambient NO_2 concentrations are below the applicable WAAQS and NAAQS.

Maximum CO emissions would occur from the same production activities (well site pumps and compression facilities) that result in maximum NO_2 impacts. Maximum CO modeled concentrations, when combined with representative background CO concentrations, remain below the applicable WAAQS and NAAQS.

Maximum predicted NO_2 and CO emission concentrations are presented in **Table H-7, Maximum Modeled NO_2 and CO Impacts**.

Table H-7, Maximum Modeled O_3 Impacts

Pollutant	Averaging Time	Direct Modeled (μg/m^3)	RPM Background (μg/m^3)	Total Predicted (μg/m^3)	WAAQS (μg/m^3)	NAAQS (μg/m^3)
Ozone	1-hour	21.0	62.6	83.6	235	235
	8-hourl	14.7	62.6	77.3	157	157

5.0 FAR-FIELD/CUMULATIVE IMPACTS MODELING

The purpose of the far-field analyses was to quantify potential air quality impacts on Class I and sensitive Class II areas from emissions of NO_X, SO_2, PM_{10}, and $PM_{2.5}$ expected to result from the development and operation of the Seminoe Road Project. As shown on **Figure 20, Air Quality Modeling Domain**, the modeling domain for the cumulative impact assessment included the following Class I and sensitive Class II areas:

Bridger Wilderness Area (Class I);

- Fitzpatrick Wilderness Area (Class I);
- Popo Agie Wilderness Area (Class II);
- Wind River Roadless Area (Class II);
- Mount Zirkel Wilderness Area (Class I);
- Rawah Wilderness Area (Class I);
- Savage Run Wilderness Area (Federal Class II, Wyoming Class I);
- Rocky Mountain National Park (Class I); and
- Dinosaur National Monument (Federal Class II, Colorado Class I).

Predicted pollutant concentrations at these sensitive areas were compared to applicable ambient air quality standards and PSD Class I and Class II increments and were used to assess potential impacts to the air quality related values (AQRV) of visibility (regional haze) and acid deposition. Potential lake acidification from acid deposition impacts was analyzed for the following 14 lakes designated as acid sensitive:

- Deep Lake in the Bridger Wilderness Area;
- Black Joe Lake in the Bridger Wilderness Area;
- Hobbs Lake in the Bridger Wilderness Area;
- Upper Frozen Lake in the Bridger Wilderness Area;
- Lazy Boy Lake in the Bridger Wilderness Area;
- Ross Lake in the Fitzpatrick Wilderness Area;
- Lower Saddlebag Lake in the Popo Agie Wilderness Area;

- West Glacier Lake in the Glacier Lakes Ecosystem Experiments Site (GLEES);
- Lake Elbert in the Mount Zirkel Wilderness Area;
- Seven Lakes in the Mount Zirkel Wilderness Area;
- Summit Lake in the Mount Zirkel Wilderness Area;
- Island Lake in the Rawah Wilderness Area;
- Kelly Lake in the Rawah Wilderness Area; and
- Rawah Lake #4 in the Rawah Wilderness Area.

5.1 Modeling Methodology

The EPA-approved CALMET/CALPUFF modeling system (CALMET Version 5.53, Level 030709, and CALPUFF Version 5.711, Level 030625) was used for the far-field cumulative modeling analyses. The CALMET meteorological model used wind fields developed from 1995 meteorological data, and the CALPUFF dispersion model combined these wind fields with project-specific and regional emissions inventories of SO_2, NO_X, PM_{10}, and $PM_{2.5}$ to estimate ambient concentrations and AQRV impacts at in-field and far-field receptor locations.

The CALMET and CALPUFF models follow the methods described in TRC 20004a and the following standard guidance sources:

- Guideline on Air Quality Models, 40 CFR, Part 51, Appendix W;
- Interagency Work Group on Air Quality Modeling Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, EPA-454/R-98-019, Office of Air Quality Planning and Standards, December 1998; and,
- Federal Land Managers - Air Quality Related Values Workgroup (FLAG), Phase I Report, December 2000.

The CALMET wind fields developed for this analysis follow the CALMET methodologies established as part of the Southwest Wyoming Technical Air Forum for southwest Wyoming, and were further enhanced through the use of additional meteorological data sets and revised CALMET model code.

5.2 Project Modeling Scenarios

Modeling scenarios were developed for the electrified proposed action and a non-electrified scenario. The modeled proposed action scenario included 26 wells outside the electrification zone and one non-electrified compressor facility. The non-electrification scenario modeled assumed that well pumps and compressor facilities would be powered by natural gas.

Maximum field-wide emissions reflect the last year of field development for both scenarios, which show 1,040 wells in production and 200 wells being drilled and developed by six drilling rigs. Compression for both scenarios was assumed at 90% of permitted capacity. The modeled emissions for these two scenarios are shown in **Table H-8, Maximum Emissions**.

Table H-8, Maximum Emissions (tons/year)

Project Phase/Constituent	Proposed Action	Non-Electrification Scenario
Production Well[1]		
NO_x	5.1	205.9
SO_2	0.0	0.0
PM_{10}	0.0	0.0
$PM_{2.5}$	0.0	0.0
Production Traffic[2]		
NO_x	0.3	0.3
SO_2	0.01	0.01
PM_{10}	295.6	295.6
$PM_{2.5}$	44.2	44.2
Compression[3]		
NO_x	34.7	104.2
SO_2	0.0	0.0
PM_{10}	0.0	0.0
$PM_{2.5}$	0.0	0.0
Construction[4]		
NO_x	300.1	300.1
SO_2	31.9	31.9
PM_{10}	70.7	70.7
$PM_{2.5}$	39.7	39.7
Total		
NO_x	340.2	610.5
SO_2	31.9	31.9
PM_{10}	366.3	366.3
$PM_{2.5}$	83.9	83.9

Notes:
(1) Includes emissions from well site down-hole water pump engines.
(2) Includes emissions from all traffic associated with 1040 wells in production.
(3) Includes emissions from the proposed compressor stations.
(4) Includes emissions associated with 6 drilling rigs, 2 under construction (rig-up/rig-down), 4 operating continuously.

5.3 Meteorological Model Input And Options

CALMET was used to develop wind fields for the model domain (TRC 2004a). Model domain extent was selected based on available refined mesoscale meteorological model (MM5) data from the Southwest Wyoming Technical Air Forum study and the locations of the PSD Class I and sensitive Class II wilderness areas within the modeling domain.

The modeling domain was processed to a uniform horizontal grid using a 4-kilometer resolution based on a Lambert Conformal Projection defined with a central longitude/latitude at (-108.55°/42.55°) and first and second latitude parallels at 30° and 60°. The modeling grid consisted of 125 x 100, 4-kilometer grid cells, and covered the Seminoe Road project area and l analyzed Class I and sensitive Class II areas. The total area of the modeling domain was 500 x 400 kilometers. Ten vertical layers were used, with heights of 20, 40, 100, 140, 320, 580, 1,020, 1,480, 2,220, and 2,980 meters.

The CALMET analysis utilized the MM5 data (processed at a 20-kilometer horizontal grid spacing), data from 51 surface meteorological stations and 134 precipitation stations, and four upper air meteorological stations to supplement MM5 upper air estimates. USGS 1:250,000-Scale Land Use and Land Cover (LULC) data, and USGS 1-degree DEM data were used for land use and terrain data in the development of the CALMET wind fields. The CALMET model was run following control switch settings that were developed as part of SWWYTAF to develop the one-year (1995) wind field data set.

The modeling domain extended as far south and east as possible given the available refined MM5 data. The Interagency Work Group on Air Quality Modeling (IWAQM) guidance for CALMET/CALPUFF recommends that the horizontal domain of a model grid extend 50 to 80 kilometers beyond the receptors and sources being modeled to ensure potential re-circulation wind flow effects are properly modeled. The re-circulation wind patterns may not be completely resolved by CALMET for the generated wind field in the southern and eastern portions of the Rocky Mountain National Park area because this area is less than 50 kilometers from the modeling grid boundary. However, the potential impacts from the Seminoe Road Project would be appropriately assessed because the direct wind flow patterns that could transport potential project (and other regional) emissions to the Rocky Mountain National Park are properly characterized in the modeling domain.

5.4 Dispersion Model Input And Options

The CALPUFF model was used to model project-specific and regional emissions of NO_X, SO_2, PM_{10}, and $PM_{2.5}$ (TRC 2004a).

CALPUFF was run using the IWAQM-recommended default control file switch settings for all parameters. Chemical transformations were modeled based on the MESOPUFF II chemistry mechanism for conversion of SO_2 to sulfate (SO_4) and NO_X to nitric acid (HNO_3) and nitrate (NO_3). Each of these pollutant species was included in the CALPUFF model runs.

NO_X, HNO_3, and SO_2 were modeled with gaseous deposition, and SO_4, NO_3, PM_{10}, and $PM_{2.5}$ were modeled using particle deposition. The PM_{10} emissions input to CALPUFF included only the PM_{10} emissions greater than the $PM_{2.5}$ (i.e., modeled PM_{10} = PM_{10} emission rate – $PM_{2.5}$ emission rate). Total PM_{10} impacts were determined in the post-processing of modeled impacts.

5.4.1 Chemical Species

The CALPUFF chemistry algorithms require hourly estimates of background ozone and ammonia concentrations to predict the conversion of SO_2 and NO/NO_2 to sulfates and nitrates, respectively. Background ozone data for the 1995 meteorological data year were available for six stations within the modeling domain:

- Pinedale, Wyoming,
- Centennial, Wyoming,
- Yellowstone National Park, Wyoming,
- Craters of the Moon National Park, Idaho,
- Highland, Utah, and
- Mount Zirkel Visibility Study, Hayden, Colorado.

Hourly ozone data from these stations were used in the CALPUFF modeling, with a default value of 44.7 parts per billion (ppb) (7 a.m.-7 p.m. mean) used for missing hours. A background ammonia concentration of 1.0 ppb was used as suggested in the IWAQM guidance for arid lands.

5.4.2 Model Receptors

CALPUFF model receptors, at which the concentration, deposition, and AQRV impacts were calculated, were defined along the boundaries of Class I and other sensitive areas at a 2-

kilometer spacing and within the boundaries of these areas on a 4-kilometer Cartesian grid. Discrete receptors were placed on a Cartesian grid at a 4-kilometer spacing within the Seminoe Road Project area. Individual receptor points were defined at each of the 14 acid-sensitive lakes. Receptor elevations for Class I and sensitive Class II areas were determined from 1:250,000 scale USGS DEM data. Elevations for the sensitive lake receptors were derived from 7.5-minute USGS topographical maps.

5.4.3 Source Parameters

CALPUFF source parameters were determined for project and regional source emissions of NO_X, SO_2, PM_{10}, and $PM_{2.5}$ (TRC 2004a). Project sources were input to CALPUFF using point sources to idealize compressor stations, drilling rigs, pit flares, and down-hole well pump engines. Additionally, 4-kilometer-square area sources at a 4-kilometer spacing were placed throughout the project area to idealize vehicle traffic, wind erosion and down-hole well pump emissions.

Non-project regional emissions were input to CALPUFF using area sources to idealize non-compression RFD sources and countywide well sites; and point sources to idealize state-permitted, RFD compression, and RFFA sources. Non-compression RFD emissions were modeled using area sources developed for each proposed field development as a best fit to the respective project area. Countywide well emissions were modeled using area sources that best fit the respective county area.

5.5 Criteria Pollutant Background Data

Ambient air concentration data collected at regional monitoring sites provided the measure of the background conditions during the most recent available time period. Regional monitoring-based background values for criteria pollutants (PM_{10}, $PM_{2.5}$, NO_2, and SO_2) were collected at monitoring sites in Wyoming and northwestern Colorado and are summarized in **Table H-9, Far-field Analysis Background of Ambient Air Quality Concentrations**. These ambient air background concentrations are added to modeled pollutant impacts to yield total predicted ambient air quality concentrations for comparison to applicable ambient air quality standards.

Table H-9, Far-Field Analysis Background of Ambient Air Quality Concentrations (μg/m^3)

Pollutant	Averaging Period	Measured Background Concentration
Nitrogen dioxide (NO_2)[1]	Annual	3.4
PM_{10}[2]	24-hour	33
	Annual	16
$PM_{2.5}$[2]	24-hour	13
	Annual	5
Sulfur dioxide (SO_2)[3]	3-hour	132
	24-hour	43
	Annual	9

Notes:
(1) Data collected at Green River Basin Visibility Study site, Green River, Wyoming during period January-December 2001 (ARS 2002).
(2) Data collected by WDEQ-AQD at Emerson Building, Cheyenne, Wyoming, Year 2001.
(3) Data collected at LaBarge Study Area at the Northwest Pipeline Craven Creek Site 1982-1983.

5.6 Visibility Background Data

Background visibility data were obtained from IMPROVE monitoring sites located at the Bridger Wilderness Area, the Mount Zirkel Wilderness Area, and the Rocky Mountain National Park. See **Table H-10, IMPROVE Background Aerosol Extinction Values**. Background visibility data are used in combination with modeled pollutant impacts to estimate change in visibility conditions that is measured as change in light extinction. The IMPROVE background visibility data are provided as reconstructed aerosol total extinction data based on the quarterly mean of the 20 percent cleanest days measured at each site for the historical monitoring period of record through December 2002.

Table H-10, IMPROVE Background Aerosol Extinction Values

IMPROVE Site	Quarter	Hygroscopic (Mm^{-1})	Non-Hygroscopic (Mm^{-1})	Monitoring Period
Bridger Wilderness Area	1	0.845	1.666	1989-2002
	2	1.730	3.800	1988-2002
	3	1.902	5.637	1988-2002
	4	0.915	2.035	1988-2002
Mount Zirkel Wilderness Area	1	1.269	2.591	1995-2002
	2	2.028	4.163	1995-2002
	3	2.358	5.151	1994-2002
	4	0.961	2.262	1994-2002
Rocky Mountain National Park	1	0.986	2.117	1991-2002
	2	2.457	5.261	1991-2002
	3	2.651	6.709	1991-2002
	4	0.790	2.720	1990-2002

5.7 Lake Chemistry Background Data

The most recent lake chemistry background ANC data were obtained for each sensitive lake. The 10th percentile lowest ANC values were calculated for each lake following procedures provided by the Forest Service. These ANC values and the number of samples used in the calculation of the 10th percentile lowest ANC values are provided in **Table H-11, Background ANC Values for Acid Sensitive Lakes**.

Table H-11, Background ANC Values for Acid Sensitive Lakes

Wilderness Area	Lake	Latitude (Deg-Min-Sec)	Longitude (Deg-Min-Sec)	10th Percentile Lowest ANC Value (µeq/l)	Number of Samples	Monitoring Period
Bridger	Black Joe	42º44'22"	109º10'16"	67.0	61	1984-2003
Bridger	Deep	42º43'10"	109º10'15"	59.9	58	1984-2003
Bridger	Hobbs	43º02'08"	109º40'20"	69.9	65	1984-2003
Bridger	Lazy Boy	43º19'57"	109º43'47"	18.8	1	1997
Bridger	Upper Frozen	42º41'13"	109º09'39"	5.0	6	1997-2003
Fitzpatrick	Ross	43º22'41"	109º39'30"	53.5	44	1988-2003
GLEES(1)	West Glacier Lake	41º22'38"	106º15'31"	35.2	14	1988-1996
Mount Zirkel	Lake Elbert	40º38'3"	106º42'25"	51.9	55	1985-2003
Mount Zirkel	Seven Lakes	40º53'45"	106º40'55"	36.2	55	1985-2003
Mount Zirkel	Summit Lake	40º32'43"	106º40'55"	47.3	95	1985-2003
Popo Agie	Lower Saddlebag	42º37'24"	108º59'38"	55.5	43	1989-2003
Rawah	Island Lake	40º37'38"	105º56'26"	68.7	15	1996-2002
Rawah	Kelly Lake	40º37'32"	105º57'34"	181.1	13	1995-2002
Rawah	Rawah Lake #4	4040'16"	105º57'28"	41.2	13	1996-2002

Note:
(1) GLEES (Glacier Lakes Ecosystem Experiments Site) – Medicine Bow National Forest, Snowy Range, Wyoming.

5.8 Impact Assessment

ALPUFF modeling was performed to compute direct and cumulative impacts from the Seminoe Road Project and regional sources.

CALPUFF-modeled concentration impacts were post-processed with POSTUTIL and CALPOST for each far-field sensitive area to derive:

- Concentrations for comparison to ambient standards (WAAQS and NAAQS), PSD Class I significance thresholds, and PSD Class I and II Increments;
- Deposition rates for comparison to sulfur (S) and nitrogen (N) deposition thresholds and to calculate changes to acid neutralizing capacity (ANC) at sensitive lakes; and

- Light extinction changes for comparison to visibility impact thresholds. For in-field locations, CALPUFF concentrations were post-processed to compute maximum concentration impacts for comparison to WAAQS and NAAQS.

5.8.1 Concentration

The CALPOST and POSTUTIL post-processors were used to summarize concentration impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at PSD Class I and sensitive PSD Class II areas, and at in-field locations. Predicted impacts are compared to applicable ambient air quality standards, PSD Class I and Class II increments, and significance levels.

PM_{10} concentrations were computed by adding predicted CALPUFF concentrations of PM_{10}, $PM_{2.5}$, SO_4, and NO_3. $PM_{2.5}$ concentrations were calculated as the sum of modeled $PM_{2.5}$, SO_4, and NO_3 concentrations. The PM_{10} impacts from project-related traffic emissions (production and construction) were not included when post-processing the PM_{10} impacts at all far-field receptor locations, only the $PM_{2.5}$ impacts were considered. This assumption was based on supporting documentation from the Western Regional Air Partnership (WRAP) analyses of mechanically generated fugitive dust emissions that suggest that particles larger than $PM_{2.5}$ tend to deposit out rapidly near the emissions source and do not transport over long distances (TRC 2004b). This phenomenon is not modeled adequately by CALPUFF. Therefore, these sources were not considered in the total modeled impacts to avoid overestimating PM_{10} impacts at far-field locations. The total PM_{10} impacts from traffic emissions were included in the in-field concentration modeling.

Far-Field Results. The modeling indicates that the Seminoe Road Project would cause and direct or cumulative impacts above any federal or state air quality standards or established PSD increments, and such impacts would be below the proposed PSD Class I significant impact levels at the evaluated Class I areas (TRC 2004b).

In-Field Results. The modeling of the Seminoe Road Project shows that there would be no exceedences of air quality standards within and nearby the project Area from project construction and production activities.

5.8.2 Deposition

Sulfur (S) and nitrogen (N) deposition impacts were modeled. The POSTUTIL utility was used to estimate total S and N fluxes from CALPUFF predicted wet and dry fluxes of SO_2, SO_4, NO_X, NO_3, and HNO_3. CALPOST summarized the annual S and N deposition values from the POSTUTIL program. Predicted Seminoe Road Project direct impacts were compared to the NPS deposition analysis thresholds (DAT) for total N and S deposition in the western U.S., which are defined as 0.005 kilograms per hectare per year (kg/ha-year) for both elements.

Modeling results indicated that there would be no direct project N or S deposition impacts above the DAT and that cumulative N and S deposition impacts would be well below the cumulative analysis thresholds. Further, there would be no adverse impacts from acid deposition as modeled results were well below Forest Service thresholds, defined as 5 kg/ha-yr for S and 3 kg/ha-yr for N (TRC 2004b).

5.8.3 Sensitive Lakes

The modeling indicates that direct and cumulative deposition impacts from the Seminoe Road Project would not contribute significantly to an increase in acidification at any of the sensitive lakes (TRC 2004b).

The CALPUFF-predicted annual deposition fluxes of S and N at sensitive lake receptors were used to estimate the change in ANC. The change in ANC was calculated following the January 2000, Forest Service Rocky Mountain Region's *Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide*. The predicted changes in ANC were compared with the Forest Service's Level of Acceptable Change (LAC) thresholds of 10 percent for lakes with ANC values greater than 25 microequivalents per liter (μeq/l) and 1 μeq/l for lakes with background ANC values of 25 μeq/l or less.

5.8.4 Visibility

The CALPUFF model-predicted concentration impacts at far-field PSD Class I and sensitive Class II areas were post-processed with the CALPOST model to estimate potential impacts to visibility (regional haze) for both the electrified and non-electrified scenarios.

The CALPOST model was used to estimate visibility impacts from predicted concentrations of PM_{10}, $PM_{2.5}$, SO_4, and NO_3. Similar to post-processing far-field PM_{10} concentration impacts,

PM_{10} impacts from project-related traffic emissions were not included in the total estimated impacts. Only $PM_{2.5}$ impacts were considered.

Background Conditions. Visibility impairment calculations were performed using estimated natural background visibility conditions and measured background visibility conditions from the Bridger Wilderness Area, the Mount Zirkel Wilderness Area, and Rocky Mountain National Park IMPROVE sites (TRC 2004b).

The IMPROVE background visibility data are provided as reconstructed aerosol total extinction data, based on the quarterly mean of the 20 percent cleanest days measured at each site for the historical monitoring period of record through December 2002.

The natural background visibility data used with the FLAG visibility analysis are shown in **Table H-12, FLAG Report Background Extinction Values**.

Table H-12, FLAG Report Background Extinction Values

Season	Hygroscopic (Mm^{-1})	Non-hygroscopic (Mm^{-1})
Winter	0.6	4.5
Spring	0.6	4.5
Summer	0.6	4.5
Fall	0.6	4.5
Note: (1) Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report, December 2000.		

The IMPROVE method used EPA-provided monthly relative humidity factors (TRC 2004b). See **Table H-13, Monthly Relative Humidity Factors From IMPROVE Sites.**

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are reported in percent change in light extinction and change in deciview (dv). The thresholds are defined as 5 percent and 10 percent of the reference background visibility or 0.5-dv and 1.0-dv for project and cumulative source impacts, respectively. The BLM considers a 1.0-dv change as a significant adverse impact. It should be noted that there are no applicable local, state, tribal, or federal regulatory visibility standards.

Table H-13, Monthly Relative Humidity Factors From IMPROVE Sites

IMPROVE Site	Quarter	Months	f(RH) Values
Bridger Wilderness Area[1]	1	Jan, Feb, Mar	2.5, 2.3, 2.3
	2	Apr, May, Jun	2.1, 2.1, 1.8
	3	Jul, Aug, Sep	1.5, 1.5, 1.8
	4	Oct, Nov, Dec	2.0, 2.5, 2.4
Mount Zirkel Wilderness Area[2]	1	Jan, Feb, Mar	2.2, 2.2, 2.0
	2	Apr, May, Jun	2.1, 2.2, 1.8
	3	Jul, Aug, Sep	1.7, 1.8, 2.0
	4	Oct, Nov, Dec	1.9, 2.1, 2.1
Rocky Mountain National Park	1	Jan, Feb, Mar	1.9, 2.0, 2.0
	2	Apr, May, Jun	2.1, 2.3, 2.0
	3	Jul, Aug, Sep	1.9, 1.9, 2.0
	4	Oct, Nov, Dec	1.8, 2.0, 1.9

Notes:
(1) Also used for Fitzpatrick and Popo Agie Wilderness Areas, and Wind River Roadless Area.
(2) Also used for Rawah and Savage Run Wilderness Areas, and Dinosaur National Monument.

Far-Field Results. Using both the FLAG and IMPROVE background visibility data, direct visibility impacts from Seminoe Road Project sources were predicted to be below 0.5-dv.

However, the cumulative modeled results (encompassing the Atlantic Rim Project, the Seminoe Road Project, and other regional sources) revealed that the BLM 1.0-dv significance threshold could be exceeded for a few days each year at the Bridger, Popo Agie, and Wind River Wilderness areas. The highest predicted impact would occur at the Bridger Wilderness, where it was modeled that the BLM 1.0-dv threshold could be exceeded on four days per year (using IMPROVE data) but only one day per year (using FLAG data). The maximum deciview change at the Bridger Wilderness Area was estimated as 2.1 dv (Using IMPROVE data) and 1.8 dv (using FLAG data) (TRC 2004b).

The FLAG report defines a 0.4 percent change in extinction (0.04 dv) to be a project-specific significance level for cumulative visibility analyses. As such, a project is regarded as having an insignificant contribution to a cumulative visibility impact if that project contribution to a cumulative visibility impact of 1.0 dv is less than 0.04 dv. Using these criteria, an analysis was performed for all days when estimated cumulative visibility impacts for sensitive receptor areas were predicted to be at or above the BLM 1.0-dv significance threshold. The results of this analysis showed that Seminoe Road Project impacts were below the 0.04-dv visibility threshold for all days when the cumulative visibility impacts were predicted to be 1.0 dv or greater (TRC 2004b). Thus, it was concluded that the Seminoe Road Project would not contribute to any significant visibility impacts to any of the Class I or sensitive Class II PSD areas in the region.

Appendix I

Monitoring Results for the Seminoe Road Pilot Project

Monitoring Results for the Seminoe Road Pilot Project
Bob Lange - November 14, 2005

I. Introduction:

This appendix details monitoring data collected for the Seminoe Road Pilot Project by the BLM. Data included cross-sections to look at channel erosion in Pool Table Draw, water quality sampling in Pool Table Draw and a shallow groundwater well cluster below the stock pond in Pool Table Draw.

Monitoring of the Pilot Project has shown that continuous discharge of water into ephemeral channels near Seminoe Reservoir results in channel incision and lateral adjustment producing channel erosion significantly above undisturbed conditions. Further, water quality changes and conveyance loss is minimal to water moving down drainages and appears to be seasonally dependent and the shallow groundwater in the alluvium below the reservoir on Pool Table Draw is connected to reservoir waters.

II. Channel Erosion in Pool Table Draw

An "ephemeral drainage" means a drainage that flows only in direct response to precipitation in the immediate watershed or in response to melting of a cover of snow or ice, and a drainage, which has a channel bottom that is nearly always above the local water table. The EIS analysis area includes ten main ephemeral drainages that are being considered as potential discharge drainages for Seminoe Road Project produced water.

Ephemeral drainage channels dry out between storm events, which reduces infiltration and increases surface runoff along the bottom of the channels. Sediment moves in pulses with these storm events resulting in wide channel forms with fine textured bed deposited material. Due to the dry soils in these channel bottoms water predominantly moves as sheet flow or in macropores created by preferential erosion and/or animal burrows. Abrupt changes in surface water flows due to surface roughness from vegetation (sagebrush, greasewood, and grasses), the channel gradient, and/or preferential channels form in features like animal trails cause surface water to concentrate and velocities to increase. This process can increase the erosive energy of the water during storm events.

These flood events are usually short lived since a typical summer thunderstorm last less than several hours. The majority of the water in these systems moves quickly through the drainage in flash floods and storm pulses that are only attenuated based on the travel time of the water (Figure 4).

Ephemeral channels are susceptible to erosion in the drainage channel bed, called "headcuts". Erosion potential was evaluated during baseline data collection efforts. A headcut is an abrupt vertical drop in a channel that is a result of the breakdown of soil structure or an increase in flow concentration or velocity. Erosion can continue in the channel below a headcut causing a gulley to form, and can cause the channel to be incised deeper than before, a process called down-cutting. The abrupt change in elevation over the headcut increases the erosive energy of the water and can allow the headcut to migrate upstream.

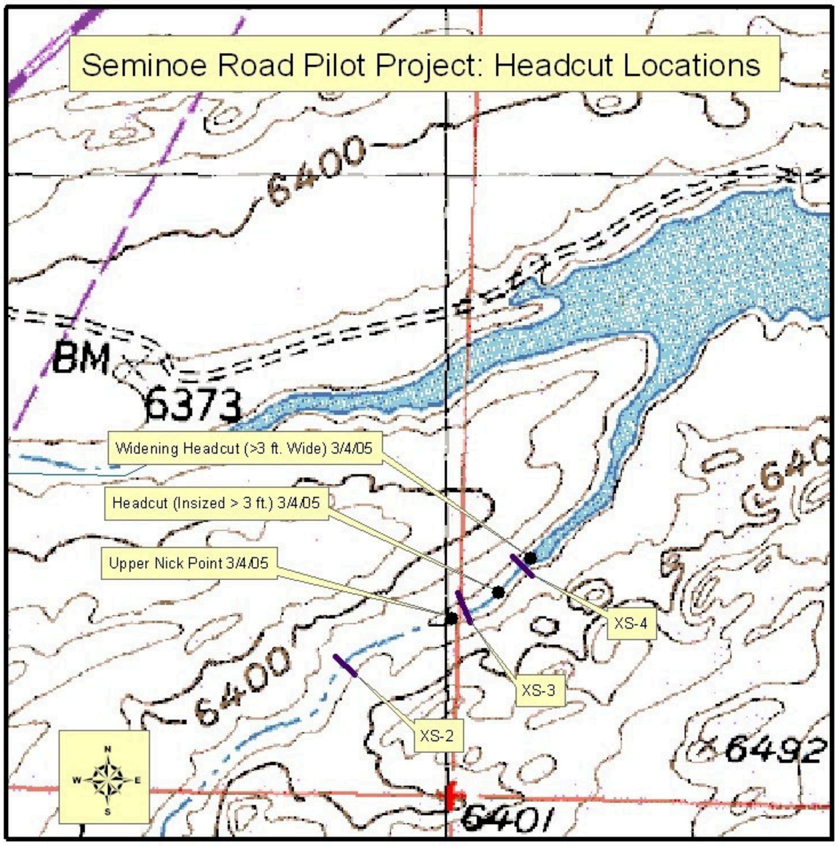
The channel erosion (one headcut beginning the pool of the reservoir, and the other a nick point or nick points that have extended up past the high pool level for the reservoir) were first observed in 2001. These erosional features have steadily extended up the drainage and can be grouped into three types of features. Farthest upstream is a series of nick points that are typically 1 foot or less in elevation drop (Map 1), at about XS-2 a significant vertical adjustment takes place to a severely incised channel 3 to 5 feet deep and 1 foot wide, and finally to a widening gulley driven by bank slumping due to undercutting by the channel that is 5-15 feet deep and 3 to 20 feet wide (Figure 1).

Figure 1: Pictures of headcut during the first two years (2001-2002). The picture on the left shows the change in velocity that down cuts the headcut and allows it to migrate upstream with small disharges. After the initial vertical adjustment the headcut widens with bank sluffing shown on the right. Note the current position of the headcut is in the sagebrush shown in the background.

Riprap was placed in the channel in 2002 in an attempt to reduce the erosional energy at the location of the downstream headcut and was unsuccessful as shown in the Figure 2. Figure 2 was taken the winter after the rip-rap was installed and shows one section of the rip-rap channel undercut by flows. In the background, two piles of riprap can be seen that had not yet been installed.

Figure 2: Riprap in Channel

In January of 2003, the BLM established three cross-sections (XSs) upstream of the high pool line of the reservoir (Map 1).



***Map 1**:* Cross-sections and Current Locations for Headcut Features.

Data from these cross-sections show that the headcut (the narrow incised portion) moved through XS-4 in the months after the storm event on 8/16/03. The headcut did not cut through XS-4 during the storm event, but did so after (Figure 3). The data also shows a consistent increase in depth, cutting 1/3 ft. deeper from 8/24/04 to 9/15/04 during periods of moderate rainfall.

The channel sides in the vicinity of XS-4 are beginning to be undercut and it can be anticipated to result in a wider channel similar to what occurs just below XS-4. The headcut is fast approaching XS-3, and the highest nick point is just beyond XS-3. These facts support the opinion that the continuous discharge from the project provides the energy for the vertical adjustment, which contributes to the later widening of the channel.

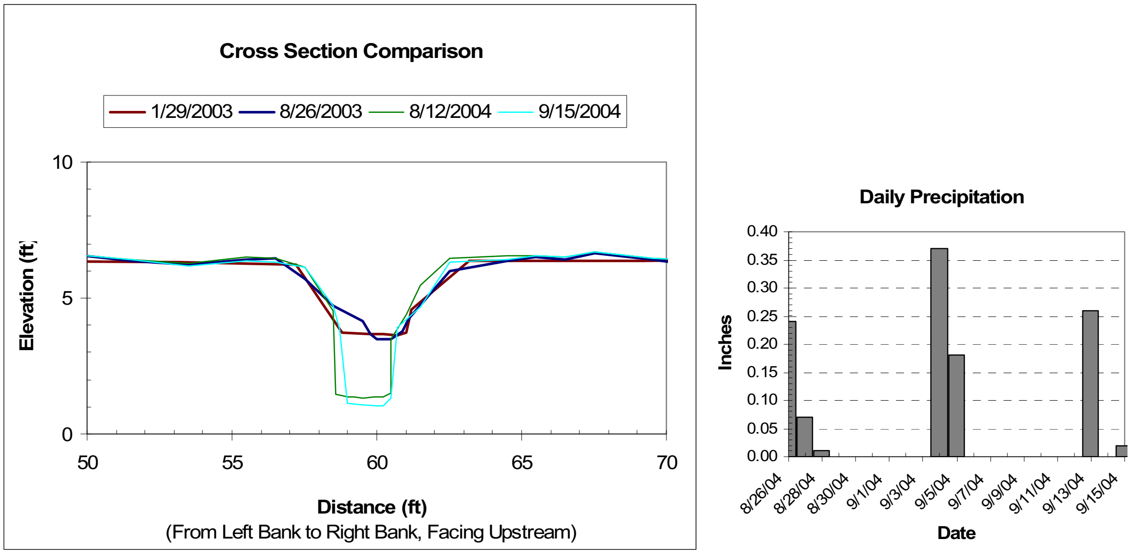


Figure 3: Cross-section 4 Measurements and precipitation from 8/26-9/15/2004.

Empirical methods used to calculate peak storm are notoriously inaccurate for ephemeral systems. This is because the equations are based on relationships calculated from perennial gaged watersheds. The USGS released, "Peak-Flow Characteristics of Wyoming Streams, Report 03-4107" in 2003. Using this method the 2 year storm event is estimated to be 53 cfs and the 95% confidence interval around this value would be 15 cfs and 182 cfs (Figure 4).

The flood event in August 2003 was photographed and the flows can be estimated at XS-4 using the Mannings equation (Figure 4). As can be seen from Figure 4 the terrace had overland flow during the storm event. Using the elevations from 8/26/03 and assuming the high elevation of the water was 3.5 feet above the channel bottom and an average of 0.5 ft above the terrace (much higher than what is shown in the photograph), the peak would conservatively be under 82 cfs.

Return Interval	Flow (cfs)	95% Confidence	
		Lower Limit	Higher Limit
$Q_{1.5}$ =	33	9	125
Q_2 =	53	15	182
$Q_{2.33}$ =	65	19	215
Q_5 =	131	43	399

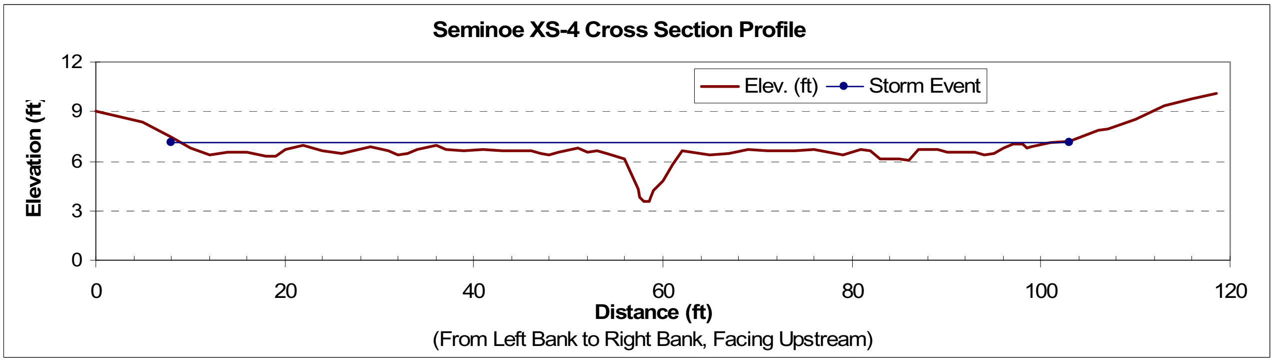


Figure 4: Flood Event Downstream of XS-4, XS-4 and Storm Events using Miller, 2003.

The original water management plan used accepted methods at the time (Lowham, 1976 and Craig and Rankl, 1978), however with the new USGS method (Figure 4) estimates much lower flows for the peak events. As can be seen from the large range between the 95% confidence intervals these flows are still only estimate. The storm event in August 2003 was probably about a 5 year event and not entirely uncommon in this drainage. In itself this or other storm events don't last long enough to trigger the types of vertical adjustment in the channels witnessed. This point is further substantiated by cross-sectional data collect that show a fairly consistent downcutting with typical precipitation.

Monitoring of these sites has shown consistent movement of active headcutting upstream from the locations observed in early 2003. The process is vertical adjustment via a series of knick points that eventually form a narrow trench for the channel. This narrow trench with steep sides is then widened due to bank slumping and piping. The final state is a gulley detached from the flood-plane with very few lateral features to reduce erosional energy (figure 1).

III. Water Quality Sampling

Two channel sampling trips were implemented, one in 12/6/2003 and the other in 8/04/2004.

The water quality data collected on December 6, 2003 showed that the discharged water was not changing significantly as it moves down the channel during the winter months. This relationship may change in other seasons. This can be seen from comparing site XS-1 and XS-2 and also by comparing XS-3 and XS-4 with TDS. There is a 19 mg/L increase between 1 and a decrease of 40 mg/L from 3 to 4. Iron shows a similar response, except showing a minor increase between 1 and a slight decrease between 3 and 4. Other parameters show a similar pattern, i.e. not changing very much as the water moves down the channel.

Table 1: Summary Field Data for All Cross Sections

XS #	**Discharge 12/3/03 (cfs)**	**Discharge 8/4/04 (cfs)**	**Dissolved Iron 12/3/03 (mg/L)**	**Dissolved Iron 8/4/04 (mg/L)**	**Dissolved Manganese 12/3/03 (mg/L)**	**Dissolved Manganese 8/4/04 (mg/L)**
XS1	0.40	0.12	0.95	0.94	0.020	0.040
XS2	0.40	0.11	0.92	1.35	0.020	0.040
EF	0.76	0.60	0.79	0.15	0.040	0.010
XS3	1.04	0.72	0.84	0.03	0.010	0.010
XS4	1.02	0.87	0.84	0.28	0.030	0.010

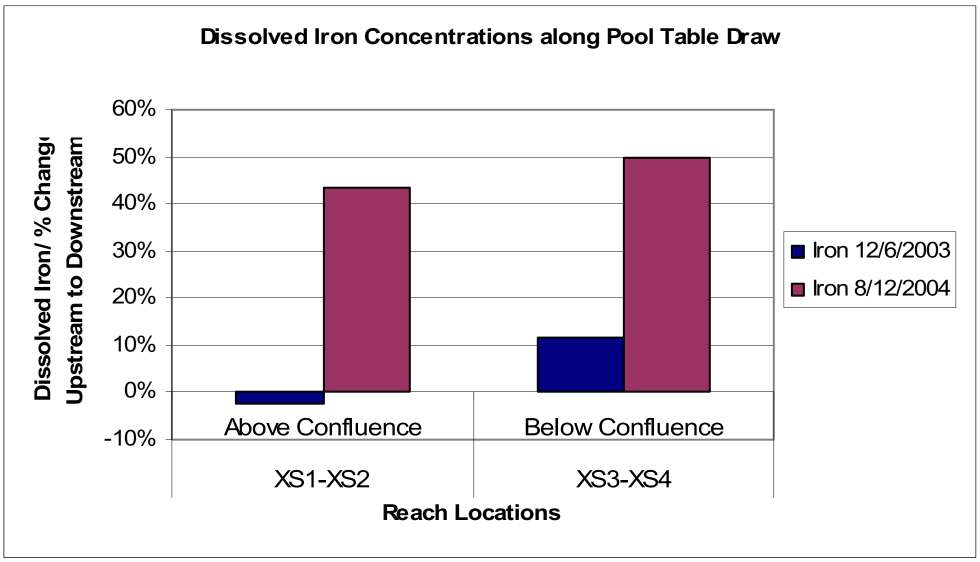


Figure 5: Iron Concentration Changes in Channel Reaches, Represents the Difference between an Upstream and Downstream Site**.**

Figure 5 shows the change between two locations on two different reaches. Notice that the iron concentrations changed significantly in August, but not in December.

Appendix J

Overview of Surface Water Mixing Model

Appendix J – Overview of Surface Water Mixing Model

A surface-water mixing model (Mixing Model) was prepared to evaluate the potential impacts of the Seminoe Road Project action alternatives. The Mixing Model was based on a geochemical model developed by the EPA for the Powder River Basin EIS (BLM, 2003). The Mixing Model differs from the EPA model as it was designed to fit the site-specific conditions of the Seminoe Road Project and to determine the potential effects of releasing produced water into the North Platter River and Seminoe Reservoir. The Mixing Model estimates the mixed concentrations of sodium, calcium, and magnesium for the calculation of the sodium absorption ratio (SAR), as well as the mixed specific conductivity (a measure of overall salinity). The Mixing Model was designed to estimate the potential effect of project discharge on the quality of the North Platte River system water for irrigation purposes and to show general changes in overall water quality. No other constituents were considered for the modeling. A surface-water mixing model is illustrated in **Figure 42, Diagram of a Surface Water Mixing Model**.

The Mixing Model utilizes conservative assumptions and the model results likely over-estimate potential surface water quality effects. As stated previously, the model was designed to qualitatively compare the potential effects of the various action alternatives. The model results provide numeric values, but these values should only be used to compare relative differences between project action alternatives. The assumptions used for the modeling include:

- Inflows into Seminoe Reservoir for each month are equal to the average historical inflows for that month.
- Water volume in Seminoe Reservoir is constant on an annual basis, *i.e.* the water volume changes month to month, but is constant for any 12-month period.
- Seminoe Road Project discharge water will not increase the reservoir volume or evaporation, but only increase outflow.
- Existing baseline water quality in the North Platte River above Seminoe Reservoir and in Seminoe Reservoir is assumed to be constant during low and high flow.

- Evapo-concentration does not play a significant role in changing the water quality in Seminoe Reservoir.

- Water quality of the Seminoe Road Project produced water is similar to water quality of the Pilot Project and does not change between the discharge points and the receiving waters of the North Platte River or Seminoe Reservoir.

- All constituents calculated behave conservatively, *i.e.* do not undergo chemical reactions or adsorption.

To approximate the mixing effects as they occur along the North Platte River and in Seminoe Reservoir, the Mixing Model provided results for the following six locations:

- Location 1 is in the North Platte River, below Dirtyman Draw. The flow in the North Platte River and discharge from discharge points DS-6, DS-7, and DS-18 are combined.

- Location 2 is in Upper Seminoe Reservoir. The flow mixes with discharge from discharge points DS-8, DS-13, and DS-14 and with 16% of the total Seminoe Reservoir volume.

- Location 3 is in Upper Middle Seminoe Reservoir. The flow mixes with discharge from discharge points DS-5, DS-9 and DS-12, and with 20% of reservoir volume.

- Location 4 is in Middle Seminoe Reservoir. The flow mixes with discharge from discharge points DS-2, DS-3, DS-4, DS-10 and DS-11 and 34% of reservoir volume. Additional inflows enter Seminoe Reservoir at this location from the Medicine Bow River and O'Brien Creek. It was assumed that all inflows not attributable to the North Platter River would enter the reservoir at this location. Outflow from Location 4 mixes with 30% of Seminoe Reservoir volume.

- Location 5 is in Lower Seminoe Reservoir at the dam and has no additional inflows from either discharge or tributary streams. Outflow from Seminoe Reservoir mixes with the volume in Kortes Reservoir.

- Location 6 is at the outflow of Kortes Reservoir (Miracle Mile) and does not have inflows except for the outflow from Seminoe Reservoir.

The locations of the modeled sites are shown in **Figure 12, Produced Water Discharge Points – Alternative B**. Additional details on the Mixing Model setup, assumptions, input parameters, and results are described in the Surface Water Modeling Technical Report (HydroGeo 2004c).

Appendix K

Wildlife Monitoring and Protection Plan

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1.0 Introduction

This wildlife monitoring/protection plan was prepared in conjunction with the environmental impact statement (EIS) for the Seminoe Road Natural Gas Development Project (SRNGD). The goal of the plan is to avoid and/or minimize adverse impacts to wildlife present on project-affected areas by monitoring wildlife population trends on the SRNGD during the course of project development and operations and by developing appropriate mitigation actions. Map 1 shows the location of the SRNGD and associated wildlife monitoring areas. Implementation of the plan will allow land managers and project personnel opportunities to achieve and maintain desired levels of wildlife productivity and populations on the SRNGD (e.g., at pre-project levels) by minimizing and/or avoiding potential adverse impacts to wildlife species. In addition, the implementation of this plan will facilitate the maintenance of a diverse assemblage of wildlife populations on the SRNGD simultaneously with the development of natural gas reserves.

The proposed SRNGD, located in Townships 21, 22, 23 and 24 North, Ranges 84, 85 and 86 West, in Carbon County, Wyoming, involves the development of a maximum of 1,240 wells, on up to 785 well pad sites. Associated facilities would include access roads, gas and water pipelines, compressor stations; water disposal systems and an electric power supply system. The proposed life-of-project (LOP) is estimated to be 30 or more years. Alternative development strategies also have been proposed. A complete description of the proposed project and alternatives is provided in Chapter 2 of the EIS.

Proposed inventory, monitoring, and protection measures will be implemented under each potential development scenario, except that the plan will not be implemented under the No Action Alternative. Implementation of the plan will begin in 2005, and is estimated to continue for the LOP; however, the plan may be terminated at the end of any year when there is sufficient evidence that wildlife populations and productivity in the SRNGD have been successfully protected. The plan will receive a major review for effectiveness every 5 to 6 years or as determined b y the Review Team.

2.0 Implementation Protocol

This section provides preliminary wildlife inventory, monitoring, and protection protocol. A summary of primary protocol components is provided in Table 1. Standard protocol for Application for Permit to Drill (APD) and right-of-way (ROW) application field reviews are provided in Table 2. Alternative protocols likely will be developed in the future in response to specific needs identified in annual reports (Section 2.1.1). Methods are provided for each wildlife species/category, and additional species/categories may be added based on needs identified in annual reports. The wildlife species/categories for which specific inventory, monitoring, and protection procedures will be applied were developed based on management agency (Bureau of Land Management [BLM], U.S. Fish and Wildlife Service [USFWS], Wyoming Game and Fish Department [WGFD]) and individual concerns identified during the preparation of the EIS.

Considerable efforts will be required by agency and operator personnel for plan implementation. Many of the annually proposed agency data collection activities are consistent with current agency requirements. Additionally, during annual planning (Section 2.1.2) and throughout project implementation, all efforts will be made to accommodate agency personnel schedules and responsibilities, and further agency cost-sharing approaches will be considered such that public demands and statutory directives are achieved.

2.1 Annual Reports and Meetings

2.1.1 Reports

During project development, operators will provide an updated inventory and description of all existing project features (i.e., location, size, and associated level of human activity at each feature), as well as those tentatively proposed for development during the next 12 months in a format that is compatible with a Geographic Information System (GIS). This inventory will be submitted to the BLM by operators no later than October 15 of each calendar year. These data will be coupled with annual wildlife inventory, monitoring, and protection data obtained for the previous year and included in annual reports. Annual reports will be prepared by the operator or operators' third party contractor with BLM oversight. Annual wildlife inventory, monitoring and protection data gathered in conjunction with the project will be provided to the BLM by October 15 of each calendar year.

Annual reports will summarize annual wildlife inventory and monitoring results, note any trends across years, identify and assess protection measures implanted during past year, specify monitoring and protection measures proposed for the upcoming year, recommend modifications to the existing wildlife monitoring/protection plan based on the success and/or failures of past years and identify additional species/categories to be monitored. Where possible, the data presented in reports will be used to identify potential correlations between development and wildlife productivity and/or abundance, as well as, sources of potential disturbance to wildlife. A GIS will be used for information storage; retrieval, planning, and annual GIS data updates will be conducted. Raw data collected each year also will be provided to other management agencies, at the request of the agencies.

Annual reports will be completed in draft and submitted to the BLM, operators and other interested parties by November 15 of each year. A final annual report will be issued to all potentially affected individuals and groups by early February of each year. Additional reports may be prepared in any year, as necessary, to comply with other relevant wildlife laws, rules, and regulations.

2.1.1 Meetings

A one day meeting will be organized by the BLM and held in December of each year to discuss and modify, as necessary, proposed wildlife inventory, monitoring and protection protocol for the subsequent year. A protocol regarding how to accommodate previously unidentified development sites will also be determined during the annual meeting. Any final decisions regarding wildlife inventory, monitoring and protection protocol will be made by the BLM based on the input of all affected parties.

Additional meetings may be held in any given year to inform and update cooperators on the findings of additional reports as necessary.

2.2 Annual Inventory And Monitoring

Inventory and monitoring protocols will be as identified below for each wildlife species/category. These protocols will be unchanged across development alternatives, except as authorized by the BLM or specified in this plan. Additional wildlife species/categories and associated surveys may be added or wildlife species/categories and surveys may be omitted in future years, pending results presented in the coordinated review of annual reports. Opportunistic wildlife observations may be made throughout the year by agency and operator personnel present in the project area.

The frequency of inventory and monitoring will be dependent upon the level of development in the project area. Inventory and monitoring results may lead to further, currently unidentifiable, scientific studies specifically designed to determine cause and effect. The review team and/or BLM will identify the level of effort required by this wildlife plan subject to the standard listed below. Site and species-specific surveys will be conducted in association with APD and ROW application field reviews.

2.2.1 Threatened, Endangered, Candidate, and Other Species of Concern

The level of inventory/monitoring required for threatened, endangered, candidate, and other species of concern (TEC & SC) will be commensurate with established protocols for the potentially affected species. All surveys will be conducted in coordination with the BLM. Methodologies and results of these surveys will be included in annual reports and provided in separate supplemental reports. A preliminary list of TEC & SC species proposed for management and known from or potentially occurring in the vicinity of the project area is shown on Table 3. As

TEC & SC species are added to or withdrawn from USFWS, BLM, and/or WGFD lists, appropriate modifications will be incorporated to this plan and specified in annual reports.

TEC & SC data collected during surveys and described below will be provided only as necessary to those requiring the data for specific management and/or project development needs. Site- and species-specific TEC & SC surveys will be conducted as necessary in association with all APD and ROW application field reviews.

2.2.1.1 Black-Footed Ferret

The USFWS, in coordination with the WGFD, has developed a list of habitat blocks that are not likely to be inhabited by black-footed ferrets (block cleared). In these areas, take of individual ferrets and effects to a wild population are not an issue and surveys for ferrets are no longer recommended. Although ferret surveys are not required in these areas, the area may still maintain value for the survival and recovery of the species in the future. Additionally, areas remain that require ferret surveys (non-block cleared) in potential habitat. A portion of the project area coincides with the Seminoe complex, which is a non-block cleared area, requiring ferret surveys in areas that would likely result in the take of a ferret during project implementation.

BLM biologists will determine the presence/absence of prairie dog colonies at each proposed development site during APD and ROW application field reviews. Prairie dog colonies in the project area will be mapped and burrow densities determined by a BLM-approved operator-financed biologist, as necessary and in association with proposed development plans. Colonies that meet USFWS criteria as potential black-footed ferret habitat (USFWS 1989), in non-block cleared areas, will be surveyed for black-footed ferrets by an USFWS-certified, operator-financed, surveyor prior to BLM authorizing disturbance of these colonies. Surveys will be conducted as deemed necessary, during consultation with the BLM and/or USFWS. Black-footed ferret surveys will be conducted in accordance with USFWS guidelines (USFWS 1989) and approved by BLM and USFWS.

2.2.1.2 Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

Inventory and monitoring protocol for bald eagle, peregrine falcon, and ferruginous hawk will be as described for raptors (Section 2.2.2).

2.2.1.3 Greater Sage-Grouse

Sage grouse lek inventories will be conducted by the BLM on the project area and a two mile buffer to determine lek locations every 5 years, or as deemed appropriate by the BLM. Surveys may be conducted aerially, with operator-provided financial assistance for aircraft rental, or on the ground, in order to determine lek locations.

Selected leks within the two miles of existing and proposed disturbance areas will be monitored annually to determine lek attendance by the BLM or a BLM-approved operator-financed biologist, between March 1 and May 15, such that all leks on these areas are monitored at least once every 3 years. Monitoring efforts will be implemented at all leks present on affected sections, two-mile buffers, and selected undeveloped comparison areas. The BLM will direct lek-monitoring efforts such that efforts are made to have the same individuals monitor the same leks within and across years. Data must be collected by all parties using accepted WGFD techniques and meeting accuracy standards agreed upon by WGFD and BLM. Standard site- and species-specific sage grouse lek surveys will be conducted as necessary in association with all APD and ROW application field reviews.

2.2.1.4 Mountain Plover

Mountain plover habitat will be mapped within proposed disturbance areas (as identified in annual reports) prior to development of these areas by the BLM or a BLM-approved operator-financed biologist. In addition, these areas will be surveyed annually by the BLM or a BLM-approved operator-financed biologist to detect the presence of plovers. Surveys will be conducted during the period of May 1 through June 20. Data collected during these surveys will be provided on mountain plover route survey forms. Standard site-specific habitat surveys will be conducted as necessary in association with all APD and ROW application filed reviews.

2.2.1.5 Western Burrowing Owl

Prairie dog colonies and other suitable burrowing owl nesting areas on and within 0.75 miles of existing and proposed disturbance areas will be searched for western burrowing owls by the BLM or during June through August to determine the presence or absence of nesting owls. If burrowing owls are found, attempts will be made to determine reproductive success. Standard site-specific surveys will be conducted in association with all APD and ROW application field reviews.

2.2.1.6 Other TEC & SC Species

Surveys for other TEC & SC species will be conducted by the BLM or a BLM-approved operator-financed biologist in areas of potential habitat within 0.5 mile of proposed disturbance sites prior to disturbance. These surveys may be implemented in conjunction with surveys for other species or as components of APD and/or ROW application processes. If any TEC & SC species are observed, the observations will be noted on appropriate data forms and efforts will be made to determine their activities (e.g., breeding, nesting, foraging, hunting, etc.). If any management agency identifies a potential for concern regarding any of these species, additional inventory and monitoring and mitigation may be implemented as specified in annual reports.

2.2.2 Raptors

Raptor inventories will be conducted by the BLM, at least every five years or prior to development of proposed disturbance areas (as identified in annual reports), to determine the location of raptor nests. Raptor nest monitoring will be conducted by the BLM or a BLM approved operator-financed biologist, annually, at known nest locations, between April and July, in order to ascertain nest activity status. These surveys may be implemented aerially, via helicopter, or from the ground. Operators may provide financial assistance for aircraft rental.

Nest productivity monitoring will be conducted by the BLM at active nests, for selected species, to determine nesting success. Monitoring generally will be conducted from the ground, and attempts will be made to determine the cause of any documented nest failure. Operators may provide financial assistance for aircraft rental, as necessary. Site- and species-specific raptor nest inventories will be conducted as necessary in association with all APD and ROW application field reviews.

All raptor nest/productivity surveys will be conducted using procedures that minimize potential adverse effects to nesting raptors. Specific survey measures for reducing detrimental effects are listed in Grier and Fyfe (1987) and Call (1978) and include the following.

- Nest visits will be delayed for as long as possible in the nesting season.
- Nests will be approached cautiously, and their status (i.e., number of nestlings/fledglings) will be determined from distance with binoculars or a spotting scope.
- Nests will be approached tangentially and in an obvious manner to avoid startling adults.
- Nests will not be visited during adverse weather conditions (e.g., extreme cold, precipitation events, windy periods, and hottest part of the day).
- Visits will be kept as brief as possible.
- All inventories will be coordinated by the BLM.
- The number of nest visits in any year will be kept to a minimum.
- All raptor nest location data will be considered confidential.

2.2.3 Big Game Crucial Range

Data on big game use of crucial winter ranges on the project area and an adjacent one mile buffer will be requested annually by the BLM from the WGFD, as deemed necessary by the BLM.

This information will be used to assess the effectiveness of protection measures implemented for the project.

2.2.4 Other Inventory and Monitoring Measures

Additional inventory and monitoring measures may be applied for other species as specified in annual reports. Surveys will be conducted in adherence with protocol to be established by the BLM, other agencies and operators. Operators may provide financial assistance for these investigations.

2.2.5 General Wildlife

BLM staff will be responsible for maintaining records of selected wildlife species observed during the course of their activities on the project area. Operator personnel may also provide data on wildlife observations. The information provided will include observations of wildlife species, their numbers, location, activity, and other pertinent data as applicable and identified on the General Wildlife Observation Data Sheet presented in Figure 1 of this plan. Where operators are uncertain of the USGS coordinates for an observation, a general description of the location may be provided and in instances where species of sex information is questionable, operators will identify the observation as such.

2.3 Protection Measures

The wildlife protection measures proposed herein have been developed from past measures identified for oil and gas developments in Wyoming. Additional measures may be included and/or existing measures may be modified in any given year as allowable and as deemed appropriate by BLM in consultation with other agencies, operators and interested parties. These measures will be specified in annual reports. Protection measures will be implemented by operators with assistance from and/or in consultation with the BLM. In addition, these measures may be modified on a site-specific basis as deemed appropriate by the BLM after completion of APD and ROW application field reviews.

The principal protection measure for most wildlife will be species- and project-specific measures as well as general wildlife protection measures (Section 2.3.4). Implementation of these measures may benefit other wildlife species found on and adjacent to the project area. Sensitive/crucial habitats should be avoided where possible.

2.3.1 TEC & SC

USFWS and WGFD consultation and coordination will be conducted for all protection activities relating to TEC & SC species and their habitats. Where possible, these actions will be specified in advance in the annual reports.

2.3.1.1 Black-footed Ferret

In general, all prairie dog colonies on the project area will be avoided, where practical. If prairie dog colonies, in non-block cleared areas, of sufficient size and burrow density for black-footed ferrets are scheduled to be disturbed, black-footed ferret surveys of these colonies will be conducted pursuant to BLM and/or USFWS decisions made during informal consultations. Survey protocol will adhere to USFWS guidelines as established in USFWS (1989) and will be conducted by a USFWS-qualified biologist a maximum of one year in advance of the proposed disturbance. Reports identifying survey methods and results will be prepared and submitted to the USFWS and BLM in accordance with Section 7 of the Endangered Species Act of 1973, as amended, and the Interagency Cooperation Regulations. Surveys will be financed by the operators.

If black-footed ferrets are found on the project area, the USFWS will be notified immediately and formal consultations will be initiated to develop strategies that ensure no adverse effects to the species. Before ground-disturbing activities are initiated in black-footed ferret habitat, authorizations to proceed must be received from the BLM, in consultation with the USFWS.

2.3.1.2 Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

Protection protocol will be as described for raptors (see Section 2.3.2). Additional measures will be applied on a species- or site-specific bases, as deemed appropriate by the BLM and/or USFWS, and specified in annual reports.

2.3.1.3 Greater Sage-Grouse

Surface disturbance or occupancy will be prohibited with 0.25 miles of the perimeter of occupied greater sage-grouse leks; Human activity would be avoided between 6:00 p.m. and 9:00 a.m. from March 1 to May 20 within 0.25 miles of the perimeter of occupied greater sage-grouse leks; Surface disturbance and other actions that create permanent and high-profile structures such as buildings, storage tanks and overhead power lines, will not be constructed within 0.25 to 1.0 mile of the perimeter of greater sage-grouse leks on and adjacent to the project area, as determined on a case-by-case basis; Surface disturbing and disruptive activities will not be allowed within two miles of an occupied greater sage-grouse lek or in nesting and early brood-rearing habitat associated with individual leks (when identified and delineated), from March 1 to July 15; Surface disturbing and disruptive activities will not be allowed between November 15 and March 14 in delineated winter concentration areas; and, in order to minimize noise disturbances to strutting greater sage-grouse, compressor stations will be muffled with hospital style mufflers. Other techniques and/or equipment can be utilized, when it is demonstrated that they result in similar or increased noise reduction. Additional noise reduction techniques may be required if research shows that current techniques are not adequate.

2.3.1.4 Mountain Plover

Mountain plover habitat will be avoided where practical. Where these habitats will be disturbed, reclamation will utilize procedures designed to reestablish suitable plover habitat. The primary protection measure for mountain plover on the project area will be avoidance plover habitat during the breeding season. All surface-disturbing activities will be restricted from April 10 to July 10 in mountain plover habitat. Addition protection measures, as shown in figure 2, may be implemented in identified mountain plover occupied habitat (i.e., areas where broods and/or adults have been observed in the current year or documented in at least 2 of the past 3 years).

2.3.1.5 Western Burrowing Owl

Protection protocol will be as described for raptors (Section 2.3.2) as well as avoidance of prairie dog colonies, where practical (Section 2.3.1.1).

2.3.1.6 Other TEC&SC Species

If crucial features for any TEC & SC species are found during surveys of areas within 0.5 miles of proposed disturbance sites, avoidance of these features will be accomplished in consultation and coordination with BLM, USFWS, and WGFD. Construction activities in these areas will be curtailed until there is concurrence between BLM, USFWS, and WGFD on what activities can be authorized. Activities will, in most cases, be delayed until such time that no adverse effects will occur.

It is assumed that protocol specified in Section 2.3.4 for general wildlife will likely benefit TEC & SC species as well. If any management agency identifies a potential for impacts to any TEC & SC species, additional measures may be implemented as specified in annual reports.

2.3.2 Raptors

The primary protection measure for raptor species on the project area will be avoidance of nest locations during the breeding season. All surface-disturbing activities will be restricted from February 1 through July 31 within a 0.75 to 1.0 mile radius of raptor nests, depending upon species. In addition, well locations, roads, ancillary facilities, and other surface structures requiring a repeated human presence will not be constructed within 825 feet of raptor nests, except ferruginous hawk, where the restriction will be to 1,200 feet (restrictions will generally exclude surface disturbance).

Operators will notify the BLM immediately if raptors are found nesting on or within 1,200 feet of project facilities, and operators will assist the BLM as necessary in erecting artificial nesting structures (ANSs), as appropriate. The use of ANSs will be considered as a last resort for raptor protection. If nest manipulation or a situation requiring a “taking” of a raptor nest becomes necessary, a special permit will be obtained from the Denver USFWS Office, Permit Section, and will be initiated with sufficient lead time to allow for development of mitigation. Required corresponding permits will be obtained from the WGFD in Cheyenne. Consultation and coordination with the USFWS and WGFD will be conducted for all protection activities relating to raptors.

If it is found that project activities could potentially affect raptor nesting on or adjacent to the project area, as determined from decreased raptor productivity or nesting, or documented nest abandonment or failure, ANSs may be constructed at a rate of up to two ANSs for on impacted nest. Existing degraded raptor nests may be upgraded or reinforced to minimize potential impacts. ANSs will be located within the nesting territory of potentially affected raptor pairs, outside of the line-of-sight or nest buffer of actively nesting pairs, where possible. Operators will be responsible for the annual maintenance of ANSs throughout the LOP. Annual ANS maintenance activities will be completed after August 15 and prior to October 15 each year, as necessary. All ANSs on public lands will become the property of the BLM upon completion of the project. Pertinent data regarding ANSs or nests proposed for upgrading will be identified in annual reports.

In cases where existing project features are located within the nest buffers of active raptor nests, no prolonged maintenance activities will be allowed during critical periods. The exact dates of exclusion will be determined by the BLM and will likely vary between nests and from year to year, depending on the species present and variations in weather, nesting chronology, and other factors.

Any power line construction will follow the recommendations of the Avian Power Line Interaction Committee (APLIC) (1994, 1996) and Olendorff et al. (1981) to avoid collisions and/or electrocution of raptors.

2.3.3 Big Game Species

No construction activities or prolonged maintenance actions will be conducted within big game crucial winter range during the crucial winter periods of November 15 – April 30. If right-of-way fencing is required, it will be kept to a minimum, and the fences will meet BLM/WGFD approval for facilitating wildlife movement. Wildlife-proof fencing will be used only to enclose areas that are potentially hazardous to wildlife species, or reclaimed areas where it is determined that wildlife species are impeding successful vegetation establishment. Snow fences, if used, will be limited to segments of 0.25 miles or less. Project personnel will also be advised to minimize stopping and exiting their vehicles in big game winter habitat during crucial winter periods. In addition, escape openings will be provided along roads in big game crucial winter ranges, as designated by the BLM, to facilitate exit of big game animals from snowplowed roads. Additional habitat protection/improvement measures may also be applied in any given year as directed by the BLM, in consultation with operators and other agencies, and specified in annual reports.

2.3.4 General Wildlife

Unless otherwise indicated, the following protection measures will be applied for all wildlife species. Additional measures primarily designed to minimize impacts to other project area resources (e.g., vegetation and surface water resources, including wetlands, steep slopes, etc.) are identified in EIS section 2.8 and Chapter 4, and these measures may provide additional protection for wildlife. Additional actions may be applied in any given year to further minimize potential impacts to wildlife. These actions will be specified in annual reports.

All roads on and adjacent to the project area that are required for the proposed project will be appropriately constructed, improved, maintained, and signed to minimize potential wildlife/vehicle collisions and facilitate wildlife (most notably big game) movement through the project area. Appropriate speed limits will be adhered to on all project roads, and operators will advise employees and contractors regarding these speed limits. Some existing roads on the project area and surrounding transportation planning area may be reclaimed if they become redundant or closed (gated and locked) to deny unnecessary access.

To protect important habitat in portions of the project area (i.e., ephemeral draws dominated by basin big sagebrush) areas with sagebrush greater than three feet tall will be avoided where possible.

Addition non-species-specific wildlife mitigations include the following.

Reserve, workover, and flare pits and other locations potentially hazardous to wildlife will be adequately protected by netting and/or fencing as directed by the BLM to prohibit wildlife access. If dead or injured raptors, big game, migratory birds, or unusual wildlife are observed on the project area, operator personnel will contact the appropriate BLM and WGFD offices. Under no circumstances will dead or injured wildlife be approached or handled by operator personnel. Employee and contractor education will be conducted regarding wildlife laws. If violations are discovered on the project area, operators will immediately notify the appropriate agency. If the violation is committed by an employee or contractor, said employee or contractor will be disciplined and may be dismissed by the operator and/or prosecuted by the WGFD and/or USFWS.
Operators will implement policies designed to control off-site activities of operational personnel and littering, and will notify all employees (contract and company) that conviction of a violation can result in disciplinary action, including dismissal.

Additional project- and site-specific mitigation measures may be added in future years, as specified in annual reports.

3.0 Literature Cited

Avian Power Line Interaction Committee. 1994. Mitigating bird collisions with power lines: The state of the art in 1994. Edison Electric Institute, Washington, D.C. 78 pp. + append.

Baxter, G.T., and M.D. Stone. 1980. Amphibians and reptiles of Wyoming. Wyoming Game and Fish Department, Bulletin No. 16. 137 pp.

Call, M.W. 1978. Nesting habitats and surveying techniques for common western raptors. U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 316. 115 pp.

Cerovski, A.O., M. Grenier, B. Oakleaf, L. Van Fleet, and S. Patla. 2004. Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. Wyoming Game and Fish Department Nongame Program, Lander. 206pp.

Dorn, J.L., and R.D. Dorn. 1990. Wyoming birds. Mountain West Publishing, Cheyenne, Wyoming. 138 pp.

Grier, J.W., and R.W. Fyfe. 1987. Preventing research and management disturbance. Pages 173-182 In B.A.G. Pendleton, B.A. Milsap, K.W. Cline, and D.M. Bird, editors. Raptor management techniques. Institute of Wildlife Research, National Wildlife Federation, Scientific and Technical Series No. 10. 420 pp.

Olendorff, R.R., A.D. Miller, and R.M. Lehman. 1981. Suggested practices for raptor protection on power lines: The state of the art in 1981.

Raptor Research Report No. 4, Raptor Research Foundation, Inc., University of Minnesota, St. Paul 111 pp.

Stebbins, R.C. 2003. Western Reptiles and Amphibians, 3rd Ed. Houghton Mifflin Company, Boston, Massachusetts and New York, New York. 533pp.

U.S. Fish and Wildlife Service. 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act. U.S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico (April 1989). 10 pp + append.

Table 1 – Summary of General Wildlife Reporting, Inventory, and Monitoring, Seminoe Road Natural Gas Development Project

Action	Dates	Responsible Entity
Annual tentative plan of development	By October 15, annually	Operator
Annual inventory, monitoring and protection data	By October 15, annually	
Annual reports	Annually: Draft – early November Final – early January	Operator
Annual meeting	December and as necessary	BLM with participation by other agencies and operators
Inventory/Monitoring		
Raptor nest inventory	At least every five years, prior to development	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Raptor monitoring	Annually from April to July	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Greater sage-grouse lek inventory	At least every five years	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Greater sage-grouse lek monitoring	Annually from March to mid-May	BLM or BLM approved operator financed biologist
Big game crucial winter range use/monitoring	As available	BLM will request data from WGFD
Mountain Plover surveys	Annually from May to June	BLM or BLM approved operator financed biologist

Table 2, Summary of General APD/ROW Application Stage Survey/Protection Measures, Seminoe Road Natural Gas Development Project

Protection Measure	Dates	Responsible Entity
Raptor nest survey/inventory within 0.75 to 1.0 miles of proposed disturbance	Yearlong	BLM, operator
Raptor nest season avoidance within 0.75 to 1.0 miles	February 1 to July 31	BLM, operator
Raptor nest avoidance with 825 feet (1200 feet for ferruginous hawk nests)	Yearlong	BLM, operator
BLM	Yearlong, as necessary	BLM, operator
BLM	Yearlong, as necessary	BLM, operator
BLM	Yearlong, as necessary	BLM, operator
BLM	Yearlong, where practical	BLM, operator
Black-footed ferret surveys	As appropriate in accordance with USFWS guidelines	Operator financed USFWS-approved biologist
Mountain Plover habitat surveys	Yearlong	BLM, operator
Mountain Plover nest/brood avoidance	April 10 to July 10	BLM, operator
Greater sage-grouse lek/nesting habitat avoidance within 2.0 miles of proposed disturbance	March 1 to June 30	BLM, operator
Greater sage-grouse lek avoidance within 0.25 miles of proposed disturbance	Yearlong	BLM, operator
Big game crucial winter range avoidance	November 15 to April 30	BLM, operator
General wildlife avoidance/protection	A necessary	BLM, other agencies, operator

Table 3, Threatened, Endangered, Candidate, and Sensitive Species Potentially Occurring on or in the Vicinity of the Seminoe Road Natural Gas Development Project

Species	Habitat
Endangered Species	
Black-footed Ferret	Prairie dog colonies with black-tailed prairie dog complex greater than 80 acres or white-tailed prairie dog complex greater than 200 acres
Threatened Species	
Bald Eagle	Conifers, cottonwood-riparian river ecosystems
Endangered/Threatened Species	
North Platte River species	Platte River System
Candidate Species	
Western boreal toad	Riparian habitat above 7,500 feet in elevation
BLM Wyoming Sensitive Species	
Swift Fox	Grasslands
Townsend’s Big-eared Bat	Forests, basin-prairie shrub, caves and mines
White-tailed Prairie Dog	Basin-prairie shrub, grasslands
Wyoming Pocket Gopher	Meadows with loose soil
Baird’s Sparrow	Grasslands, weedy fields
Brewer’s Sparrow	Basin-prairie shrub
Burrowing Owl	Grasslands, basin-prairie shrub
Ferruginous Hawk	Basin-prairie shrub, grassland, rock outcrops
Greater Sage-grouse	Basin-prairie shrub, mountain-foothill shrub
Loggerhead Shrike	Basin-prairie shrub, mountain foothill shrub
Long-billed Curlew	Grasslands, plains, foothills, wet meadows
Peregrine Falcon	Tall Cliffs
Sage Thrasher	Basin-prairie shrub, mountain foothill shrub
Trumpeter Swan	Lakes, ponds, rivers
White-faced Ibis	Marshes, wet meadows
Northern Leopard Frog	Beaver ponds, permanent water in plains and foothills

Figure 1, General Wildlife Observation Data Sheet

Species	Date	Time	Datum (i.e. NAD 27/83)	UTM Zone	Northing	Easting	# Adult	# Juvenile	Distance (meters)	Direction (degrees)

Figure 2, Mountain Plover Additional Protection Measures

Mountain Plover- Additional Protection Measures

- To protect the identified mountain plover occupied habitat, the proposed activity will not be allowed as proposed. An alternative such as moving the facility, directional drilling, piping and storage of condensate off the identified mountain plover occupied habitat to a centralized facility, or other technique for the minimization of ground disturbance and habitat degradation will be required.

- To protect the identified mountain plover occupied habitat, the proposed facility will be moved ½ mile from the identified occupied habitat.

- To protect the identified mountain plover occupied habitat and because mountain plover adults and broods may forage along roads during the night, traffic speed and traffic volume will be limited during nighttime hours from April 10 to July 10.

- Within ½ mile of the identified mountain plover occupied habitat, speed limits will be posed at 25 mph on resources roads and 35 mph on local roads during the brood rearing period (June 1-July 10).

- The access road will be realigned to avoid the identified mountain plover occupied habitat.

- To protect the identified mountain plover occupied habitat, traffic will be minimized from Jun 1-July 10 by car-pooling and organizing work activities to minimize trips on roads within ½ mile of the mountain plover occupied habitat.

- To protect the identified mountain plover occupied habitat, work schedules and shift changes will be modified from Jun 1-July 10 to avoid the periods of activity from ½ hour before sunrise to ½ hour after sunset.

- To protect the identified mountain plover occupied habitat, power lines will be either buried or poles will include a perch inhibitor in their design. This will be required within ½ mile of the identified mountain plover occupied habitat.

- To protect the identified mountain plover occupied habitat, fences, storage tanks, and other elevated structures will be either constructed as low a possible and/or will incorporate perch-inhibitors into their design.

- Road-killed animals will be promptly removed from areas within ½ miles the identified mountain plover occupied habitat.

- To protect the identified mountain plover occupied habitat, seed mixes and application rates for reclamation will be designed to produce stands of sparse, low-growing vegetation suitable for plover nesting.

- To minimize destruction of nests and disturbance to breeding mountain plovers, no reclamation activities or other ground-disturbing activities will occur from April 10 to July 10 unless surveys consistent with the Plover Guidelines or other USFWS approved method find that no plovers are nesting in the area.

- A plugged and abandoned well within ½ mile of the identified mountain plover occupied habitat will be identified with a marker 4 feet tall with a perch inhibitor on the top of the marker.

Map 1-Wildlife Survey Areas, Seminoe Road Natural Gas Development Project Area, Carbon County, Wyoming, 2005

Appendix L

Biological Assessment

Draft
Biological Assessment
of
Threatened, Endangered, Proposed, and Candidate Species
for the
Seminoe Road Gas Development Project

Prepared by

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

and

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Fort Collins, Colorado

February 2005

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1.0 PROJECT DESCRIPTION

This Biological Assessment (BA) discusses the potential effects of the proposed Seminoe Road Gas Development (Seminoe Road) Project on threatened and endangered species, proposed species, and candidate and petitioned species pursuant to the Endangered Species Act (ESA) of 1973. This BA also presents recommendations to assure that the construction and subsequent operation of the proposed project will neither jeopardize the continued existence of those species nor result in the destruction or adverse modification of their critical habitats. Analysis of effects of this proposed project on threatened, endangered, proposed, and candidate species complies with the provisions of the ESA.

Dudley & Associates, LLC (Dudley) has notified the Bureau of Land Management (BLM), Rawlins Field Office, that Dudley intends to drill additional development wells within the Seminoe Road Project Area (SRPA). The SRPA currently contains 16 active producing wells, with accompanying production-related facilities within the smaller Seminoe Road Pilot Area. Two additional wells have been approved, but those locations have not yet been developed. The pilot project wells are drilled and spaced on 160-acre units. The pilot project wells and associated roads lie in Townships 23 and 24 North, Range 85 West, 6th PM, Carbon County, Wyoming.

While the Seminoe Road Environmental Impact Statement (EIS) is being prepared, BLM may approve additional interim coalbed methane gas wells within an expanded Pilot Area in the SRPA. The objective of the Pilot Area wells is to allow Dudley to drill, complete, and produce sufficient wells to determine which geologic objectives are gas productive, which drilling and completion techniques are economical, if dewatering of the drilling objectives can be achieved, and what depths or pressure windows may be preferred to target economic gas production.

The SRPA is located in Townships 21, 22, 23 and 24 North, Ranges 84, 85 and 86 West, 6th Principal Meridian (PM) in the northwest Hanna Basin, Carbon County, Wyoming. The project area is located approximately 20 miles northeast of the City of Rawlins, 18 miles north-northeast of the Town of Sinclair, and generally east of Carbon

County Road 351 (Seminoe Road), although portions of the SRPA also lie to the west of Seminoe Road (see **Figure 1, General Location Map)**.

The project area is approximately 137,000 acres (215 sections) in size and encompasses a checkerboard ownership pattern of federal (>49 percent) and private (fee) (>49 percent), with some state surface. The BLM Rawlins Field Office manages the federal surface and mineral estates. Dudley owns or controls oil and gas leasehold interests comprising approximately 80 percent of the project area. The BLM manages the balance of the leased and un-leased federal oil and gas interests in the project area. Four alternatives are being analyzed in the EIS being prepared for the proposed project: No Action (Alternative A), Proposed Action (Alternative B), Direct Discharge (Alternative C), and Underground Injection (Alternative D). Descriptions of each alternative are discussed in detail in Chapter 2 of the Draft EIS (BLM 2005) and are summarized below.

1.1 Alternative A (No Action)

Under the No Action Alternative, there would be no additional gas development or production activities beyond those permitted under the existing Pilot Project, and there would be no additional effects to wildlife habitat or wildlife species. As a result, wildlife habitat distribution, extent, and condition as well as wildlife populations would remain similar to existing conditions, assuming there are no major alterations in current land use activities or practices. Wildlife habitats within the SRPA would continue to be subject to low levels of disturbance in the form of existing gas production wells as well as livestock grazing, recreation, and coal mining.

1.2 Alternative B (Proposed Action)

Full project development would result in an initial direct habitat loss of 6,174 acres or 4.5 percent of the SRPA over an approximate 9-year period. Specific well locations are not known at this time, but gas well development would occur at a scale of four wells per section or per square mile (160-acre spacing). In addition, some surface locations within the SRPA may not be feasible to drill, either for economical (e.g., high road construction costs), physical (e.g., steep terrain), or other environmental reasons (e.g., proximity to the North Platte River or Seminoe Reservoir).

Much of the initial disturbance associated with well pads, roads, and utility installation would be reclaimed following well development and infrastructure construction. The area that would remain disturbed for operations during the approximate 30-year life of project would be approximately 2349 acres or 1.7 percent of the SRPA. A total of 3,825 acres would be reclaimed to grassland habitat as soon as possible after well installation and associated construction are completed. Specifics on reclamation timing, goals, and methodology are provided in the reclamation plan contained within the Seminoe Road Project Draft EIS (BLM 2005). The remaining acreage would not be reclaimed until the cessation of project operations.

Discharge of produced water would result in the development of narrow, linear wetland habitats along the discharge drainages, and watering areas for wildlife would be available in the proposed discharge drainages. In addition, year-round inundation of the three closed playa basins (St. Mary's Anticline Basin, Alkali Flats, and Ferris Lake) from produced water discharge south of Seminoe Reservoir and the North Platte River would create additional wildlife watering areas and wetland habitat in these basins for the life of the project.

1.3 Alternative C (Direct Discharge)

This alternative would be similar to the Proposed Action except that produced water would be piped directly to the North Platte River and Seminoe Reservoir rather than being released down existing ephemeral drainages. As a result, there would be no development of narrow, linear wetland habitats along the discharge drainages, but some discharge water would be made available at strategic locations for wildlife and livestock use. In addition, year-round inundation of the three closed playa basins: St. Mary's Anticline Basin, Alkali Flats, and Ferris Lake would not occur, thereby reducing the amount of wildlife watering areas and potential wetland habitat development in these basins for the life of the project. Water quality and quantity effects in the North Platte River and Seminoe Reservoir would be the same as described for the Proposed Action except the quantity of produced water reaching these receiving waters would be about 5,000 acre-feet or 7 percent greater than the Proposed Action, because there would be no infiltration into alluvium/colluvium or evaporation along the drainages.

1.4 Alternative D (Underground Injection)

This alternative would be similar to the Proposed Action except that produced water would not be discharged into the North Platte River, Seminoe Reservoir, or the closed basin playas. Similar to Alternative C, there would be no potential for development of wetland habitats within discharge drainages or in the closed basin playas, but some discharge water would be made available at strategic locations for wildlife and livestock use. There would also be no produced water available for wildlife use in the closed basin playas.

2.0 METHODS

The assessments and recommendations contained within this BA are based upon information obtained from several sources: (1) published literature, (2) unpublished agency reports and data, (3) personal communications with state and federal agency wildlife specialists, (4) meetings with state and federal agency plant and wildlife specialists, and (5) field surveys.

2.1 Published Literature

Published scientific documents that pertain directly to the specific circumstances and issues involved in this analysis were reviewed and incorporated into this BA. Literature sources used in this assessment are appropriately cited.

2.2 Unpublished Agency Reports and Data

Unpublished documents and data from the files of the Wyoming Game and Fish Department (WGFD) and U.S. Fish and Wildlife Service (USFWS) were reviewed, utilized, and referenced, where applicable, in this BA. Available data on threatened and endangered species in the project area were reviewed in the preparation of the Draft EIS and this BA. Materials reviewed include distribution and habitat maps, progress reports, recovery plans, sighting records, management plans, and survey guidelines for threatened and endangered species.

Some information concerning historical wildlife usage of the project area was obtained through the BLM Rawlins Field Office and District IV biologists of the WGFD. This information was specific to current and historical locations for wildlife species. The Wyoming Natural Diversity Database (WYNDD) was also queried for reports of rare or unique plant and wildlife species within the SRPA.

2.3 Personal Communications

Individuals interviewed during the fact-finding process, either directly or by telephone, included: Mr. Larry Apple and Heath Cline (BLM Wildlife Biologists, Rawlins), Ms. Kathleen Erwin (USFWS Biologist, Cheyenne), and Mr. Greg Hiatt (WGFD Wildlife Biologist, Sinclair).

2.4 Meetings

Numerous meetings were held among state and federal wildlife specialists and Cedar Creek Associates, Inc. (Cedar Creek) concerning potential impacts to wildlife that may result from the proposed project. Concerns raised in these meetings regarding development of the proposed project have been addressed in either this BA or in the Draft EIS (BLM 2005).

2.5 Field Surveys

Existing special status wildlife information available from the BLM and WGFD for the project area was supplemented through wildlife surveys conducted by Cedar Creek and TRC from 2000 to 2004. These data collections consisted of aerial and ground surveys to determine: (1) occurrence of threatened, endangered, proposed, candidate, or sensitive species and/or habitats in the SRPA; (2) the occurrence, location, size, and burrow density of white-tailed prairie dog colonies within portions of the SRPA; (3) presence or absence of black-footed ferrets within portions of the SRPA, and (4) the location and activity status of raptor nests within portions of the SRPA.

2.6 BA Preparation

Personnel who cooperated in the preparation of this BA were Michael Phelan, wildlife biologist with Cedar Creek Associates, Inc. (Cedar Creek) and Heath Cline, wildlife biologist with the BLM. Cedar Creek and TRC staff biologists assisted in the collection of field data.

3.0 SPECIES CURRENT STATUS AND HABITAT USE

The USFWS has determined that 14 species, listed under the ESA as threatened, endangered, proposed, or candidate or as a petitioned species pursuant to the ESA, are potentially present within the area under the management of the Rawlins BLM Field Office (USFWS 2004a; Table 1). In addition, four federal endangered and two threatened species have been identified as susceptible to downstream water depletions in the North Platte River system.

Common Name	Scientific Name	Status
Mammals		
Black-footed ferret	*Mustela nigripes*	Endangered
Canada lynx	*Lynx Canadensis*	Threatened
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Threatened
Pygmy rabbit	*Brachylagus idahoensis*	Petitioned
Birds		
Bald eagle*	*Haliaeetus leucocephalus*	Threatened
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	Petitioned
Whooping crane*	*Grus Americana*	Endangered
Interior least tern*	*Sterna antillarum*	Endangered
Piping plover*	*Charadrius melodus*	Threatened
Eskimo curlew*	*Numenius borealis*	Endangered
Amphibians		
Western boreal toad	*Bufo boreas boreas*	Candidate
Wyoming toad	*Bufo baxteri*	Endangered
Fish		
Pallid sturgeon*	*Scaphirhynchus albus*	Endangered
Plants		
Blowout penstemon	*Penstemon haydenii*	Endangered
Ute-ladies'-tresses	*Spiranthes diluvialis*	Threatened
Colorado butterfly plant	*Gaura neomexicana* ssp. *Coloradensis*	Threatened
Western prairie fringed orchid*	*Platanthera praeclara*	Threatened

* Water depletions in the Platte River system may affect these species found downstream of the SRPA, but there would be no water depletions resulting from the Seminoe Road Project.

There would be no downstream water depletions associated with any of the alternatives, and water would be added to the North Platte River system under Alternatives B and C. All of these species and their federal status under the ESA are listed in Table 1.

3.1 Threatened, Endangered, Proposed, and Candidate Species

3.1.1 Black-footed Ferret (Endangered)

The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). Black-footed ferrets were considered extinct until a small population was discovered near Meeteetsee, Wyoming in 1981. Much of our current knowledge of this species is based on studies completed on the Meeteetsee population. Following an outbreak of distemper, surviving ferrets were brought into captivity and a captive breeding program was initiated. Since then a non-essential experimental population of black-footed ferrets has been reintroduced in the Shirley Basin/Medicine Bow Special Management Area. The Shirley Basin/Medicine Bow Special Management Area is located immediately east of Seminoe Reservoir and north of the Medicine Bow River arm of Seminoe Reservoir. The physical barrier imposed by Seminoe Reservoir and the Medicine Bow River precludes any potential movement of ferrets from this reintroduced population into the SRPA.

In Wyoming, prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980, Fagerstone 1987). Within the SRPA, white-tailed prairie dog towns represent potential habitat for black-footed ferret. According to USFWS guidelines (1989), white-tailed prairie dog towns or complexes greater than 200 acres represent potential habitat for black-footed ferrets. A town complex is defined as two or more neighboring towns each less than 7 kilometers from the other. A number of towns meeting these criteria within the Pilot Project Area and along the related gas gathering pipeline and access road were identified and surveyed for ferrets by TRC (2002a, 2002b). The results of these surveys were negative. It is expected that other white-tailed prairie dog towns or complexes of towns within the SRPA would require black-footed ferret clearance surveys prior to project development in these areas. The BLM would require avoidance of these towns where possible, but if avoidance is not feasible, clearance surveys for black-footed ferrets may be warranted prior to ground disturbing activities within qualifying prairie dog colonies. Surveys would be conducted according to the most current USFWS guidelines (USFWS 1989 or later). Portions of the SRPA within Townships 23 North and 24 North, Range 86 West; Township 22 North, Ranges 84 West and 85 West; and Township 21 North, Range 84 West have been blocked cleared by the USFWS and surveys for black-footed ferrets in white-tailed prairie dog colonies within these portions of the SRPA would not be required. However, the USFWS may require that prairie dog towns within block cleared areas be evaluated for their suitability for reintroduction of black-footed ferrets.

3.1.2 Canada Lynx (Threatened)

Although Wyoming comprises part of the species' historic geographical range, no lynx sightings have been documented in the SRPA or within a 6-mile perimeter (WYNDD 2004). In a collaborative effort, the BLM and WYNDD completed a lynx habitat suitability map for the State of Wyoming (Beauvais et al. 2001). According to the habitat map, no Lynx Analysis Units (LAU) exist within the SRPA, and lands within the SRPA provide low to poor quality lynx habitat. Lynx could potentially travel through the SRPA, but this likelihood is very low due to a lack of suitable habitat.

Due to the facts that: (1) the SRPA does not include high elevation lodgepole pine/spruce-fir habitat types preferred by this species, (2) the SRPA does not support suitable habitat for snowshoe hares, a principal prey for lynx, (3) there are no recorded lynx sightings within a 6-mile buffer in either the SRPA (WYNDD 2004), and (4) the closest potential habitat is approximately 18 miles to the southeast and 30 miles to the south in the Medicine Bow Mountains and Sierra Madre Mountains, respectively, it is unlikely that lynx would occur on or near the SRPA and is therefore not discussed further in this document.

3.1.3 Preble's Meadow Jumping Mouse (Threatened)

In Wyoming, Preble's meadow jumping mouse is found within riparian habitat corridors east of the Laramie Range Mountains and south of the North Platte River (USFWS

2004a). A petition to delist this species is currently being evaluated by the USFWS. The SRPA is located more than 75 miles west of the known distribution of the Preble's meadow jumping mouse, and this

species is not expected to occur on the project area. Therefore, Preble's meadow jumping mouse is not discussed further in this document.

3.1.4 Bald Eagle (Threatened)

Summer nesting habitat for this species consists of large trees, cliffs, or sheltered canyons associated with preferred food sources that consist of fisheries or waterfowl concentration areas along large rivers, lakes, or reservoirs. During the non-breeding season (fall and winter), bald eagles forage along rivers with open water as well as over uplands with big game carrion or prairie dog populations. Potential winter roosting sites are generally associated with large trees protected from the weather along open water portions of rivers or on lakes and reservoirs where waterfowl are available as prey. Potential foraging, perching, and nesting habitat for bald eagle exists along the North Platte River within the SRPA.

Although there are no records of nesting or winter roosting use along this segment of the North Platte River (WYNDD 2004), incidental observations made by BLM biologists indicate a possible nesting attempt by a bald eagle pair along the North Platte River near Seminoe Reservoir. Cedar Creek biologists' observation of an adult and immature bald eagle in cottonwood trees near the North Platte River (SW 1/4, Section 10, T. 22 N., R. 85 W.) in August 2003 also provided indirect evidence of possible nesting by bald eagles somewhere along this segment of the North Platte River.

3.1.5 Yellow-billed Cuckoo (Candidate)

The yellow-billed cuckoo is a Neotropical migrant that winters in South America and breeds from southeast Canada, throughout most of the United States (except the northern Great Plains to the northwest coast) and northern Mexico (Payne 1997). In North America, the cuckoo population is divided into two subspecies. The population west of the Continental Divide is considered the Western or California subspecies and the population east of the Continental Divide is the Eastern subspecies. Trends developed from Breeding Bird Survey (BBS) data indicate that the yellow-billed cuckoo is declining throughout its range, and the most dramatic declines have been associated with the Western subspecies. As a result, the yellow-billed cuckoo has twice been petitioned as an endangered species pursuant to the Endangered Species Act (ESA). The Southwest Region of the U.S. Fish and Wildlife Service rejected the first petition submitted in 1987. The second petition was submitted in 1998 and called for the listing of cuckoos west of the Continental Divide as a subspecies or a geographically, morphologically, behaviorally, and ecologically distinct population from cuckoos east of the Continental Divide. In July 2001, the USFWS concluded that the petitioned action was warranted but precluded by higher priority listing actions. Currently, the yellow-billed cuckoo is considered a candidate species.

The last record of a yellow-billed cuckoo being detected on a BBS route in Wyoming was from 1995 (USGS Patuxent Wildlife Research Center 2004). The yellow-billed cuckoo is a BLM sensitive species throughout Wyoming, and it may be found in cottonwood/ riparian habitats below 7,000 feet and in urban areas throughout the state (WGFD 1999). In Wyoming, it is thought to prefer cottonwood stands for foraging and willow thickets for nesting. Stands of narrow-leaf cottonwoods along the North Platte River near Seminoe Reservoir may represent potential foraging habitat for yellow-billed cuckoo, although well-developed willow thickets are generally lacking probably because of cattle grazing along the river and large fluctuations of reservoir levels. The WYNDD (2005, http://uwadmnweb.uwyo.edu/wyndd/) indicates the possible breeding distribution of both the western and eastern subspecies of the yellow-billed cuckoo to be outside of the SRPA and Carbon County. In addition, the WYNDD (2005, http://uwadmnweb.uwyo.edu/wyndd/) indicates there has been only one observation of yellow-billed cuckoo in Carbon County since 1982. This observation was near the North Platte River upstream of Seminoe Reservoir and was probably of a transient or nomadic individual. The WYNND (2004) has no records of this species within the SRPA, and the yellow-billed cuckoo has not been documented in southeast Wyoming by Breeding Bird Surveys (BBS) conducted by the USGS, Patuxent Wildlife Research Center from 1966 through 2003 (Sauer et al. 2004). No further discussion is provided for yellow-billed cuckoo in this document.

3.1.6 Western Boreal Toad (Candidate)

One of the true toads (*Bufo*) endemic to Wyoming, the boreal toad occurs in wet areas of the foothills, montane, and subalpine zones to 10,500 feet. Boreal toads range from Alaska to northern New Mexico in the Rocky Mountains, west to the Pacific coast (Baxter and Stone 1992). Along the western periphery of this toad's range, it may be found in relatively dry habitats at elevations down to sea level (Stebbins 1951). This toad is generally found near water during the day but may move farther from water to forage during the night (Baxter and Stone 1992). This species congregates near water bodies to breed from mid-May to July dependent upon seasonal weather and elevation. Boreal toads breed in any body of water lacking a strong current and with gradually descending banks at some point around the perimeter (Loeffler 1998). Egg placement is usually in shallows where the thermal effects of the sun are optimized (Loeffler 1998). Available evidence indicates that females may disperse over greater distances and into drier habitats than the males (Loeffler 1998). Recent studies of toads by the Colorado Department of Wildlife (CDOW) indicate that male toads remain within 300 meters of breeding sites, while females can move up to 3 to 4 miles from breeding areas (Jones 1999). Selected upland habitats for both males and females include aspen and conifer habitats with rocky areas or ground squirrel holes where toads seek refuge in rock crevices or rodent burrows to avoid temperature extremes and desiccation.

In Wyoming, this species is restricted to mountains and foothills in areas having relatively moist conditions. It inhabits the central and western mountain ranges but has not been observed in the Bighorn Mountains or the Black Hills (Baxter and Stone 1992). The range for boreal toads is thought to encompass the North Platte River and Seminoe Reservoir (Baxter and Stone 1992), and the Wyoming Species Atlas (WGFD 1999) indicates sightings within Carbon County. However, no sightings of this species within six miles of the project area have been reported (WYNDD 2004). It appears that habitat within the majority of the SRPA is too arid for this species to persist and breed. Also, suitable breeding habitat, shallows with slow-moving water, is generally lacking along the North Platte River and the banks of Seminoe Reservoir.

3.1.7 Wyoming Toad (Endangered)

The Wyoming toad was historically associated with floodplain ponds along the Big and Little Laramie Rivers in Albany County (Baxter and Stone 1992). Currently, the Wyoming toad is only known to occur at Mortenson Lake National Wildlife Refuge. However, reintroduction efforts are underway in other portions of its former range. The Wyoming toad did not historically, and does not currently occur on or near the SRPA and is therefore not discussed further in this document.

3.1.8 Blowout Penstemon (Endangered)

The Wyoming Natural Diversity Database ranking for blowout penstemon is G1/S1, indicating this plant is critically imperiled because of extreme rarity (5 or fewer occurrences) at both the global and state levels (WYNDD 2004). Blowout penstemon is probably the rarest plant species native to the Great Plains (NGPC 2002). The species is most common in the open, sandy habitats of wind-excavated depressions (blowouts) in dune tops. In Wyoming, the species has also been documented on very steep, unstable sand dunes (Fertig 2001). Within these limited habitats, this short-lived perennial frequently occurs in large, multi-stemmed clumps. In June and July, when in bloom in Wyoming, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts. In addition to features of its leaves and flowers, blowout penstemon's lavender or vanilla-like fragrance distinguishes it as only one of two fragrant species of the 300 penstemons in the world (NGPC 2002).

Blowout penstemon is a regional endemic of the Sand Hills in Nebraska and the Great Basin Divide in Carbon County, Wyoming and is known from 15 extant occurrences rangewide. Two of these occurrences are located in Wyoming in northwest Carbon County in the Ferris and Seminoe Mountains. These two sites occupy approximately 80 acres within a 5 square mile area (Fertig 2001). Rangewide this species occurs on sparsely vegetated shifting sand dunes and wind eroded blowout depressions. In Wyoming, blowout penstemon typically grows on sandy aprons or steep sandy slopes at the base of granitic or sedimentary mountains or ridges at elevations ranging from 6,680 to 7,440 feet.

Blowout penstemon was not observed by any of the vegetation surveys conducted in the SRPA (HydroGeo 2004; TRC 2001). Several steep, sparsely vegetated, sandy slopes on the lee (east) side of ridges in the lower portion of Mountain Lion Draw were surveyed, but no populations of blowout penstemon were located (HydroGeo 2004). There are no known active sand dunes or areas of potential habitat for blowout penstemon in the SRPA and based on known distribution and habitat characteristics for blowout penstemon, this species is not likely to occur in the SRPA.

3.1.9 Ute Ladies'-tresses Orchid (Threatened)

Ute ladies'-tresses orchid is a perennial, terrestrial orchid with stems 8 to 20 inches tall, and flowers consisting of white or ivory flowers clustered into a spike arrangement at the top of the stem. The plant blooms mainly from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. Habitat for Ute ladies'-tresses orchid can occur in major riparian corridors subject to fluvial erosion/deposition, or more ideally, in moist to very wet meadows along streams. It has also been found in abandoned stream meanders that still have ample ground water, near springs, and lakeshores. The habitat on which the species depends has been drastically modified by urbanization, agriculture, and development (description adapted from NatureServe 2004).

Ute ladies'-tresses orchid was designated as threatened in 1992 when it was only known from Colorado, Utah, and Nevada. Since that time, it has been found in Wyoming, Montana, Nebraska, and Idaho (NatureServe 2004), and a petition to delist this species is currently being evaluated by the USFWS. The known locations of the species in Wyoming include Converse, Goshen, Laramie, and Niobrara Counties. Ute ladies'-tresses orchid was not observed by any of the vegetation surveys conducted in the SRPA (HydroGeo 2004; TRC 2001). Although suitable habitat for Ute ladies'-tresses orchid may exist along the North Platte River, the SRPA is outside of the known occurrences of this species and its presence is unlikely.

3.1.10 Colorado Butterfly Plant (Threatened)

The Colorado butterfly plant is a short-lived perennial herb that typically occurs on subirrigated soils on level or slightly sloping floodplains and drainage bottoms at elevations of 5,000-6,400 feet (Fertig 2000). The species is often found a short distance from meandering stream channels. This species is known to occur in Laramie County in southeastern Wyoming, in southwestern Nebraska and in northeastern Colorado. This species is not known and is not expected to occur on or near the SRPA and is therefore not discussed further in this document.

3.2 Platte River Species

The SRPA is within the Platte River drainage basin. According to the USFWS (USFWS 2004), water depletion in the Platte River system may affect and is likely to adversely affect the species addressed in this section. These species and their habitats are not found within the SRPA, but they could be adversely affected if actions within the SRPA result in downstream water depletions. Although none of the Seminoe Road Project would result in water depletions in the Platte River System, there is the potential for water quality impacts to the system as a result of produced water discharge.

3.2.1 Whooping Crane (Endangered)

Critical habitat for the whooping crane many miles downstream of the SRPA and Wyoming is located along the Platte River floodplain between Lexington and Dehman, Nebraska (Federal Register 1978). Whooping crane habitat consists of large expanses of wetlands that provide suitable food (insects, crayfish, frogs, small fish) and open expanses near wetlands for nightly roosting (Federal Register 1978).

3.2.2 Interior Least Tern (Endangered)

The interior least tern nests on unvegetated sand-pebble beaches and islands of large reservoirs and rivers. Interior least terns avoid areas where relatively thick vegetation provides cover for potential predators. No habitat for the interior least tern is found on the SRPA or in Wyoming, but habitat is located downstream along the Platte River in Nebraska (USFWS 1990).

3.2.3 Piping Plover (Threatened)

Critical habitat for the piping plover includes prairie alkali wetlands and surrounding shoreline, including 200 feet of uplands above the high water mark; river channels and associated sandbars, and islands; reservoirs and their sparsely vegetated shorelines, peninsulas, and islands; and inland lakes and their sparsely vegetated shorelines and peninsulas (Federal Register 2002). Critical habitat for the species is downstream of the SRPA and Wyoming in Nebraska beginning at the Lexington Bridge and extending to the Platte's confluence with the Missouri River 252 mi (405.5 km) downstream (Federal Register 2002). Open shorelines and sandbars of rivers, large reservoirs, alkali wetlands, lakes and rivers provide suitable breeding habitat for the piping plover.

3.2.4 Eskimo Curlew (Endangered)

The Eskimo curlew migrates from wintering grounds in the pampas of Argentina, northward through Central America and the central Great Plains of North America to breeding grounds in northern Canada and Alaska (Gollop et al. 1986). The spring migration route passes through Nebraska, but not Wyoming (Gollop et al. 1986), where the birds may stopover along the Platte River. In the fall they migrate eastward to Labrador, then south over the Atlantic Ocean back to South America (Gollop et al. 1986). Habitat for the Eskimo curlew includes grasslands, tundra, burned prairies, plowed fields, marshes, mudflats, meadows, and pastures. Burned prairies and marshes may be attractive during migration (Gollop et al. 1986). The loss of prairie habitat in North America may have contributed to the decline of the Eskimo curlew, but the primary reason for the rarity of the bird was market hunting in the late 1800s and early 1900s (Gollop et al. 1986). No suitable habitat for the Eskimo curlew occurs on the SRPA, and the species has not been reported within or near the SRPA (WYNDD 2004).

3.2.5 Bald Eagle (Threatened)

Aside from this species potential presence within the SRPA, bald eagles are also known to nest and forage along downstream portions of the North Platte River and other rivers within the Platte River system. Nesting and foraging habitat in the North Platte River system is similar to that described for bald eagle under Section 3.1.4.

3.2.6 Pallid Sturgeon (Endangered)

The pallid sturgeon is a native fish found in the Mississippi/Missouri River system. The pallid sturgeon is present in the lower Platte River in eastern Nebraska but does not occur in the Platte River system in western Nebraska or Wyoming. Suitable habitat for the pallid sturgeon consists of large turbid rivers with sand or gravel bottoms. The pallid sturgeon is threatened by habitat degradation such as decreased turbidity, which can be caused by impoundments.

3.2.7 Western Prairie Fringed Orchid (Threatened)

The western prairie fringed orchid is a long-lived perennial herb with stems that can grow to 1.2 meters tall from an underground tuber. The plant blooms for about a three-week period starting in mid-June in the southern portion of its range to late July in the north. Habitat of the western prairie fringed orchid is the western portions of North American tall-grass prairie, and it is most commonly observed on moist, calcareous soils, sub-saline prairies and sedge meadows (many flooded for a period of 1-2 weeks during the year). Published accounts and herbarium records suggest that this plant was widespread and perhaps locally common prior to European settlement. Declines are due to the extensive and on-going conversion of the tall-grass prairie to agricultural uses throughout its range (description adapted from NatureServe 2004).

The western prairie fringed orchid was designated as a threatened species in its entire range in 1989. Within the area covered by this listing, this species is known to occur outside of Wyoming in Iowa, Kansas, Minnesota, Missouri, North Dakota, Nebraska, Oklahoma, and in Manitoba Province, Canada (NatureServe 2004).

3.3 Petitioned Species

The following species that do or may occur on the SRPA have been petitioned for listing under the ESA.

3.3.1 Pygmy Rabbit

The former range of the pygmy rabbit was thought to be limited to portions of Idaho and Utah until their presence was confirmed in southwest Wyoming (Campbell et al. 1982). HWA also documented sightings of pygmy rabbit south of Fontenelle Reservoir in southwest Wyoming in eastern Lincoln County and western Sweetwater County in 1994 (HWA 1994). Pygmy rabbits are limited to areas of dense and tall big sagebrush in predominantly sandy soils (Campbell et al. 1982, Clark and Stromberg 1987, Heady et al. 2002). The SRPA is well east of the known range of pygmy rabbit, and no pygmy rabbit records within 6 miles of the SRPA are listed by the WYNDD (2004). In addition, tall, dense stands of sagebrush and friable soils preferred by pygmy rabbit are essentially lacking within the SRPA. No further discussion of pygmy rabbit is provided in this document.

3.3.2 Columbian Sharp-tailed Grouse

The USFWS was petitioned on October 14, 2004 to list the Columbian sharp-tailed grouse under the Endangered Species Act (ESA) because of population declines over much of the species' range. The BLM has also placed the Columbian sharp-tailed grouse on the BLM Wyoming State Director's Sensitive Species List (BLM 2002). It is one of six sub-species of sharp-tailed grouse found in North America. Habitat types associated with the distribution of the species in the northwestern United States include sagebrush-bunch grass, meadow-steppe, mountain-shrub, and riparian zones (Giesen and Connelly 1993). Reductions in these native vegetation types due to agricultural practices and livestock grazing are believed to be the primary causes of population declines since the turn of the 20th century. Suitable habitat for Columbian sharp-tailed grouse is essentially lacking within or near the SRPA, and there are no records of this species presence or breeding activity (leks) in or within 2 miles of the SRPA. No further discussion of Columbian sharp-tailed grouse will be provided in this document.

4.0 DIRECT AND INDIRECT IMPACTS OF THE PROPOSED ACTION AND DETERMINATION OF EFFECTS FOR LISTED SPECIES

Although the total acres of wildlife habitat that would be disturbed under the action alternatives is known, the distribution of this disturbance will not be known until actual well locations are determined. Therefore, in order to assess the direct and indirect impacts of the proposed project, it was assumed that any section of land may potentially be developed at the level of four locations per section under the action alternatives.

4.1 Proposed Action

Under the Proposed Action approximately 6,174 acres of wildlife habitat would be sequentially disturbed over 30 years. However, with concurrent reclamation of disturbed habitats the total unreclaimed disturbance area at any given point in time would never equal the sequential total. Under the action alternatives, reclamation would reduce impacts to 2,349 acres or 1.4 percent of the SRPA by the end of the development phase of the project. Timing of reclamation and climatic conditions will influence reclamation success.

4.1.1 Threatened, Endangered, Proposed, and Candidate Species

Black-footed Ferret. White-tailed prairie dog towns are known to occur in areas of suitable habitat throughout the SRPA. It is likely that some of these towns or complexes of towns, outside of the block clearance area would meet the requirements for consideration as black-footed ferret habitat. Development of the Proposed Action may result in direct disturbance of some portions of these prairie dog towns or complexes.

Surveys for black-footed ferrets would be required prior to ground disturbing activities within prairie dog towns or town complexes determined to provide potential habitat for black-footed ferret. Surveys would be conducted according to the most current USFWS guidelines (USFWS 1989 or later). Surveys would not be required for white-tailed prairie dog colonies within the “block clearance” portion of the SRPA. However, these prairie dog colonies may analyzed as potential black-footed ferret reintroduction sites.

Consultation with the USFWS would be initiated prior to surveys being conducted. If black-footed ferrets or sign are found, no project related disturbance would occur within the prairie dog complex, and previously authorized project related activities on-going in such towns or complexes would be suspended immediately. The USFWS would be notified within 24 hours if a black-footed ferret or their sign is observed. As long as surveys for black-footed ferrets are conducted in suitable prairie dog towns or town complexes before they are disturbed and the prescribed avoidance measures (listed in the *Coordination Measures* section) are applied, impacts to the black-footed ferret are unlikely to occur. Based upon the analyses of the proposed project, the current and potential status of the species in the project area, other land use activities in the area, and incorporation of the coordination measures recommended in this BA, it is concluded that implementation of the Proposed Action **may affect** but is **not likely to adversely affect** the black-footed ferret.

Bald Eagle. Potential nesting habitat for bald eagles is located only in proximity to the North Platte River. Bald eagles may utilize other portions of the SRPA for foraging during winter months because the majority of the SRPA is classified as pronghorn winter/yearlong range. (Winter/yearlong range is defined by the WGFD as range that is used yearlong, but during winter, has a substantial influx of animals from other seasonal ranges.) In addition, a small portion of crucial winter/yearlong mule deer range is located within the southwest corner of the SRPA near the North Platte River. Upland habitat use by bald eagles within the project area would probably be limited to winter scavenging forays. Few trees large enough for eagle roosting or nesting exist on the project area, and these are found along the North Platte River. In order to preclude the potential for any disturbance of bald eagle nest or winter roost sites, the following mitigation measures would be employed.

- Before any project disturbance occurs within 1 mile of suitable tree stands along the North Platte River, appropriate surveys would be conducted, during the appropriate season, to determine if any winter roost or nest sites exist within 1 mile of proposed disturbance sites. The 1-mile requirement could be reduced depending on intervening topography between suitable habitat and potential disturbance sites. Surveys would be coordinated with the USFWS.

- If any bald eagle winter roost or nest sites are located, appropriate buffers and mitigation measures will be developed in consultation with the USFWS to preclude any impacts to these sites. At a minimum, no disturbance activities would be permitted within 1 mile of winter roost or nest sites during the period of occupation of these sites. No permanent surface disturbance would also be permitted within 1,200 feet of a bald eagle nest site.

The potential for vehicle collisions with big game would increase as a result of increased vehicular traffic associated with the presence of construction crews and activities in the project area. Because bald eagles commonly feed on carrion, particularly during the winter months, the presence of road-killed big game carcasses on and adjacent to Seminoe Road and other access roads could serve as an attractant to foraging bald eagles. Eagles feeding on these carcasses are in danger of being struck by moving vehicles. Any increase in the death rate of bald eagles from vehicular collisions would constitute a significant impact. Because the potential for an increase in the incidence of big game-vehicle-eagle encounters exists, measures to avoid and/or reduce such incidents would be taken. Such measures shall include the following.

- Regular drivers undergo training describing the circumstances under which vehicular collisions with bald eagles are likely to occur and the measures that can be employed to minimize them, including reduced speeds
- Prohibition of unnecessary off-site activities of operational personnel and inform all project employees of applicable wildlife laws and penalties associated with unlawful take and harassment.
- Removal of vehicle-killed carcasses from the ROWs of access roads on the project area to eliminate the exposure of carrion-feeding eagles to the threat of being struck by vehicles.
- Operators will internally enforce existing drug, alcohol, and firearms policies.
- Posting of a 25 mph speed limit on access roads controlled by Dudley.

Based upon the analyses of the proposed project, the current and potential status of the species in the project area, other land use activities in the area, and incorporation of the coordination measures recommended in this BA, it is concluded that implementation of the Proposed Action **may affect** but is **not likely to adversely affect** the bald eagle.

Western Boreal Toad. In Wyoming, this species is restricted to mountains and foothills in areas having relatively moist conditions. It inhabits the central and western mountain ranges but has not been observed in the Bighorn Mountains or the Black Hills (Baxter and Stone 1992). The range for boreal toads is thought to encompass the Muddy Creek watershed (Baxter and Stone 1992), and the Wyoming Species Atlas (WGFD 1999) indicates sightings within both Sweetwater and Carbon counties. However, no sightings of this species within 6 miles of the project area have been reported (WYNDD 2004).

This species has not been documented within the SRPA. Habitat within the majority of the SRPA is too arid for this species to persist and thrive, but it may occur in isolated areas where habitat is suitable along the North Platte River. Three BLM standard stipulations would limit project development near the North Platter River or Seminoe Reservoir. They are as follows.

- No surface occupancy or drilling within 1,000 feet of the Seminoe Reservoir maximum water surface, which has been determined to be at an elevation 6357.00 feet. (Only applies where the United States owns 100 percent of the fee mineral interest.)
- No surface occupancy within 500 feet of the normal high water line of any and all live streams. (Only applies where the United States owns 100 percent of the fee mineral interest.)
- No surface occupancy within 0.25 mile of the North Platte River unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts.

Based on these stipulations, it is unlikely the BLM would permit project disturbance activities within riparian or wetland habitats along the North Platte River within the SRPA. In the event that disturbance within riparian or wetland habitats is permitted by the BLM, the BLM would require that surveys for western boreal toad be completed. Therefore, it is unlikely that the Proposed Action would impact the western boreal toad or lead to its listing as threatened or endangered.

Blowout Penstemon. Potential habitat for blowout penstemon is not present within the SRPA since there are no active sand dune areas known to be present. Site-specific field surveys required by the BLM for each development phase of the proposed project would ensure that suitable habitat for blowout penstemon would not be affected by project development. In the unlikely event that suitable habitat or a population of this species is located within the SRPA, specific mitigation measures would be developed to preclude any impacts to this species or its preferred habitat. Based upon the analyses of the proposed project, the current status of this species, other land use activities in the area, and incorporation of the coordination measures recommended in this BA, it is concluded that implementation of the Proposed Action would have **no effect** on blowout penstemon.

Ute Ladies'-tresses. Suitable habitat for Ute ladies'-tresses orchid may exist along the North Platte River, but the SRPA is well outside of the known populations of this species and its presence is unlikely. As indicated under the preceding section on boreal toad, three BLM standard stipulations would limit project development near the North Platter River or Seminoe Reservoir. Based on these stipulations, it is unlikely the BLM would permit project disturbance activities within riparian or wetland habitats along the North Platte River within the SRPA, and, therefore, it is unlikely that project implementation would impact Ute ladies'-tresses orchid.

Based upon the analyses of the proposed project, the current and potential status of the species in the project area, other land use activities in the area, and incorporation of the coordination measures recommended in this BA, it is concluded that implementation of the Proposed Action would have **no effect** on Ute ladies'-tresses orchid.

4.1.2 Platte River Species

The whooping crane, interior least tern, piping plover, Eskimo curlew, bald eagle, pallid sturgeon, and western prairie fringed orchid are all found considerably downstream of the SRPA along the Platte River in Nebraska. No habitat for any of these species, except bald eagle (see Section 4.1.1) occurs on the SRPA and they are not likely to occur there. The USFWS has taken the position in its Section 7 Consultations that federal actions resulting in water depletion to the Platte River system may affect and are likely to adversely affect these species. However, the action alternatives would not result in any water depletions in the Platte River system, and Alternatives B and C would result in added water to the system. Based on the hydrologic analyses presented in Section 3.5.3 of the Draft EIS (see Appendix A), project development would result in only minor increases in SAR values in Seminoe Reservoir and would not have any impact on water quality in downstream portions of the North Platte River or the Platte River system.

In addition, project development would result in an increase in water supply to Seminoe Reservoir and the North Platte River and would not result in any water depletions in downstream portions of the Platte River system. Therefore, implementation of the Proposed Action would have **no effect** on threatened or endangered species in the Platte River system.

4.2 Alternative A – No Action

Under the No Action Alternative, there would be no additional development or production activities beyond those permitted under the existing Pilot Project, and there would be no additional effects to wildlife habitat or wildlife species. Therefore, this alternative would have **no effect** on threatened, endangered, proposed, candidate, or petitioned species in the SRPA.

4.3 Alternative C (Pipeline to Reservoir)

The Pipeline to Reservoir alternative (Alternative C) would be similar to the Proposed Action except that produced water would be piped directly to the North Platte River and Seminoe Reservoir rather than being released down existing ephemeral drainages. Therefore, potential impacts to threatened, endangered, proposed, candidate, or petitioned species in the SRPA would be the same as those discussed for the Proposed Action in Section 4.1.

4.4 Alternative D (Underground Injection)

The Underground Injection alternative (Alternative D) is the same as the Proposed Action except that produced water would not be discharged into the North Platte River or Seminoe Reservoir. Therefore, potential impacts to threatened, endangered, proposed, candidate, or petitioned species in the SRPA would be the same as those discussed for the Proposed Action in Section 4.1 except there would be water discharge added to the Platte River system.

5.0 CUMULATIVE IMPACTS

The cumulative impact analysis (CIA) approach is used to evaluate the influences of recent, past, present, and reasonably foreseeable future human developments on the local wildlife resources. This approach examines impacts associated with a proposed project in context with all other past and future developments, whether or not they are related. It also allows the wildlife manager and land management agency to evaluate impacts on a broader scale. However, one of the inherent problems associated with CIA is that there are no definable limits as to the exact boundary or size of the geographic area to be considered. The BLM recommends evaluating cumulative impacts on a watershed basis for natural resources related to watershed function and stability. However, with special concern wildlife and plant species, there are no clear, definable limits as to the most appropriate area to be considered in CIA. Moreover, complete information on the distribution, population levels, and habitats of specific species of concern is lacking and most accounts of these species are incidental in nature.

During the construction phase, the Proposed Action would disturb 6,174 acres. Disturbance areas within the SRPA would be reduced upon reclamation of pipeline ROWs, unused portions of the drill pad, portions of roads, and ancillary facility disturbances during the production phase for each alternative, resulting in long-term disturbance of 2,349 acres under the Proposed Action.

Black-footed Ferret

Provided that avoidance measures outlined in this document are followed, the potential for an incremental increase in cumulative impacts due to the implementation of the Proposed Action **may affect** the black-footed ferret but is **not likely to adversely affect** the black-footed ferret.

Bald Eagle

Provided that avoidance measures outlined in this document are followed, the potential for an incremental increase in cumulative impacts due to the implementation of the Proposed Action **may affect** but is **not likely to adversely affect** the bald eagle.

Western Boreal Toad

Implementation of the Proposed Action is not expected to contribute to cumulative impacts upon the western boreal toad due to a lack of confirmed occurrences of the species within the SRPA and protection of wetland habitat along the North Platte River.

Blowout Penstemon

Implementation of the Proposed Action is not expected to contribute to cumulative impacts upon blowout penstemon due to a lack of potential habitat and confirmed occurrence of the species within the SRPA.

Ute Ladies'-tresses

Implementation of the Proposed Action is not expected to contribute to cumulative impacts upon Ute ladies-tresses because the SRPA is outside of the known range of this species.

Platte River Species

No habitat for any of these species occurs in the SRPA, and they would not occur there. The Proposed Action would not have any impact on water quality in downstream portions of the North Platte River or the Platte River system. In addition, Alternatives B and C would result in an increase in water supply to Seminoe Reservoir and the North Platte River and would not result in any water depletions in downstream portions of the Platte River system. Therefore the Proposed Action would have no cumulative impacts on listed species in the Platte River system.

6.0 COORDINATION MEASURES TO AVOID OR REDUCE ADVERSE IMPACTS

The following procedures will be implemented to eliminate or substantially reduce potential adverse effects of the proposed project to threatened, endangered, proposed, candidate, and petitioned species that may occur on or near the SRPA or that may be impacted by the project.

- If disturbance of prairie dog colonies located within non-block clearance areas cannot be avoided, black-footed ferret surveys will be conducted in town or town complexes according to USFWS guidelines (USFWS 1989) if the affected towns meet the survey requirements. Towns or colonies within block-clearance areas will be analyzed for their suitability as potential reintroduction sites for black-footed ferrets.

- Well pads and disturbances shall be placed outside of prairie dog colonies where feasible.

- Should black-footed ferrets be documented in a prairie dog complex located within the project area, impacts to the species or its habitat will be completely avoided, and previously authorized project-related activities on-going in the prairie dog complex shall be suspended immediately.

- The BLM and operators shall conduct educational outreach to employees regarding the nature, hosts, and symptoms of canine distemper, and its effects on black-footed ferrets, focusing attention on why pets would be prohibited from work sites.

- All suspected observations of black-footed ferrets, their sign, or carcasses on the SRPA, however obtained, shall be promptly (within 24 hours) reported to the BLM and USFWS.

- Before any project disturbance occurs within 1 mile of suitable tree stands along the North Platte River, appropriate surveys would be conducted to determine if any winter roost or nest sites exist within 1 mile of proposed disturbance sites. Surveys would be coordinated with the USFWS.

- If any bald eagle winter roost or nest sites are located appropriate buffers and mitigation measures will be developed in consultation with the USFWS to preclude any impacts to these sites. At a minimum, no disturbance activities would be permitted within 1 mile of winter roost or nest sites during the period of occupation of these sites.

- All drivers shall undergo a training session describing the type of wildlife in the area that are susceptible to vehicular collisions in order to reduce the potential for vehicle-big game collisions and subsequent jeopardy to bald eagles feeding on road-killed carrion. The circumstances under which such collisions are likely to occur, and the measures that could be employed to minimize them shall be discussed. Reduced speed limits shall be implemented to reduce potential for vehicle-wildlife collisions.

- Carcasses shall be removed from access roads, shoulders, and the ROWs to minimize bald eagle exposure to vehicle collisions.

- Appropriate sedimentation, erosion control, and produced water control measures included in the Record of Decision will be implemented to avoid changes in water quality or quantity in the streams within the SRPA. Water discharge into Seminoe Reservoir will be regulated by the Wyoming Department of Environmental Quality (DEQ).

- Construction equipment fueling and servicing areas shall be located at least 150 feet from surface water drainages and riparian areas.

6.1 Standard BLM Stipulations

Several Standard BLM Stipulations would apply to the SRPA. They are listed below in no particular order.

- Prior to surface occupancy, surveys are required to ensure no threatened, endangered, candidate, proposed, or other special status species are present. Exploration and development proposals may be limited, or modifications required, if activity is planned within the boundaries of a threatened, endangered, candidate, or other special status plant/animal species as it then exists.

- No surface occupancy or drilling within 1,000 feet of the Seminoe Reservoir maximum water surface, which has been determined to be at an elevation 6357.00 feet. (Only applies where the United States owns 100 percent of the fee mineral interest.)

- No surface occupancy within 500 feet of the normal high water line of any and all live streams. (Only applies where the United States owns 100 percent of the fee mineral interest.)

- Surface occupancy is restricted or prohibited in big game crucial winter range (November 15 – April 30) unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts. Construction and other activities potentially disruptive to wintering wildlife are prohibited during the period of November 15 to April 30 for the protection of big game winter habitat.

- No surface occupancy within 0.25 mile of the North Platte River unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts.

- No surface occupancy within 0.25 mile of sage grouse leks unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts. Construction and other activities potentially disruptive to strutting and nesting sage grouse are prohibited within a 2-mile radius of active leks during the period of March 1 to June 30 for the protection of sage grouse nesting areas.

- Surface occupancy will be restricted or prohibited within Raptor Concentration areas unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts. No roads or development within 0.5-1.0 of active or inactive raptor nest sites.

- Construction and other activities potentially disruptive to nesting raptors are prohibited during the period of February 1 to July 31 for the protection of raptor nesting areas.

- Construction and other activities are prohibited during the reproductive period of April 1 to June 30 for the protection of potential mountain plover habitat.

- Construction and other activities within white-tailed prairie dog towns greater than 200 acres would require informal/formal consultation with the U.S. Fish and Wildlife Service.

7.0 EFFECTS OF THE PROJECT ON THE EXPECTED STATUS OF SPECIES IN THE FUTURE

Provided that the coordination measures described above are implemented, the proposed project is not expected to alter the current status of, or result in any decreased survival of, any of the species discussed in this document during the project or after project completion.

8.0 REFERENCES CITED

Baxter, G. T., and M. D. Stone. 1992. Amphibians and Reptiles of Wyoming. Wyoming Game and Fish Department, 137pp.

Beauvais, G.P., D. Keinath, and J. Ratner. 2001. Habitat mapping and field surveys for lynx (*Lynx Canadensis*) on lands administered by the USDI-Bureau of Land Management in Wyoming. Wyoming Natural Diversity Database, Laramie, Wyoming. 11 pp. Plus appendices.

Bureau of Land Management (BLM). 2002. BLM Wyoming sensitive species policy and list, September 20, 2002. Bureau of Land Management, Cheyenne, Wyoming. 14pp.

Bureau of Land Management (BLM). 2005. Draft Environmental Impact Statement for the Seminoe Road Gas Development Project. Document in Preparation. BLM, Rawlins Field Office.

Campbell, T.M., T.W. Clark, and C.R. Groves. 1982. First record of pygmy rabbits (*Brachylagusidahoensis*) in Wyoming. Great Basin Naturalist 42:100.

Clark, T.W. and M.R. Stromberg. 1987. Mammals in Wyoming. University of Kansas Museum of Natural History, Public Education Series No. 10. 313pp.

Fagerstone, K.A. 1987. Black-footed ferret, long-tailed weasel, and least weasel. Pages 548-573 *in* M. Novak, J.A. Baker, M.E. Obbard, and B.Mallock, editors. Wild

Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario.

Federal Register. 1978. Proposed critical habitat for the whooping crane. 43(160):36588-36590.

Federal Register. 2002. Designation of critical habitat for the northern Great Plains breeding population of the piping plover; final rule. 67(176):57637-57717.

Fertig, W. 2000. Status Review of the Colorado Butterfly Plant (*Gaura neomexicana* ssp. *coloradensis).* Prepared for the Wyoming Cooperative Fish and Wildlife Research Unit, U.S. Fish and Wildlife. Wyoming Natural Diversity Database, Laramie, WY. Retrieved February 6, 2004 from www.uwyo.edu/wyndd.

Fertig, W. 2001. 2000 survey for blowout penstemon (*Penstemon haydenii*) in Wyoming. A report prepared for the Bureau of Land Management Wyoming State Office. Wyoming Natural Diversity Database, University of Wyoming, Laramie.

Giesen, K. M. and J. W. Connelly. 1993. Guidelines for management of Columbian sharp-tailed grouse habitats. Wildl. Soc. Bull. 21:325-333.

Gollop, J.B. T.W., Barry, and E.H. Iverses. 1986. Eskimo curlew a vanishing species? Saskatchewan Natural History Society special publication No. 17. Regina Saskatchewan. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdata/curlew/curlew.htm (Version 16 July 1997).

Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. The Ronald Press Company, New York. 1083pp.

Hayden-Wing Associates (HWA). 1994. Wildlife technical report for the Expanded Moxa Arch Analysis Area. Unpublished report prepared for the BLM Kemmerer Resource Area and Gary Holsan Environmental Planning.

Heady, L.T., K.I. Gabler, and J.W. Laundre'. 2002. Habitat selection by pygmy rabbits in southeast Idaho. Department of Biological Sciences Idaho State University, Pocatello, ID 83209. Website: http://www.id.blm.gov/techbuls/01_07/entiredoc.pdf

Hillman, C.N. and T.W. Clark. 1980. Mustela nigripes. Mammalian Species No. 126. 3pp.

HydroGeo, Inc. 2004. Draft 2003 Vegetation Addendum Report, Seminoe Road Gas Development Project, Prepared for Bureau of Land Management.

Jones, M. 1999. Wildlife biologist, CDOW, Fort Collins, Colorado. Personal communication with M. Phelan, Cedar Creek Associates, Inc., January 14, 1999.

Loeffler, C. (Ed.). 1998. Conservation plan and agreement for the management and recovery of the southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*). Boreal Toad Recovery Team. 66 pp. + appendices.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 10, 2004).

Nebraska Game and Parks Commission (NGPC). 2002. The blowout penstemon: an endangered species. http://www.ngp.ngpc.state.us

Payne, R.B. 1997. Family Cuculidae (Cuckoos). Pp. 508 – 607 *in* J. del Hoyo, A. Elliott, and J. Sargatal (eds.). Handbook of the Birds of the World. Vol. 4. Sandgrouse to Cuckoos. Lynx Edicions, Barcelona. 679 pp.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD.

Stebbins, R. C. 1951. Amphibians of western North America. University of California Press, Berkeley. 539pp.

TRC . 2001. Riparian Vegetation Baseline Investigations of Discharge Drainage Channels for the Seminoe Road Pilot Project, Carbon County, Wyoming. Prepared for Dudley & Associates, LLC.

TRC. 2002a. Black-footed ferret survey of prairie dog towns 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 18, Seminoe Road Coalbed Methane Pilot Project pipelines, Carbon County, Wyoming. Unpublished report prepared by TRC, Laramie, Wyoming. March 2002. 7 pp. + appendix.

TRC. 2002b. Black-footed ferret survey, Seminoe Road Coalbed Methane natural gas gathering pipeline and access road project, Carbon County, Wyoming. Unpublished report prepared by TRC, Laramie, Wyoming. July 2002. 6 pp. + map & appendices.

U. S. Fish and Wildlife Service (USFWS). 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act. U.S. Department of the Interior, Fish and Wildlife Service, Denver, CO and Albuquerque, NM. 15pp.

USFWS. 1990. Recovery plan for the interior population of the least tern (Sterna Antillarum). Twin Cities, Minnesota. 90 pp.

USFWS. 2004a. Threatened, endangered, and proposed species which may occur within the Bureau of Land Management, Rawlins Field Office's area of management. March 23, 2004. Fish and Wildlife Service, Cheyenne, Wyoming.

USGS Patuxent Wildlife Research Center. 2004. North American Breeding Bird Survey Internet data set, 15 September 2004 (http://www.pwrc.usgs.gov/bbs/retrieval/).

Wyoming Game and Fish Department (WGFD). 1999. Atlas of birds, mammals, reptiles and amphibians in Wyoming. Wyoming Game and Fish Department, Biological Services Section, Lander, WY. 190pp.

Wyoming Natural Diversity Database (WYNDD). 2004. Data compilation for Cedar Creek Associates, Inc. and HydroGeo for the Seminoe Road Project Area, completed May 28, 2004. Unpublished reports. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.

Wyoming Natural Diversity Database (WYNDD). 2005. http://uwadmnweb.uwyo.edu/wyndd/

Appendix M

Cultural Resources Management Plan

Appendix M – Cultural Resources Management

Contents

1.0 Program Objectives

The BLM has developed a cultural resources program designed to inventory, evaluate, and manage cultural resources on BLM-administered public land and in areas of BLM responsibility. The BLM management of cultural resources (archaeological, historic, and socio-cultural properties) is in accordance with the provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and other applicable legislation.

2.0 Identification of Cultural Resources

The BLM requires cultural resource inventories for actions involving public lands and/or federal mineral estate that include surface disturbance as a part of the action. Three classes of inventory have been established; Class III is the most intensive and the most often required for areas that have not been subjected to previous inventories or have been subjected to complete surface disturbance in the past.

Class I inventories are completed with the use of existing data from cultural resource inventory files maintained by both the BLM and the Wyoming State Historic Preservation Office (SHPO). Class I inventories serve to identify known properties and are used to determine if more intensive inventory of specific areas is appropriate. This determination is made in consultation with the Wyoming SHPO and often results in the completion of Class II or Class III inventories.

Class II inventories are statistically based sample surveys designed to aid in characterizing the probable density, diversity, and distribution of cultural properties in the area, to develop and test predictive models, and to answer appropriate research questions. Within individual sample units, survey aims, methods, and intensity are the same as those applied in Class III survey. Class II survey may be conducted in several phases, using different sample designs, to improve statistical reliability.

Class III intensive field surveys are conducted by professional archaeologists through pedestrian survey of an entire target area. The intent of a Class III inventory is to locate and record all historic properties and is consistent with standards in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716). Class III inventories conform to the prevailing professional survey standards for the region involved, provided that the regional standards meet or exceed the Secretary's Standards and Guidelines. Because Class III survey is designed to produce a total inventory of the cultural properties observable within the target area, once it has been completed no further survey work should be needed in the target area as long as the current standards are met. Areas with a high probability of containing buried cultural materials or known cultural materials may require additional work of professional monitoring and/or data recovery excavations. Areas that require additional work are analyzed on a case-by-case basis, depending on the proposed action and the types of cultural resources present in the project area.

3.0 BLM Jurisdiction on Privately Owned and/or Split Estate Lands

Class III inventories are generally required before surface-disturbing actions are authorized on publicly owned surface lands and/ or on private or state owned surface lands if the proposed project could not occur without the use of federally owned lands. If a project requires the use of federally owned surface lands as well as privately owned surface lands, there are two authorities that require federal agencies to apply the same NHPA Section 106 compliance standards to private lands as they do federal lands. The regulations at 36 CFR, Part 800.4(b) require the Federal agency to “take the steps necessary to identify historic properties within the area of potential effect.” That this includes both Federal and nonfederal lands is implicit throughout the statute and the regulations, since the regulatory definition of “area of potential effect is “the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties” [36 CFR, Part 800.16(d)]. It makes no distinction between Federal and nonfederal lands. More explicit, however, is Executive Order No. 11593, entitled “Protection and Enhancement of the Cultural Environment.” Under the EO, Section 1(3) it states that all Federal agencies: “…in consultation with the Advisory Council on Historic Preservation, institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of **non-federally owned** sites, structures and objects of historical, architectural, or archaeological significance.”

Split estate lands are defined as those lands where surface ownership has been transferred to private landowners from the Federal government but the mineral rights were retained by the Federal government. These situations arose either through patent under 1914 amendment to the Homestead Act or purchase under the Stock-raising Act of 1916. Each of these Acts also allowed for the Federal government to “reenter and occupy so much of the surface…as may be required for all purposes reasonably incident to the mining or removal of coal or other minerals.” At the time of purchase, the buyer agreed to these terms. Since completing compliance of the NHPA Section 106 process is required of a Federal agency by statute and regulation prior to the Federal action, then being able to complete that process is a purpose reasonably incident to the extraction of the minerals.

4.0 Evaluation of Cultural Resource Sites

The BLM evaluates the significance of cultural resources identified during inventory in consultation with the Wyoming SHPO to determine if the resources are eligible for inclusion in the National Register of Historic Places (NRHP). Cultural resource properties may be considered eligible for listing in the National Register if they meet one or more of the following criteria:

- Criterion A: An historic property is associated with an event or events that have made a significant contribution to the broad patterns of America's History.
- Criterion B: An historic property is associated with the lives of persons significant to our past.
- Criterion C: An historic property embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic value or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: An historic property has yielded or may be likely to yield information important in prehistory or history.

Those sites eligible under Criteria A, B, or C require case-by-case consultation in which the Wyoming SHPO has 30 days to reply. According to a Programmatic Agreement between the Wyoming BLM and the Wyoming SHPO, the BLM has implied concurrence for determining eligibility of sites under Criterion D of the NHPA.

> To facilitate evaluation of cultural resource values in Wyoming, the BLM has devised guidelines for determining the eligibility of archaeological and historical sites and historic trails (BLM Manual 8110.32). The guidelines supplement the National Register criteria for evaluation (36 CFR 60.4) and provide consistency across the state. Application of the guidelines ensures that significant cultural resources are recognized and managed accordingly.

Properties that encompass large areas can be deemed to have contributing and non-contributing portions. Contributing portions are seen to retain integrity of the values for which the property is considered eligible for the NRHP. Non-contributing portions are identified portions of the property, which are not deemed to retain the integrity of values, which would render the property eligible for the NRHP. The determination of contributing versus non-contributing portions of an eligible property can be made at any time after adequate evaluation has been conducted.

5.0 Standard Protective Measures

Within the framework described above, the BLM has developed protective measures to minimize adverse effects on significant cultural resource values.

Protective measures are used in response to the actions of BLM programs involving surface disturbance. These measures include cultural resource inventories, evaluation of cultural resources located during inventory, and mitigation of potential adverse impacts on significant cultural resources. Mitigation may include avoidance, data recovery (including excavation), or other protective measures. Avoidance is the primary and preferred mitigative measure used to protect cultural resources. Consultation with the Wyoming SHPO and the Advisory Council on Historic Preservation is required when surface-disturbing actions are expected to adversely affect properties eligible for the National Register. An adverse effect to an historic property is defined in 36 CFR 800.5(1).

Although Class III inventories are completed before any surface disturbance can begin, the BLM's opportunity to preserve significant cultural resource values in place can be precluded if cultural properties are not identified prior to initiation of an action. This generally would result in an unanticipated discovery situation. In cases such as this, mitigative actions such as data recovery would be implemented.

6.0 Cultural Resource Laws and Regulations

American Antiquities Act of 1906 – provides for permits to authorize scholarly use of properties, for misdemeanor-level penalties to control unauthorized use, and for presidential designation of outstanding properties as national monuments for long-term preservation.

National Historic Preservation Act of 1966 –

- Section 106 directs all federal agencies to take into account effects of their undertakings (actions and authorizations) on properties included in or eligible for the NRHP.
- Section 110 sets inventory, nomination, protection, and preservation responsibilities for federally owned cultural properties. Section 110(c) requires each federal agency to designate a Preservation Officer to coordinate activities under the act.

National Environmental Policy Act of 1969 – establishes national policy for the protection and enhancement of the environment, including “important historic, cultural, and natural aspects of our national heritage.”

Executive Order 11593 (“Protection and Enhancement of the Cultural Environment,” 36 F.R. 8921, May 13, 1971) directs federal agencies to inventory cultural properties under their jurisdiction, to nominate to the NRHP all federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and also to assure that federal plans and programs contribute to preservation and enhancement of non-federally owned properties.

Federal Land Policy and Management Act of 1979 – directs the BLM to manage public lands on the basis of multiple use in a manner that will protect the quality of historical resources and archaeological values. No distinction is made regarding National Register eligibility. FLPMA is the primary basis for managing cultural resources on the public lands.

American Indian Religious Freedom Act of 1978 – establishes the policy of the United States to protect and preserve for the American Indian, Eskimo, Aleut, and Native Hawaiian the inherent right of freedom to believe, express, and exercise their traditional religions. Federal agencies are directed to evaluate their policies and procedures to determine if changes are needed to ensure that such rights and freedoms are not disrupted by agency practices.

Archaeological Resources Protection Act of 1979 – provides felony-level penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age, found on public lands or Indian lands. The act also prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands.

Executive Order 13007: Indian Sacred Sites – establishes access to and ceremonial use of Indian sacred sites by Indian religious practitioners on federal lands. The federal agencies shall avoid adversely affecting the physical integrity of such sacred sites and maintains confidentiality of said sites.

Executive Order 13084: Consultation and Coordination with Indian Tribal Governments – establishes all federal agencies are required to consult with Native American tribes when developing regulatory policies that may affect tribal communities.

Programmatic Agreement Among the Bureau of Land Management, The Advisory Council on Historic Preservation and the National Conference of SHPOs Regarding the Manner in Which BLM will meet its Responsibilities under the National Historic Preservation Act.

State Protocol Agreement between the Wyoming BLM State Director and Wyoming SHPO.

Appendix N

Soils and Vegetation Information

Appendix N – Soils and Vegetation Information

PLANT SPECIES LIST

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Graminoids				
Alkali bluegrass	POJU	*Poa juncifolia var. ampla*	FACU+	
Alkali bluegrass	POJU	*Poa juncifolia var. juncifolia*	FACU+	
Alkali cordgrass	SPGR	*Spartina gracilis*	FACW	
Alkali sacoton	SPAI	*Sporobolus airoides*	FAC*	
Annual rabbitfoot grass	POMO	*Polypogon monspeliensis*	FACW	
Baltic rush	JUBA	*Juncus balticus*	FACW+	
Basin wildrye	ELCI	*Elymus cinereus (Leymus cinereus)*	FAC	
Blackroot sedge	CAEL	*Carex elynoides*		
Bluebunch wheatgrass	ELSP	*Elymus spicatus*	UPL	
Bluegrass	POA	*Poa sp.*		
Bottlebrush squirreltail	ELEL	*Elymus elymoides (Sitanion hystrix)*	FACU-	
Bulrush	*Scirpus*	*Scirpus sp.*	OBL	
Burreed	*Sparganium*	*Sparaganium sp.*	OBL	
Canada bluegrass	POCO	*Poa compressa*	FACU+	
Cattail	*Typha*	*Typha*	OBL	
Cheatgrass	VRITE/ANTE	*Bromus tectorum (Anisantha tectorum)*	-	BLM Weedy Species of Concern
Clustered field sedge	CAPR	*Carex praegracilis)*	FACW	
Contracted Indian ricegrass	ORCO/ACCO	*Oryzopis contracta (Achnatherum contractum)*	-	
Creeping bentgrass	AGST	*Agrostis stolonifera*	FAC*	
Creeping spikerush	ELPA	*Eleocharis palustris*	OBL	
Crested wheatgrass	AGCR	*Agropyron cristatum var. desortum*	–	
Cusick alkaligrass	PUCU	*Puccinellia cusickii*	NI	
Douglas sedge	CADO	*Carex douglasii*	FAC-	
Flattened rush; Roundfruit rush	JUCO	*Juncus compressus*	OBL	
Foxtail barley	HOJU; CRJU HOCA	*Hordeum jubatum (Critesion jubatum) Hordeum x caespitosum*	FAC	
Green needlegrass	STVI/NAVI	*Stipa viridula (Nasella virdula)*	-	
Hardstem bulrush	SCAC	*Schoenplectus acutus var. occidentalis (Scirpus acutus)*	OBL	
Indian ricegrass	ORHY/ACHY	*Oryzopsis hymenoides (Achnatherum hymenoides)*	UPL	
Inland slatgrass	DIST	*Distichlis stricta Distichlis stricta ssp spicata*	FAC+	
Kentucky bluegrass	POPR	*Poa pratensis*	FAC	
Marsh arrowgrass	TRPA	*Triglochin palustris*	OBL	
Mat muhly	MURI	*Muhlenbergia richardsonis*	FAC+	
Meadow barley	HOBR	*Hordeum brachyantherum*	FACW-	
Meadow foxtail	ALPR	*Alopecurus pratensis*	FACW	

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Narrow-leaved sedge; Neddleleaf sedge	CAST	*Carex stenophylla*	-	
Nebraska sedge	CANE	*Carex nebrascensis*	OBL	
Needle-and thread	STCO/HECO	*Stipa comata (Heterostipa comata)*		
Nuttall's alkaligrass	PUNU	*Puccinellia nuttalliana*	FACW+	
Prairie junegrass	KOMA	*Koeleria macrantha*	-	
Pulp muhly	MUFI	*Muhlenbergia filiformis*	FACW-	
Saltmarsh bulrush	BOMA/SCMA	*Bolboschoernus maritimus var paludosus (Scirpus maritimus)*	OBL	
Sandberg bluegrass	POSE	*Poa secunda var. secunda (Poa sandbergii) (Poa canbyi)*	-	
Seaside arrowgrass	TRMA	*Triglochin maritime var. elata*	OBL	
Sedge	CAREX	*Carex sp.*	-	
Shortawn foxtail	ALAE	*Alopecurus aequalis*	OBL	
Slender wheatgrass	ELTR	*Elymus trachycaulus (Agropyron trachycaulum)*	FAC	
Thickspike wheatgrass	ELLA	*Elymus lanceolatus (Agropyron dasystachyum) Agropyron lanceolatum)*	FACU-	
Threadleaf sedge	CAFI	*Carex filifolia*	-	
Threesquare bulrush	SCPU	*Schoenoplectus pungens Scirpus pungens)*	OBL	
Toad rush	JUBU	*Juncus bufonius*	FACW	
Weeping alkaligrass	PUDI	*Puccinellia distans*	FACW+	
Western wheatgrass	ELSM	*Elymus smithii (Agropyron smithii) (Pascopyron smithii)*	FACU	
Woolly sedge	CALA/CAPE	*Carex lanuginose (Carex pellita)*	OBL	
Shrubs/Subshrubs/Trees				
Basin big sagebrush	ARTRTR	*Artemisia tridentate var. tridentate*	-	
Birdfoot sagebrush; Birdsfoot sagebrush	ARPE	*Artemisia pedatifida*	-	
Black sagebrush	ARNO	*Artemisia nova*	-	
Broom snakeweed	GUSA	*Gutierrezia sarothrae*	-	
Fourwing saltbush	ATCA	*Atriplex canescens*	UPL	
Fringed sagebrush; Fringed sagewort	ARFR	*Artemisia frigida*	-	
Gardner's saltbush	ATGA	*Atriplex gardneri var. gardneri*	-	
Gardner's saltbush	ATGA	*Atriplex gardneri var. utahensis*	-	
Greasewood	SAVE	*Sarcobatus vermiculatus*	FACU+	
Green rabbitbrush; Douglas rabbitbrush	CHVI	*Chrysothamnus viscidiflorus*	-	
Mountain mahogany	CEMO	*Cercocarpus montanus*		
Mountain snowberry; Utah snowberry	SYOR	*Symphoricarpos oreophilus var. utahensis*	UPL	
Rocky Mountain juniper	JUSC	*Juniperus scopulorum*		
Rose	*Rosa*	*Rosa sp.*	-	
Rubber rabbitbrush	CHNA/ERNA	*Chrysothamnus nauseosus (Ericamerica nauseosa)*	-	
Sandbar willow	SAEX	*Salix exigua*	OBL	

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Shadscale saltbush; Spiny saltbush; Shadscale	ATCO	*Atriplex confertifolia*	-	
Shortspine horsebrush; Catclaw horsebrush	TESP	*Tetradymia spinosa*	-	
Silver sagebrush	ARCA	*Artemisia cana*	FACU*	
Skunkbush sumac	RHARTR	*Rhus aromatica var trilobata (Rhus trilobata)*	NI	
Spineless horsebrush	TECA	*Tetradymia canescens*	-	
Spiny hopsage	GRSP	*Grayia spinosa*	-	
Tamarisk, Chinese saltcedar; Fivestamen tamarisk; saltcedar	TACH	*Tamarix chinensis*	FACW	WY Noxious Weed
Wax currant; Squaw currant	RICE	*Ribes cereum*	FAC	
Winterfat	KRLA	*Krascheninnikovia lanata*	-	
Woods' rose	RWO	*Rosa woodsii*		
Wyoming big sagebrush	ARTRWY	*Artemisia tridentate var. wyomingensis*	-	
Forbs				
Alkali buttercup; Seaside buttercup	RACY	*Ranunculus cymbalaria*	OBL	
Alkali rayless aster	ASBR/SYCI	*Aster brachyactis (Symphyotrichum ciliolatum)*	FACW	
Alyssum	ALPA	*Alyssum parviflorum*	-	
American vetch	VIAM	*Vicia Americana*		
Arrowleaf balsamroot	BASA	*Balsamorhiza sagittata*	-	
Arum leaf arrowhead; Northern arrowhead	SACU	*Sagittaria cuneata*	OBL	
Biennial wormwood	ARBI	*Artemisia biennis*	FACW	
Blue mustard; Crossflower	CHTE	*Chorispora tenella*	-	
Brook cinquefoil	PORI	*Potentilla rivalis*	FACW	
Buckwheat	Eriogonum	*Eriogonum sp.*	-	
Bull thistle	CIVU	*Cirsium vulgare*	FACU	
Burreed	*Saparganium*	*Sparganium*		
Bushy bird's beak	CORA	*Cordylanthus ramosus*		
Canadian thistle; Canada thistle	CIAR	*Cirsium arvense*	FACU+	WY Noxious Weed
Catseye; Cryptantha	*Cryptantha*	*Cryptantha sp.*	-	
Cattail	*Typha*	*Typha sp.*	OBL	
Chile aster; Aster	ASAS/SYAS	*Aster ascendens (Symphyotrichum ascendens)s*	-	
Clasping pepperweed	LEPE	*Lepidium perfoliatum*	FACU+	
Common dandelion	TAOF	*Taraxacum officinale*	FACU	
Curlycup gumweed	GRSQ	*Grindelia squarrosa*	FACU	BLM Weedy Species of Concern
Cushion buckwheat	EROV	*Eriogonum ovalifolium far purpureum*	-	
Cutleaf nightshade	SOTR	*Solanum triflorum*	-	
Dandelion	*Taraxacum*	*Taraxacum sp.*		
Desert biscuitroot' Hairy seed lomatium	LOFO	*Lomatium foeniculaceum*	-	
Desert madwort; Alyssum	ALDE	*Alyssum desertorum*	-	
European stickseed	LASQ	*Lappula squarrosa*	-	

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Field pennycress	THAR	*Thlaspi arvense*	NI	
Fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	FACW	BLM Weedy Species
Flatspine burr ragweed; Annual bursage	AMAC	*Ambrosia acanthicarpa*		
Flixweed; Herb Sophia	DESO	*Desurainia Sophia*	-	BLM Weedy Species
Flodman's thistle	CIFL	*Cirsium flodmanii*	NI	
Fremont's goosefoot	CHFR	*Chenopodium fremontii*		
Geyer's larkspur	DEGE	*Delphinium geyeri*		Carbon County Declared Weed
Golden dock	RUMA	*Rumex maritimus*	FACW+	
Goldenrod	*Solidago*	*Solidago sp.*		
Goosefoot	*Chenopodium*	*Chenopodium sp.*		
Granite prickly gilia; Prickly phlox	LEPU LIPU	*Leptodactylon pungens (Linanthus pungens)*	-	
Great Plains stickseed	LACE	*Lappula cenchrusoides*	-	
Hairy whitetop	CAPU	*Cardaria pubescens*	-	WY Noxious Weed
Halogen	HAGL	*Halogeton glomeratus*	-	BLM Weedy Species of Concern; Carbon County Declared Weed
Hoary false madwort	BEIN	*Berteroa incana*	-	
Hoary tansy aster	MACA	*Machaeranthera canescens*	-	
Hooker's sandwort	ARHO/ERHO	*Arenaria hookeri (Eremogone hookeri)*	-	
Indian paintbrush	*Castilleja*	*Castilleja sp.*		
Kochia; Mexican summer-cypress	BASI/KOSC	*Bassia sieversiana (Kochia scoparia)*	FAC	
Large flower skeletonplant Prairie pink	LYGR	*Lygodesmia grandiflora*	-	
Leafy rayless aster	ASFR/SYFR	*Aster frondosus (Symphyotrichum frondosum)*	FACW+	
Lesser burdock	ARMI	*Arctium minus*	-	WY Noxious Weed
Littleleaf pussytoes	ANMI	*Antennaria microphylla*	-	
Louisiana -agewort; White sagebrush	ARLU	*Artemisis ludoviciana*	UPL	
Low pussytoes	ANDI	*Antennaria dimorpha*	-	
Lupine	*Lupinus*	*Lupinus sp.*	-	
Mariposa lily	*Calochortus*	*Calochortus sp.*		
Mat amaranth; Prostrate pigweed	AMBL	*Amaranthus blitoides*	FACW	
Milkvetch	*Astragalus*	*Astragalus sp.*		
Narrowleaf milkvetch	ASPE	*Astragalus pectinatus*		
Nodding buckwheat	ERCE	*Eriogonum cemuum*	-	
Northern water plantain	ALTR	*Alisma triviale (Alisma plantago aquatica ssp. Brevipes)*	OBL	
Norwegian cinquefoil	PONO	*Potentilla norvegica*	FAC	
Nuttail's larkspur	DENU	*Delphinium nuttallianum*		
Nuttail's povertyweed	MONU	*Monolepis nuttaliana*	FAC-	
Oakleaf goosefoot	CHGL	*Chenopodium glaucum var. salinum*	FAC	

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Paradox cinquefoil; Bushy cinquefoil	POPA	*Potentilla paradoxa*	FACW	
Persistent sepal yellow-cress	ROCA	*Rorippa calycina*	FACW	BLM Species of Concern
Pinyon goosefoot	CHAT	*Chenopodium atrovirens*	-	
Pitseed goosefoot; Zschack's goosefoot	CHBE	*Chenopodium berlandieri*	-	
Plains pricly pear	OPPO	*Opuntia polyacantha*	-	Carbon County Declared Weed
Povertyweed; Smallflower sumpweed	IVAX	*Iva axilaris*	FAC	
Prairie goldenbanner; Round-leaf false-lupine	THRH	*Thermopsis rhombifolia*	FACU	
Prairie thistle	CICA	*Cirsium canescens*	-	
Prickly lettuce	LASE	*Lactuca serriola*	FACU	
Princesplume	*Stanleya*	*Stanleya sp.*		
Prostrate knotweed	POAV	*Polygonum aviculare*	FACW-	
Prostrae vervain; Big bract verbena	VEBR	*Verbena bracteata*	FAC*	
Pursh seepweed	SUCA	*Suaeda calceoliformis*	-	
Red goosefoot	CHRU	*Chenopodium rubrum var. rubrum*	FACW+	
Red swampfire; Red saltwort	SARU	*Salicomisrubra*	OBL	
Redwool plantain; Saline plantain	PLER	*Plantago eriopoda*	FACW	
Rocky Mountain bee plant	CLSE	*Cleome serrulata*	FACU	
Rosy pussytoes	ANRO	*Antennaria rosea*	-	
Rough cocklebur	XAST	*Xanthium strumarium*	FAC	
Rush skeletonplant; Skeletonweed	LYJU	*Lygodesmia juncea*	-	
Russian knapweed	CERE	*Centaurea repens*		WY Noxious Weed
Russian thistle; Prickly Russian thistle	SATR/SAKA	*Salsola tragus (Salsola kali)*	-/UPL	BLM Weedy Species of Concern
Saline saltbush; Spearscale	ATSU	*Atriplex subspicata*	-	
Salsify; Goatsbeard	*Tragopogon*	*Tragopogon sp.*	-	
Scarlet globemallow	SPCO	*Sphaeralcea coccinea*		
Scotch thistle	ONAC	*Onopordum acanthium*	-	WY Noxious Weed
Sea-milkwort	GLMA	*Glaux maritime*	FACW+	
Silverscale saltbush	ATAR	*Atriplex argentea*	FAC-	
Silverweed cinquefoil	POAN	*Potentilla anserine (Argentina anserine)*	OBL	
Silvery lupine	LUAR	*Lupinus argenteus*	-	
Skeleton burr ragweed; Perennial bursage	AMTO	*Ambrosia tomentosa*	-	
Small flower sandpuff; Small flower sand verbena	TRMI	*Tripterocalyx micranthus*	??	
Smooth woodyaster	XYGL	*Xylorhiza glabriuscula var. glabriscula*		
Spiny phlox; Hoods's phlox	PHHO	*Phlox hoodii*	-	
Stemles goldenweed	HAAC	*Haplopappus acaulis*		
Tansymustard	*Descurainia*	*Descurainia sp.*	-	

Common Name[2]	Code	Scientific Name[1]	Region 9 Wetland Status[3]	Weed/Sensitive Plant Status[4, 5, 6]
Thistle	*Cirsium*	*Cirsium sp.*		
Tumbling orache; Tumbling saltweed	ATRO	*Atriplex rosea*	FACU	
Two-grooved milkvetch	ASBI	*Astragalus bisulcatus*	-	
Two-seed orache; Twoscale saltbush	ATHE	*Atriplex heterosperma*	-	
Water smartweed	POAM	*Polygonum amphibium*	OBL	
Waterthread pondweed	PODI	*Potamogeton diversifolius*	OBL	
Western marsh cudweed	GNPA	*Gnaphalium palustre*	FAC+	
Western tansymustard	DEPI	*Descurainia pinnata*		
Western yarrow	ACMI	*Achillea millefolium var. lanulosa*	FACU	
White water crowfoot; White water buttercup	RAAQ	*Ranunculus aquatilis*	OBL	
White wild onion; Textile onion	ALTE	*Allium textile*		
Whitetop; Hoary cress; Pepperweed whitetop	CADR	*Cardaria draba*	-	WY Noxious Weed
Wild mint; Wild field mint	MEAR	*Mentha arvensis*	FACW-	
Willowleaf dock; Willow dock	RUSA	*Rumex salicifolius var. triangulivalvis*	FACW	
Wyoming thistle	CIPA	*Cirsium pulchemimum*		
Yellow salsify	TRDU	*Tragopogon dubius*		
Yellow spider-flower; Yellow bee plant	CLLU	*Cleome lutea*	FACU	
Yellow sweetclover	MEOF	*Melilotus officinalis*	FACU	
Miscellaneous				
Field Horsetail	EQAR	*Equisetum arvense*	FAC	
Lichen	PACH/XACH	*Pamelia chlorochroa (Xanthopamelia chlorochroa)*		
Soil biomass/algae		*Oscillatoria, Lyngbya, Phormidium*		

Notes:
1. Taxonomy based on *Vascular Plants of Wyoming* 3rd Edition (Dorn 2001).
2. Common names based on *Vascular Plants of Wyoming* 3rd Edition (Dorn, 200); *Checklist of the Vascular Plants of Wyoming* (Nelson & Hartman 1994).
3. Wetland status based on *National List of Plant Species that Occur in Wetlands: Northwest (Region 9) (Resource Management Group Inc., 1993)* and *1993 Supplement to List of Plant Species that Occur in Wetlands Northwest (Region 9*); *Supplement to Biological Report 88* (Reed, P. 1993)
4. Weed/Sensitive Plant status per BLM Rawlins Field Office, Wyoming Weed and Pest Control Act of 1973, and Wyoming Natural Diversity Database (WYNDD).
5. BLM Weedy Species of Concern (Foley, 2003).
6. Adapted from 2003 Declared List of Weed and Pests for Carbon County (Wyoming Weed and Pest Council).

Soil Baseline Characteristics and Interpretations of Dominant Soil Map Units

Northern Project Boundary to Seminoe Reservoir/North Platte River					
Map Unit[1]	**202**	**334**	**336**	**436**	**438**
Topographic Position	Ridges	Terraces, Alluvial Fans	Rolling/Sloping Uplands	Uplands	Sloping Residual Uplands
Slope %	6 to 30	0 to 8	8 to 30	0 – 6	2 to 10
Depth	Very Shallow – Shallow	Deep	Very Shallow – Shallow	Moderately Deep – Deep	Shallow – Moderately Deep
pH	8.0 – 8.4	8.2 – 8.4	8.2 – 8.8	8.2 – 8.6	8.6 – 9.2
Surficial Textures[2]	chfsl - chci	l (EC)	l – cl (EC)	fsl	l – cl (EC)
Runoff Potential	High	Slow	High	Slow - Moderate	Moderate - High
Water Erosion Hazard	Severe	Slight/Severe	Severe	Slight/Moderate	Slight/Severe
Wind Erosion Hazard	Moderate	Moderate		Moderate	Moderate
Available Water Capacity	Very Low	Moderate	Very Low - Low	Low - Moderate	Low
Range Site (Names)	Very Shallow Shale	Saline Upland	Shale, Saline Upland, Shallow Loamy	Sandy	Saline Upland
Map Unit[1]	**452**	**446**	**456**	**483**	**837**
Topographic Position	Rolling/Sloping Uplands	Uplands	Alluvial Fans, Bottomlands	Alluvial Fans, Terraces, Bottomlands	Upland Sideslopes, Toe Slopes, Alluvial Fans
Slope %	3 to 8	1 to 4	0 to 3	0 to 3	3 to 15
Depth	Shallow – Moderately Deep	Very Shallow – Shallow	Deep	Deep	Moderately Deep – Deep
pH	8.2 – 8.8	8.2 – 8.8	8.0 – 9.4	8.0 – 9.4	7.2 – 8.8
Surficial Textures[2]	fsl – sl	chl – l	lls – scl (EC)	sl – scl (EC)	fsl – scl
Runoff Potential	Moderate – High	Slow – Medium	Low – High	High	Medium
Water Erosion Hazard	Slight/Severe	Moderate / Severe	Slight	Slight	Slight/Moderate
Wind Erosion Hazard	Moderate		Moderate / Severe	Moderate	Moderate
Available Water Capacity	Low	Very Low	Low – High	High	Moderate – High
Range Site (Names)	Shallow Sandy	Shale	Saline Upland	Saline Upland	Loamy
Map Unit[1]	**1402**	**1475**			
Topographic Position	Undulating Hills With Low Ridges and Knolls	Alluvial Fans, Terraces			
Slope %	3 to 20	3 to 15			
Depth	Shallow – Deep	Deep			
pH	8.0 – 8.8	8.0 – 9.0			
Surficial Textures[2]	sl	sl – scl			
Runoff Potential	Moderate - High	Moderate			
Water Erosion Hazard	Slight/Severe	Slight/Severe			
Wind Erosion Hazard	Moderate	Moderate			
Available Water Capacity	Moderate – Very Low	Moderate – High			

Appendix O

Erosion Management for Ephemeral Drainages

Appendix O – Erosion Management for Ephemeral Drainages

Ten ephemeral drainages are being considered as potential discharge drainages for produced water associated with the proposed action (Alternative B) for the Seminoe Road Project. See Section 2.4, Alternative B – Proposed Action, in the main body of this EIS. This appendix presents information pertinent to the erosion management of these drainages.

As discussed in Section 3.4.4, Ephemeral Drainages within the EIS Analysis Area, ephemeral drainages typically flow in response to precipitation in the contributing watershed or in response to runoff created by snowmelt. As flow concentrates in these drainages, the processes of aggradation and degradation occur. In ephemeral drainages, degradation of the channel generally results from channel incision or headcut formation as the erosive energy of the water dislodges and transports the soil material in the channel bed. Channel incision can also create instability in the channel banks and facilitate channel widening through bank erosion.

Aggradation, or sediment deposition, also occurs within an ephemeral drainage as the capacity to transport sediment is reduced during the falling limb of the runoff hydrograph. This sediment remains in the channel until mobilized by future runoff events. Both processes naturally occur in ephemeral drainages with the Seminoe Road Project EIS analysis area as evidenced by the presence of headcuts, unstable channel banks, gully formation and sediment deposition within the drainage channels.

This appendix is designed to provide a general overview of the type and extent of erosion management that could be implemented within the EIS analysis area to manage and minimize potential erosion and channel instability associated with a sustained flow of produced water that would be released into the drainages from the proposed action contemplated under Alternative B. An erosion process has been historically active within the existing ephemeral drainages of the existing drainages (see Section 3.4.4, Ephemeral Drainages within the EIS Analysis Area). It is anticipated that this erosion process would continue to occur but would be exacerbated by the discharge and flow of project produced water; consequently, the intent of an erosion management plan is to minimize or limit the erosion process.

Erosion management would involve the placement of structures within the drainage channels to: (1) stabilize areas where headcuts presently exist; and (2) limit the downcutting or depth of headcuts that may be created by the addition of water into the drainages. Two general concepts have been identified and are described below:

(a) Placement of rock grade control structures in the ephemeral drainages. These structures would be placed where the channels are not deeply incised and existing headcuts or downcutting do not exceed 3 feet.

(b) Placement of rock check dams in the ephemeral drainages. These structures would be placed where the channels are deeply incised and the existing headcuts or downcutting exceed 3 feet. Typically, these structures would be placed above the confluence of the existing channels with full pool level of Seminoe Reservoir.

Rock grade control structures would be placed below the invert of the existing drainage channels. The intent of the grade control structures (which include sheet piling and gabions) is to limit the channel degradation or downcutting, should erosion occur, to a maximum depth not exceeding 3 feet. Limiting the channel headcut to a depth of 3 feet reflects the historic erosional patterns within the drainages, limits the erosion associated with unstable banks, and provides for access by wildlife and livestock. The location of the structures is based on the assumptions listed below.

(a) Place a structure immediately upstream of all existing headcuts in the existing drainage channels;

(b) Place structures along each drainage to limit the downcutting to a maximum depth not exceeding 3 feet. The distance between structures is based on the difference between the existing channel slope and the anticipated slope associated with the upstream migration of the channel headcut. Based on the review of preliminary information available for the ten ephemeral drainage channels, this slope is assumed to be 0.5% (0.005 ft/ft).

(c) The project water would concentrate within the drainage channels and create a channel/headcut that would migrate upstream. The channel incised into the native materials is assumed to be not more than 3 feet in depth, and not more than 2 feet in width. A channel with this configuration and a slope of 0.5% would convey a maximum discharge (flow) of 26 cubic feet per second (cfs).

Rock check dams utilized in conjunction with the rock grade control structures would minimize the potential for erosion and would also provide a location for sediment deposition upstream of each check dam. Installation of rock check dams involves the placement of rock above the invert of the existing drainage channels. Plunge pools below each structure would also be stabilized with rock. At least one rock check dam would be placed at the downstream reach or outfall of each drainage channel above the confluence of the channel with the North Platte River or the full pool level of Seminoe Reservoir.

Table O-1, Estimates of Erosion Management Structures (Alternative B), presents preliminary information related to erosion management in the intermittent and ephemeral drainages of the EIS analysis area. **Figure 13, Conceptual Details for Erosion Management Structures**, provides conceptual details for both the rock grade control structures and the rock check dam structures.

Table O-1, Estimates of Erosion Management Structures (Alternative B)

Drainage Name[1]	Channel Length (fee)[2]	Average Gradient (%)[3]	Number of Rock Grade Control Structures[4]	Number of Rock Check Dam Structures[5]	Length of New Roads (feet)[6]	Estimated Disturbed Area (acres)[7]
Pool Table Draw	30,000	1.2	60	1	30,000	18
Ayers Draw	1,000	1.3	3	1	1,000	1
Dry Ditch	6,700	1.0	11	1	6,700	4
Dirtyman Draw	21,500	1.7	8	1	21,500	14
Longhart Draw	2,500	2.3	13	1	2,500	2
Unnamed Drainage #1	1,000	2.8	7	1	1,000	1
Unnamed Drainage #2	1,400	15	5	1	1,400	1
Mountain Lion Draw	4,300	1.7	17	1	4,300	3
St. Mary's Ditch	3,000	1.3	8	1	3,000	2
Unnamed Drainage #3	1,000	4.4	10	1	1,000	1
O'Brien Creek[8]	16,000	1.8	64	1	16,000	10
Total	**88,400**	**-**	**284**	**11**	**88,400**	**57**

Notes:

1. Refer to **Figure 12, Produced Water Discharge Points – Alternative B**.
2. This is the estimated length of the drainage channel receiving produced water under Alternative B.
3. Average gradients for ephemeral drainages from **Table 3.4-4, Ephemeral Drainage Watershed Characteristics**. Average gradient for O'Brien Creek from **Table 3.4-2 Intermittent Drainage Watershed Characteristics**.
4. Number of rock grade control structures is based on a maximum headcut depth of 3 feet and a slope of the headcut channel of 0.005 ft/ft.
5. Number of rock check dam structures assumes a minimum of one structure per drainage to trap sediment and dissipate erosive energy. Where channel incision is increased, the number of structures is determined by the slope of the existing channel and a maximum height of 5 feet for each structure.
6. New roads would need to be constructed to access engineered structures in each drainage. It is assumed that the access roads will be located adjacent to the drainages. These roads are assumed to be two-track, non all weather roads.
7. Estimated disturbed areas are determined using the following assumptions:
   Rock Grade Control Structures: 10 feet across (perpendicular to the flow in the drainage) and 50 feet wide. (Assume 0.01 acre per structure.)
   Rock Check Dam Structure: 60 feet across (perpendicular to the flow) including the rock apron, 50 feet wide. (Assume 0.07 acre per structure.)
   New Road: 25 feet wide for two-track road construction
8. O'Brien Creek is an intermittent drainage, which is a stream that is below the local water table for at least part of the year.