



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

Rawlins Field Office

January 2002



**ENVIRONMENTAL ASSESSMENT for the
Atlantic Rim Coalbed Methane Project,
Blue Sky Pod, Carbon County, Wyoming**

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Rawlins Field Office
1300 North Third Street
P.O. Box 2407
Rawlins, Wyoming 82301-2407

In Reply Refer To:

1790

JAN 24 2002

Re: Blue Sky Pod Coalbed Methane Project

Dear Reader:

Enclosed for your review and comment is the Environmental Assessment (EA) for Petroleum Development Corporation's Blue Sky Pod coalbed methane (CBM) exploration project. The project is located in one of nine areas proposed for exploration drilling for the purpose of providing information for use in the preparation of the Atlantic Rim CBM Methane Project Environmental Impact Statement. In order to satisfy the requirements of the National Environmental Policy Act, this EA was prepared to analyze impacts associated with the exploration of CBM resources northeast of Baggs, in Carbon County, Wyoming.

Analysis of the environmental consequences has led to the determination that this proposed project, with the appropriate mitigating measures, will not have a significant effect on the human environment. Therefore, an Environmental Impact Statement will not be required. Pending the results of a public review of this document, the Bureau of Land Management (BLM) will prepare a formal Decision Record.

Your comments should be as specific as possible. Comments on the alternatives presented and on the adequacy of the impact analysis will be accepted by BLM until February 28, 2002.

Comments may be submitted via regular mail to:

Brenda Vosika Neuman, Project Manager
Bureau of Land Management
Rawlins Field Office
P.O. Box 2407
1300 North Third Street
Rawlins, Wyoming 82301

In the past, the BLM Rawlins Field Office allowed comments to be submitted via electronic mail. However, at this time we are unable to receive e-mail and are uncertain as to when it may become available. **To ensure that your comments are considered, we asked that you do not send responses to the Blue Sky Pod CBM Exploration Project EA electronically.**

Because the BLM website is currently unavailable to the public, a temporary website has been set up specifically for the Atlantic Rim CBM exploration projects at www.arcbm-ea.org. If problems arise with the placement of the document on this temporary website, comments will be taken for a full 30-day period after the document is available on the web.

Please note that comments, including names, e-mail addresses, and street addresses of the respondents, will be available for public review and disclosure at the above address during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays. Individual respondents may request confidentially. If you wish to withhold your name, e-mail address, 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.

Please retain this EA for future reference. Hard copies of the EA may also be reviewed at the following locations:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009

Bureau of Land Management
Rawlins District Office
1300 N. Third Street
Rawlins, Wyoming 82301

If you require additional information regarding this project, please contact Brenda Vosika Neuman, Project Manager, at the address shown above or phone (307) 328-4389.

Sincerely,



Field Manager

Enclosure

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INTRODUCTION

Description and Location

Petroleum Development Corporation (Pedco) of Gillette, Wyoming, has notified the Bureau of Land Management (BLM), Rawlins Field Office (RFO), that the company proposes to explore for and potentially develop coalbed methane (CBM) wells in the Blue Sky Project Area (Project Area) within the Atlantic Rim Coalbed Methane Project Area that is located in south central Wyoming (**Figure 1**). The Project Area is located within the administrative boundary of the RFO in Township 15 North, Range 91 West, Carbon County, Wyoming, and is one of nine areas or well pods that comprise the Atlantic Rim Interim Drilling CBM Project. This proposal is a part of interim drilling activity that may be allowed by the BLM while an Environmental Impact Statement (EIS) is being prepared for the entire Atlantic Rim CBM Project.

The Blue Sky interim development project (Project) consists of constructing, drilling, completing, testing, and producing up to 23 exploratory CBM wells, two injection wells, access roads, a compressor station, and related production and water disposal facilities in the Project Area. All 23 of the proposed well sites are located on federal surface ownership lands administered by the BLM. A total of 19 of the proposed wells would develop federal minerals. The remaining four proposed wells would develop state minerals. One existing well, S&W State 1-16, also will be tied into the Project. This well is located on BLM surface ownership lands and State of Wyoming mineral ownership lands. The Project Area encompasses approximately 1,921 acres. The life of the Project is estimated to be 10 to 20 years.

The Project Area is located about 18 miles northeast of Baggs, Wyoming, in the Muddy Creek watershed within the Colorado River Basin, several miles outside the Baggs Elk Crucial Winter Range Area. The historic Cherokee Trail, a western travel route dating from the 1800s, is located several miles to the south, outside the Project Area.

Access to the Project Area is by State Highway 789 and Carbon County Road 608 (Dad Road). Driving directions are as follows. Travel approximately 20 miles north from Baggs, Wyoming, on SH 789 to the intersection with Carbon County Road 608 (Dad Road), or about 30 miles south on SH 789 from Interstate 80 (I-80) to Dad Road. Turn east onto County Road 608 and travel approximately six miles to the Project Area.

PURPOSE OF AND NEED FOR ACTION

Purpose and Need for the Proposed Project

The purpose of Pedco's proposal is to search for and test certain geologic formations for the presence of commercial quantities of natural gas, specifically CBM. The proposed Project would allow Pedco to determine through exploration and production of CBM if the larger scale development is feasible.

The primary objective of the exploration Project is to determine the following in support of the larger Atlantic Rim CBM Project EIS:

- gas and water production rates;
- productive coal beds;
- economical drilling and completion techniques;
- feasibility of de-watering the coal(s); and
- preferred depths or pressure windows targeted for economic gas production.

Exploration and development of federal oil and gas leases by private industry is an integral part of the BLM's oil and gas leasing program. Statutory authority for BLM's oil and gas program is derived from the Mineral Leasing Act of 1920, as amended, the Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976, the National Materials and Minerals Policy, Research and Development Act of 1980, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

The proposed CBM development would exercise the leaseholders' existing rights within the Project Area to drill for, extract, remove, and market gas products. National mineral leasing policies recognize the statutory right of leaseholders to develop federal mineral resources to meet continuing national needs and economic demands so long as natural resource values and uses are sustained. Also included is the right of the leaseholders within the Project Area to build and maintain necessary improvements, subject to renewal or extension of the lease or leases, in accordance with the appropriate authority.

Natural gas is an integral part of the U.S. energy future due to its availability, the presence of an existing market delivery infrastructure, and the environmental advantages of clean-burning natural gas as compared with other fuels. In addition, the development of abundant domestic reserves of natural gas would reduce the country's dependence on foreign sources of energy and maintain an adequate and stable supply of fuel for economic well-being, industrial production, power generation, and national security. The environmental advantages of natural gas combustion versus other conventional fuels are emphasized in the Clean Air Act Amendments of 1990.

Environmental Analysis Process

The purpose of this environmental assessment (EA) is to document the environmental analysis process used by the BLM to make decisions in accordance with the National Environmental Policy Act (NEPA). This document provides the decision-makers with information needed to make a decision that is fully informed and based on factors relevant to the proposal, including documenting analyses conducted on the proposal and alternatives, and identifying environmental effects and mitigation measures. This document also provides a vehicle for public review and comment on the proposal, the environmental analysis, and conclusions about the relevant issues.

This EA has been prepared to evaluate and disclose the potential environmental impacts associated with a CBM Project. The proposed exploration Project would affect BLM lands managed by the RFO.

Factors considered during the environmental analysis process regarding the exploratory CBM Project include the following:

- A determination of whether the proposal and alternatives are in conformance with BLM policies, regulations, and approved Resource Management Plan (RMP) direction.
- A determination of whether the proposal and alternatives are in conformance with policies and regulations of other agencies likely associated with the Project.
- A determination of well pad locations, access roads, pipelines, and production facilities that best meet other resource management objectives and minimize surface resource impacts while honoring the lease rights within the Project Area.
- A determination of impacts on the human environment resulting from the Project and Alternatives, and the development of mitigation measures necessary to avoid or minimize these impacts.

RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

The EA is prepared in accordance with NEPA and is in compliance with all applicable regulations and laws passed subsequent to the act. This EA assesses the environmental impacts of the Project and No Action Alternatives and serves to guide the decision-making process.

Conformance with Great Divide Resource Area RMP

In accordance with 43 CFR 1610.5, the proposed Project has been reviewed and is in conformance with the Great Divide RMP, approved on November 8, 1990.

The BLM's Great Divide RMP and Record of Decision (ROD) (BLM 1987, 1988a, 1990) direct the management of BLM-administered lands within the Project Area. Management of oil and gas resources, as stated in the RMP, provides for leasing, exploration and development of oil and gas while protecting other resource values. According to the RMP, all public lands in the resource area are suitable for oil and gas leasing and development, subject to certain stipulations.

The Project is located outside areas, such as the Baggs Elk Crucial Winter Range or any Areas of Critical Environmental Concern (ACECs), where surface-disturbing activities would be restricted and intensively managed to maintain important resource values. Portions of the Project Area are located within a utility/transportation system avoidance area. This area would be avoided, if possible, when permits are granted for surface-disturbing activities. If avoidance is not possible, each situation would be analyzed individually and impacts would be carefully mitigated. Management objectives and actions for soil, water, and air include reducing salt-loading and sediment-loading caused by surface-disturbing activities in watersheds that lie within the Colorado River Basin. These actions, including required monitoring, apply to the Project Area within Muddy Creek watershed. This action is also in conformance with the land use decisions pertaining to management objectives and actions for historic trail management and visual resources (Class III).

Conformance With Interim Drilling Guidelines

Drilling and development will be managed under the guidelines provided in the Interim Drilling Policy - Conditions and Criteria Under Which Development Activities May Occur Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project (**Appendix A**).

Relationship to Other Plans and Documents

The proposed Project is in conformance with the State of Wyoming Land Use Plan (Wyoming State Land Use Commission 1979) and the Carbon County Land Use Plan (Pederson Planning Consultants 1997, 1998) and would comply with all relevant federal, state, and local laws and regulations. Development of this Project would not affect the achievement of the Wyoming Standards for Healthy Rangelands (August 1977).

As part of the consultation process under Section 106 of the National Historic Preservation Act of 1966, as amended, the BLM is required to consult with the Wyoming State Historic Preservation Office (SHPO) and others, as necessary, regarding potential impacts of the proposed undertaking upon historic properties. The Project lies within the general area containing the historic Rawlins-Baggs Stage Road (eligible for inclusion in the National Register of Historic Places) and prehistoric camps (Hatcher and Davis 2001).

Issues and Concerns

Environmental and social issues and management concerns associated with the Project are identified as follows:

- Potential effects on wildlife habitats within the Project Area and adjacent lands, primarily greater sage grouse and big game crucial winter range.
- Potential effects on historic and cultural values that are currently unrecorded.
- Reclamation of disturbed areas associated with construction activities and off-road travel.
- Potential effects on surface water quality.
- Potential effects on air, soil, wildlife, and vegetation within the Project Area.
- Potential effects on groundwater.
- Potential effects on air quality (mostly from generators and compression facilities).
- Cumulative effects on all resources.

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CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

PROPOSED ACTION

The Proposed Action submitted by Petroleum Development Corporation (Pedco) consists of constructing, drilling, completing, testing, and operating 23 new CBM exploratory wells and two injection wells located on existing leases. Related access roads, utilities, flowlines, production facilities, a compressor station, and water disposal facilities also are included in the Proposed Action. **Table 2-1** summarizes proposed CBM well information by lease number. **Figure 1** shows the proposed Blue Sky Project (Project).

Table 2-1 New Well Information			
Lease Number	Well Name	Well Number	Location
CBM Wells			
WYW-141276	ARFederal	1591-1-5	T15N, R91W, Sec. 5, NENE
	ARFederal	1591-7-5	T15N, R91W, Sec. 5, SWNE
	ARFederal	1591-9-5	T15N, R91W, Sec. 5, NESE
	ARFederal	1591-11-5	T15N, R91W, Sec. 5, NESW
	ARFederal	1591-13-5	T15N, R91W, Sec. 5, SWSW
	ARFederal	1591-15-5	T15N, R91W, Sec. 5, SWSE
	ARFederal	1591-3-8	T15N, R91W, Sec. 8, NENW
	ARFederal	1591-5-8	T15N, R91W, Sec. 8, SWNW
	ARFederal	1591-9-8	T15N, R91W, Sec. 8, NESE
	ARFederal	1591-15-8	T15N, R91W, Sec. 8, SWSE
WYW-141277	ARFederal	1591-3-5	T15N, R91W, Sec. 5, NENW
	ARFederal	1591-5-5	T15N, R91W, Sec. 5, SWNW
	ARFederal	1591-1-8	T15N, R91W, Sec. 8, NENE
	ARFederal	1591-7-8	T15N, R91W, Sec. 8, SWNE
	ARFederal	1591-11-9	T15N, R91W, Sec. 9, NESW
	ARFederal	1591-15-9	T15N, R91W, Sec. 9, SWSE
WYW-146499	ARFederal	1591-3-9	T15N, R91W, Sec. 9, NENW
	ARFederal	1591-5-9	T15N, R91W, Sec. 9, SWNW
	ARFederal	1591-13-9	T15N, R91W, Sec. 9, SWSW
94-00401*	ARState	1591-3-16	T15N, R91W, Sec. 16, NENW
	ARState	1591-5-16	T15N, R91W, Sec. 16, SWNW
	ARState	1591-7-16	T15N, R91W, Sec. 16, SWNE
	ARState	1591-11-16	T15N, R91W, Sec. 16, NESW
Injection Wells			
WYW-141277	ARFederal	1591-8I	T15N, R91W, Sec. 8, SENW

Table 2-1 New Well Information			
Lease Number	Well Name	Well Number	Location
WYW-146499	ARFederal	1591-9I	T15N, R91W, Sec. 9, SWSW

Note:

* BLM surface ownership lands only

The Project is located approximately 18 miles north-northeast of Baggs, Wyoming near the intersection of SH 789 and Carbon County Road 608 (Dad Road). The Project is one of nine areas or well pods that comprise the Atlantic Rim Interim Drilling CBM Project. All 23 of the proposed CBM well sites, the two injection well sites and the one existing well site in the Project are located on surface ownership lands administered by the Bureau of Land Management (BLM) Rawlins Field Office (RFO). A total of 19 of the proposed CBM wells would develop federal minerals. The remaining four proposed CBM wells would develop state minerals. The one existing Project CBM well, S&W State 1-16, is located on State of Wyoming mineral ownership lands.

The Project is a part of the Interim Drilling Plan associated with the Atlantic Rim environmental impact analysis in Carbon County, Wyoming. The Atlantic Rim CBM Environmental Impact Statement (EIS) is scheduled to begin in 2002, and is expected to take about 24 months to complete. During the interim period before the EIS is completed, the RFO will allow up to 200 exploratory wells to be drilled, provided this activity is in compliance with criteria described in the Interim Drilling Policy (**Appendix A**), and the RFO determines through a NEPA analysis that no significant impacts would occur.

Proposed CBM development in the Atlantic Rim area is based on a Wyoming Oil and Gas Conservation Commission (WOGCC) approved 80-acre well spacing pattern. In addition to well sites, other facilities, such as access roads, gas gathering and water disposal pipelines, buried electrical utilities, injection wells, water transfer facilities, and a compressor station, would be developed to support CBM production in the well fields. The interim drilling activities would develop over a 6 to 12 month period. The life of the Project is estimated to be between 10 and 20 years. The productive life of a CBM well is estimated to be 15 years.

Specific components of the Project are shown in the Master Surface Use Program (MSUP) (**Appendix B**), Master Drilling Plan (MDP) (**Appendix C**), Water Management Plan (WMP) (**Appendix D**), and the Project Map (**Figure 1**). Project plans are summarized below in the Plan of Development.

Plan of Development

Preconstruction Planning and Site Layout

Pedco would follow the procedures outlined below to gain approval for proposed activities on BLM-administered lands or minerals within the Project Area. Development activities also would be approved by the WOGCC. The WOGCC permitting procedures require filing a state Application for Permit to Drill (APD) with the WOGCC and obtaining a ROW from the surface owner.

- Prior to the start of construction activities, Pedco would submit a federal APD, and a ROW application, along with a preliminary MSUP, MDP, WMP and a Project Map to the RFO, showing the specific location of the proposed activity (e.g., individual drill sites, pipeline corridors, access roads, or other facilities). The application would include site-specific plans that describe the proposed development (i.e., drilling plans with casing/cementing program; surface use plans with road and drill pad construction details; and site-specific reclamation plans, etc.). Approval of all planned operations would be obtained in accordance with authority prescribed in Onshore Oil and Gas Order No. 1 (Approval of Operations on Onshore Federal and Indian Oil and Gas Leases).
- The proposed facilities would be staked by Pedco and inspected by an interdisciplinary team and/or an official from the BLM to ensure consistency with the approved RMP, the Interim Drilling Policy (**Appendix A**), and oil and gas lease stipulations.
- More detailed descriptions of the proposed activity or construction plans would be submitted to the BLM by Pedco, when required for the proposed development. The plans would address concerns that may exist concerning construction standards, required mitigation, etc. Negotiation of these plans between Pedco and the BLM, if necessary to resolve differences, would be based on field inspection findings and would take place either during or after the BLM onsite inspection.
- Pedco and/or its contractors would revise the MSUP, MDP, or WMP, as necessary, per negotiations with the BLM. The BLM would complete a project-specific environmental analysis that incorporates agreed upon construction and mitigation standards. The BLM would then approve the specific proposal and attach the Conditions of Approval to the permit. Pedco must then commence the proposed activity within one year.

Following is a general discussion of proposed construction techniques to be used by Pedco. More detailed plans can be reviewed in **Appendix B**. These construction techniques would be applicable to drill sites, pipelines, and access roads within the Project Area, and may vary between the well sites.

Construction and Drilling Phase

Access Road Construction

The primary road access utilized by Pedco to reach the Project Area is Wyoming State Highway 789. Access is provided by Carbon County 608 (Dad Road), an existing one-lane road that is graveled and partially graveled. Access to drill locations from the existing road network already in place would be provided by new and upgraded crowned, ditched, and surfaced roads.

Pedco proposes to construct required new access roads across public lands in accordance with BLM Manual 9113 standards. Roads would be located to minimize disturbances and maximize transportation efficiency. Roads would be closed and reclaimed by Pedco when they are no longer required for production operations, unless otherwise directed by the BLM.

Drainage crossings on the access routes within the Project Area would either be low water crossings or crossings using 'fish-friendly' culverts where applicable. Low water crossings would be utilized in shallow channel crossings. Crossings of larger channels within the Project Area would consist of excavating an area approximately four feet deep under the travelway and filling it with rock and gravel to the level of the drainage bottom. Channel banks on either side of such crossings would be cut down to reduce grade where necessary. Culverts would be installed on smaller, steeper channel crossings. Topsoil would be conserved before channel crossing construction occurs. Also, the total area to be disturbed would be flagged on the ground before construction begins.

Well Pad Design and Construction

All of the proposed CBM wells would be drilled on surface lands administered by the BLM. A graded well pad would be constructed at each well site using cut and fill construction techniques. **Appendix B** contains a schematic drawing of a typical CBM drill site layout. The dimensions of each well pad would be approximately 200 feet by 200 feet. Each well site would disturb an estimated 1.25 acres.

A temporary mud pit would be constructed within the well pad location. A small trench would be excavated at each well and reclaimed after completion operations. Topsoil would be removed and stockpiled as required by the BLM, prior to excavating the pit. Pedco estimates the reserve pit would be open for two to eight weeks to allow for evaporation of pit fluids. During this time, the pit would be fenced on all sides to prohibit wildlife or livestock from falling into the pit.

In the event drilling is non-productive at any given site, all disturbed areas associated with that site, including the well site and new access road, would be reclaimed to the approximate landform existing prior to construction. Reclamation and site stabilization techniques would be applied as specified in the MSUP.

If drilling is productive, all access roads to the well site would remain in place for well-servicing activities (i.e., maintenance, improvements, etc.). Partial reclamation would be completed on segments of the well pad and access road ROW that are no longer needed.

Drilling and Completion Operations

Drilling of the CBM wells and injection wells would utilize either a conventional or truck-mounted drilling rig. Additional equipment and materials needed for drilling operations would be trucked to the well site. Water for use in drilling the initial well would be obtained from a local source near the Project Area. Water for drilling the remaining wells would be obtained from water produced by the initial well. Approximately 600 barrels of water would be needed for drilling each well. The actual water volume used in drilling operations would be dependent upon the depth of the well and any losses that might occur during drilling. The proposed Project would require approximately 84,000 gallons (or 0.26 acre-feet) of water per well for cement preparation, well stimulation, and dust control. Water used for drilling will come from existing Pedco CBM wells completed in coals of the Mesaverde Group. Based on existing hydrogeologic information, groundwater in the coal seams at the completions depths in the existing CBM wells is hydraulically isolated from shallow groundwater and surface water resources. The likelihood that removal of this groundwater could deplete the supply of water to Colorado River watershed is exceedingly remote.

Drilling mud would consist of native mud and bentonite. As hole conditions dictate, small amounts of polymer additives and/or potassium chloride salts may be added for hole cleaning and clay stabilization.

Depending on the depth of the coal seam, each producing well would be drilled to a depth of 1,800 feet to 2,700 feet or deeper, and would be exposed to the coal seam through perforations. The well control system would be designed to meet the conditions likely to be encountered in the hole and would be in conformance with BLM and State of Wyoming requirements. A completed CBM well bore is shown in **Appendix C**.

The drilling and completion operation for a CBM well normally requires approximately ten to fifteen people at a time, including personnel for logging and cementing activities. Each well would be drilled within a period of seven to ten days. A well completion program may be initiated to stimulate production of gas and to determine gas and water production characteristics in preparation for production of gas from a drilled, cased, and cemented well. A mobile completion rig similar to the drill rig may be transported to the well site and used to complete each well. Completion operations are expected to average two to five days per well. Upon receiving applicable permits, methane gas may be flared or vented and water temporarily discharged and contained in the reserve pit for a short period of time during testing. If determined to be productive, wells would be shut-in until pipelines and other production facilities are constructed.

Drilling of the injection wells would be accomplished with the equipment and personnel used to drill the CBM wells. Depth of the injection wells is expected to range from 4,170 to 4,450 feet. Drilling and completion of each injection well is expected to take approximately seven to fourteen days and

installation of surface equipment, holding tanks and pumping equipment, an additional fourteen days. A schematic of a typical injection well is shown in **Appendix B**. See **Appendix C** for drilling plans.

Production Operations

Well Production Facilities

Wellhead facilities would be installed if the CBM wells are productive. A weatherproof covering would be placed over the wellhead facilities. A downhole pump would be utilized to produce water from the uncased open hole or perforated interval. The long-term surface disturbance at each productive well location where cut and fill construction techniques are utilized would encompass approximately 0.25 acres. Well site production facilities typically would be fenced or otherwise removed from existing uses. A typical CBM production well site is shown in **Appendix B**.

Pipeline trenches for well gathering lines are expected to disturb 15-foot wide corridors within the 30-foot wide ROW temporarily, and to be reclaimed as soon as practical after construction is completed. Trenches would be constructed along the access roads wherever possible. Separate gathering lines would be buried in the trenches and would transport methane gas to the metering facility and compressor station and produced water to the injection wells.

At the conclusion of the Project, roads, culverts, cattleguards, pipelines, stock watering facilities, or other structures could be left in place for any beneficial use, as designated by the BLM. Water wells and produced water would be available to the BLM, with appropriations, diversion, and storage rights already properly filed with the Wyoming State Engineer's Office (WSEO). All federally-owned lands containing disturbed areas or facilities that are no longer needed would be reclaimed.

Power Generation

Electricity would be used to power pumps during well development and to initiate and maintain production. Both natural gas-fired and diesel engine-powered generators would be used on a temporary basis at individual wells until electric distribution lines are analyzed in the Atlantic Rim Coalbed Methane Project EIS. Electrical motors or natural gas-fired reciprocating or microturbine engines would power booster and blower units. Future compressors are anticipated to be natural gas-fired or electrical units. All power lines into the Project Area would be buried per the Interim Drilling Policy.

Pipelines

Three types of pipelines would be constructed as part of the proposed Project:

1. Gas-gathering pipeline systems (low pressure, from wellhead to building or metering facility, and from building through trunkline to the compressor station).
2. Produced water-gathering pipeline systems.

3. Gas-delivery pipelines (high pressure, from compressor station to existing transmission pipelines).

Reclamation of pipeline corridors would occur as soon as practical after pipeline construction is complete.

Gas-Gathering Pipeline Systems

Gas-gathering and produced water-gathering pipelines would be placed together in the same trench/ditch when practical. Construction and installation of pipelines would occur immediately upon determination of producibility of the wells. The pipeline right-of-way would typically follow access roads, except in a limited number of cases where topography dictates or as required by the BLM. Separate gathering lines would transport methane gas to production facilities and produced water away from CBM wells to injection wells.

Gathering lines, averaging 9.4 miles long in length, are expected to disturb fifteen foot wide corridors within 30-foot wide ROWs, and would gather gas from the CBM wells and transport it to the compressor station. The alignments of the gathering lines to the compressor station are shown in **Figure 1**

Development would be constrained by the gas production from the coal seam(s) and by the pipeline capacity available to transport compressed gas to markets. Currently, the pipeline capacity within the Project Area is 12-60 million cubic feet per day (MMCFD), depending on the pipeline connecting locations.

Produced Water-Gathering System and Injection Facilities

Produced water from individual wells would be collected and injected at two disposal wells (**Figure 1**). These wells would be approved by the BLM, WOGCC, and WDEQ.

The produced water from 14 CBM wells would be injected into the ARFederal 1591-9I well, an approximate minimum of 7,200 bbls/day and maximum of 19,200 bbls/day. The remaining ten wells would be injected at the ARFederal 1591-8I well, an approximate minimum of 5,142 bbls/day and maximum of 23,500 bbls/day.

Produced water-gathering pipelines would be constructed along the well access road wherever feasible, from the wellhead to the injection well locations. The water lines would be placed together in the same trench/ditch as gas gathering lines wherever practical, and buried. A typical water disposal facility is shown in **Appendix B**.

Transfer pumping stations would be utilized during production operations to transfer produced water from the CBM well(s) to the disposal well(s). The transfer pumping stations are needed in those areas where elevation differences require supplemental pumping to transfer the produced water. If transfer pumping stations are required, they would be identified in the MSUP. Each pumping station would contain a 400-barrel water tank and a small centrifugal water pump. Each pumping station would consist of a pad area having approximate dimensions of 120 feet by 120 feet, and disturbing

an estimated 1.0 acre. An approximate two-foot berm would be constructed around the perimeter of each pumping station area to contain any potential spills. A small pump house would be constructed immediately outside the bermed area to house the centrifugal pump. A typical water transfer facility is shown in **Appendix B**.

Gas-Delivery Pipelines and Compression

Produced natural gas (methane) under wellhead pressure would move through the low pressure gas gathering system to a compressor station. Typical gathering system line pressure is less than 100 pounds per square inch (psi). Gas arriving at the compressor station would be compressed from line pressure to facilitate transport and introduction of the gas into an existing transmission pipeline.

Compression of the gas at a field compressor station would increase the pressure to an estimated 700 to 1,450 psi. The compressor station would have a pad size of 200 feet by 200 feet and would result in approximately 1.5 acres of site disturbance. All compressors are expected to be housed within structures. A typical compressor station and meter facility is shown in **Appendix B**.

Should commercial quantities of CBM be discovered, a transportation pipeline would be required to move the gas to an existing pipeline system located in the NE¼ of Section 4, T.15N. R.91W. The alignment of the sales line from the compressor station to the existing sales pipeline is shown in **Figure 1**. Pedco is applying for a right-of-way (ROW) for the eight-inch diameter steel pipeline to be buried six feet deep on a 50-foot wide ROW, that would connect from the compressor station, northeast to the existing pipeline in Section 4. This sales pipeline would be approximately 1.7 miles long.

Ancillary Facilities

All wells, pipelines, and associated ancillary production facilities would be operated in a safe manner by Pedco, as set forth by standard industry operating procedures. Routine maintenance of producing wells would be necessary to maximize performance and detect potential difficulties with gas production operations. Each well location would be visited about every other day to ensure operations are proceeding in an efficient and safe manner. The visits would include checking separators, gauges, valves, fittings, and onsite storage of produced water and condensates. Routine onsite equipment maintenance would also be performed as necessary. Additionally, all roads and well locations would be regularly inspected and maintained to minimize erosion and assure safe operating conditions.

Traffic and Work Force Estimates

Estimated traffic requirements for drilling, completion, and field development operations are shown in **Table 2-2**. The 'Trip Type' column lists the various service and supply vehicles that would travel to and from the well sites and production facilities. The 'Round-Trip Frequency' column lists the number of trips, both external (i.e., to/from the Blue Sky Project Area) and internal (within the Blue Sky Project Area). The figures provided in **Table 2-2** should be considered general estimates. Drilling and production activity levels may vary over time in response to weather and other factors.

Table 2-2 Traffic Estimates		
Trip Type	Round-Trip Frequency	
Drilling (2 rigs, 2 crews/rig)	External (to/from Project Area)	Internal (within Project Area)
Rig supervisor	4/day	same
Rig crews	4/day	same
Engineers ^a	2/week	1/day/rig
Mechanics	4/week	same
Supply delivery ^b	1/week	2-4/day
Water truck ^c	1/month	2 round trips/day
Fuel trucks	2 round trips/well	same
Mud trucks ^d	1/week	2/day
Rig move ^e	8 trucks/well	8 trucks/well
Drill bit/tool delivery	1 every 2 weeks	same
Completion		
Small rig/crew	1/day	same
Cement crew	2 trips/well	same
Consultant	1/day	same
Well loggers	3 trips/well	same
Gathering systems	8/day	same
Power systems	2/day	same
Compressor stations	2/day	same
Other field development	3/day	same
Testing and operations	2/day	same

Notes:

- ^a Engineers travel to Project Area weekly and stay in a trailer at the Project Area during the week.
- ^b Current plans are to establish a central supply area within a Project Area and deliver supplies on a weekly basis.
- ^c Water trucks would deliver water to rigs from a location within the Project Area.
- ^d Current plans are to establish a central mud location within a Project Area and deliver mud on a weekly basis.
- ^e It would require four trucks to move each rig to a Project Area. Upon completion of drilling in a Project Area, each rig would move to the next Project Area.

Site Restoration and Abandonment

Pedco proposes to completely reclaim all disturbed areas not needed for production activities. Reclamation would generally include: 1) complete cleanup of the disturbed areas (drill sites, access roads, etc.); 2) restoration of the disturbed areas to the approximate ground contour that existed prior to construction; 3) replacement of topsoil over all disturbed areas; 4) ripping of disturbed areas to a depth of 12 to 18 inches; and 5) seeding of recontoured areas with a BLM approved, certified weed-free, seed mixture.

Summary of Estimated Disturbances

Table 2-3 summarizes the estimated disturbances that would result from implementation of the Project .

Table 2-3 Disturbed Area Estimates - Blue Sky Project Area					
Facility	Development Phase				Operations
	Length (feet)	Width (feet)	Area, ea. (acres)	Acres	Acres
New Roads	38,800	20	N/A	17.8	17.8
Existing Well Access Road*	1,300	20	N/A	0.6	0.6
Existing Road to be Upgraded	6,100	20	N/A	2.8	2.8
New Gathering Lines	49,600	15	N/A	17.1	0
New Sales Line	9,100	15	N/A	3.1	0
New CBM Drill Pads (23)	N/A	N/A	1.25	28.8	5.8
New Injection Wells [@] (2)	N/A	N/A	1.0	2.0	2.0
Existing Drill Pad (1)	N/A	N/A	0.75	0.75	0.3
Compressor Station (1)	N/A	N/A	1.5	1.5	1.5
Pumping Stations (4)	N/A	N/A	1.0	4	4
Total Disturbance				78.5	34.8

* Carbon County Road 608 not included in Existing Road measurements.

@ Injection Wells will be co-located with other facilities (Figure 1).

Project-Wide Mitigation Measures and Procedures

The following describes applicant-committed and agency-required measures and procedures to avoid or mitigate resource or other land use impacts. These measures and procedures will be referred to as Best Management Practices (BMPs) throughout this document. These mitigation measures and procedures would be applied on privately-owned surface unless alternate actions are specifically required by the involved private surface owners. An exception to a mitigation measure and/or design feature may be approved on public land on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted.

Preconstruction Planning, Design, and Compliance Measures

1. Pedco would designate a qualified individual to serve as compliance coordinator. This individual will be responsible for ensuring that all requirements of the APD and Plan of Development (MSUP, MDP, WMP, and Conditions of Approval) are followed.
2. Pedco and the BLM would make onsite inspections of each proposed and staked facility site (e.g., well sites and other facilities), new access road, access road reconstruction, and pipeline alignment projects to develop site-specific recommendations and mitigation measures.
3. New road construction and maintenance of existing roads in the Project Area would be accomplished in accordance with BLM Manual 9113 standards for Resource Roads and construction details outlined in the MSUP and Conditions of Approval, unless private landowners, Carbon County, or the State of Wyoming specify otherwise.
4. Prior to construction, Pedco would submit an APD package. This package would contain individual APDs for each drill site, MDP, MSUP, WMP, schematics of facilities, and ROW applications for pipelines, utilities, and access roads. APDs submitted by Pedco would show the layout of the drill pad over the existing topography, dimensions of the pad, cross sections of the cut and fill (when required), location and dimensions of reserve pit(s), and access road locations.
5. Pedco would slope-stake construction activities when required by the BLM (e.g., steep and/or unstable slopes) and receive approval from the BLM prior to the start of construction.
6. BLM would require the road to be crowned and ditched with a .03 to .05 ft crown, and the topsoil would be pulled back down on the cut slope so there is no berm left at the top of the cut slope.
7. BLM would require that culverts be covered with a minimum of 12 inches of fill or one-half the pipe diameter, whichever is greater. The inlet and outlet will be set flush with existing ground and lined up in the center of the draw. Before backfilling, the bottom of the pipe will be bedded on stable ground not containing expansive or clay soils, protruding rocks that would damage the pipe, or unevenly-sized material that would not form a good seat for the pipe. The site would be backfilled with unfrozen material and rocks no larger than two inches in diameter. Care would be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill would be brought up evenly in 6" layers on both sides of the conduit.
8. Additional culverts would be placed in the existing access road as needed or directed by BLM.
9. BLM would require surfacing of the access road with an appropriate grade of aggregate or gravel to a depth of four inches, prior to moving the drilling equipment/rig onto the pad.
10. BLM would require that access roads be maintained in a safe and usable condition. A regular maintenance program would include, but is not limited to, blading, ditching, culvert installation, and surfacing.

11. If snow removal is required outside new and existing roadways, BLM would require that snow removal equipment be equipped with shoes to keep the blade off the ground surface. If the surface of the ground is uneven, the BLM would require that special precautions be undertaken to ensure that equipment blades do not destroy vegetation.
12. BLM would require wing ditches be constructed, as necessary, to divert water from road ditches.

Resource-Specific Requirements

Pedco proposes to implement the following resource-specific mitigation measures, procedures, and BLM management requirements on public lands.

Geology/Minerals/Paleontology

Mitigation measures presented in the Soils and Water Resources sections of this EA would avoid or minimize many of the potential impacts to the surface mineral resources. Protection of subsurface mineral resources from adverse impacts would be provided by BLM and WOGCC casing and cementing policies.

Scientifically significant paleontological resources potentially occurring within the Lewis Shale, the only geologic formation of concern which underlies the Project Area, would be protected through the following mitigation measures:

1. If recommended by the BLM, each proposed facility located in areas having known and potential vertebrate paleontological resources would be surveyed by a BLM-approved paleontologist prior to surface disturbance (BLM 1987 and 1990).
2. Discovery. Contingency would be made for the accidental discovery of significant fossils by Project personnel. If fossils are discovered by construction personnel during implementation of the Project, the BLM would be notified immediately. If the fossils could be adversely affected by construction, construction activities would be redirected until a qualified paleontologist has determined the importance of the uncovered fossils, the extent of the fossiliferous deposits, and has made or implemented recommendations regarding further mitigation.
3. Field Survey. No specific data currently exists on deposits of high or undetermined paleontologic potential in Project Area. For that reason field survey for paleontologic resources would be conducted on a case by case basis, as directed by the BLM, in areas where surface exposures of the Browns Park, Green River, or Wasatch Formations occur. Field survey may result in the identification of additional mitigation measures to lessen adverse impacts to fossil resources. This mitigation may include collection of additional data or representative samples of fossil material, monitoring excavation, or avoidance. In some cases no action beyond that conducted during the field survey may be necessary.

A report would be submitted to the BLM following the completion of each field survey. That report will detail the results of the survey, including a list of fossils collected, if any, and may

include recommendations for additional mitigation. If significant fossils are collected, the report must document the curation of specimens into the collections of an acceptable museum repository, and contain appropriate geologic records for the specimens.

Air Quality

1. All BLM conducted or authorized activities must comply with applicable local, state, tribal and federal air quality regulations and standards. Pedco would adhere to all applicable ambient air quality standards, permit requirements (including preconstruction, testing, and operating permits), motorized equipment and other regulations, as required by the State of Wyoming, Department of Environmental Quality, Air Quality Division (WDEQ-AQD).
2. Pedco would not allow burning garbage or refuse at well locations or other facilities. Any flaring would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations.
3. On federal land, Pedco would initiate immediate abatement of fugitive dust (by application of water, chemical dust suppressants, or other measures) when air quality, soil loss, or safety concerns are identified by the BLM or the WDEQ-AQD. These concerns include, but are not limited to, potential exceedances of applicable air quality standards. The BLM would approve the control measure, location, and application rates. If watering is the approved control measure, the operator must obtain the water from state-approved source(s).

Soils

1. Reduce the area of disturbance to the absolute minimum necessary for construction and production operations while providing for the safety of the operation.
2. Where feasible, locate pipelines immediately adjacent to roads to avoid creating separate areas of disturbance and in order to reduce the total area of disturbance.
3. Avoid using frozen or saturated soils as construction material.
4. Minimize construction activities in areas of steep slopes.
5. Design cut slopes in a manner that would allow retention of topsoil, use of surface treatment such as mulch, and subsequent revegetation.
6. Selectively strip and salvage topsoil or the best suitable medium for plant growth, from all disturbed areas. Remove and conserve to a minimum depth of six inches and a maximum of twelve inches from all well pads, unless otherwise agreed to by the BLM and the operator.
7. Where possible, minimize disturbance to vegetated cuts and fills on existing improved roads.

8. Install runoff and erosion control measures such as water bars, berms, and interceptor ditches if needed.
9. Install culverts for ephemeral and intermittent drainage crossings. Design all drainage crossing structures to carry the 25-year discharge event, or as otherwise directed by the BLM.
10. Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Where possible, maintain a 100-foot wide buffer strip of natural vegetation (not including wetland vegetation) between construction activities and ephemeral and intermittent channels.
11. Include adequate drainage control devices and measures in the road design (e.g., road berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipators) at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road environment to avoid erosive concentrated flows. In conjunction with surface runoff or drainage control measures, use erosion control devices and measures such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. Implement a revegetation program as soon as possible to re-establish the soil protection afforded by vegetation.
12. Upon completion of construction activities not specifically required for production operations, restore topography to near pre-existing contours at the well sites, along access roads and pipelines, and other facilities sites; replace up to six inches of topsoil or suitable plant growth material over all disturbed surfaces; apply fertilizer as required; seed; and mulch.

Water Resources

Other mitigation measures listed in the Soils, and Vegetation and Wetlands sections of this EA would also apply to Water Resources.

1. Limit construction of all drainage crossings to no-flow periods or low-flow periods.
2. Minimize the area of disturbance within perennial, ephemeral and intermittent drainage channel environments.
3. Prohibit construction of well sites and other non-linear features within 500 feet of surface water and/or riparian areas. Possible exceptions to this would be granted by the BLM for linear features based on an environmental analysis and site-specific mitigation plans.
4. Design channel crossings to minimize changes in channel geometry and subsequent changes in flow hydraulics.
5. Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Where possible, maintain a 100-foot wide buffer

strip of natural vegetation(not including wetland vegetation) between construction activities and ephemeral and intermittent channels.

6. Design and construct interceptor ditches, sediment traps, water bars, silt fences and other revegetation and soil stabilization measures, as needed.
7. Construct channel crossings by pipelines such that the pipe is buried a minimum of four feet below the channel bottom.
8. Regrade disturbed channel beds to the original geometric configuration containing the same or very similar bed material.
9. Case wells during drilling, and case and cement all wells in accordance with Onshore Order No. 2 to protect all high quality water aquifers. High quality water aquifers are aquifers with known water quality of 10,000 TDS or less. Include well casing and welding of sufficient integrity to contain all fluids under high pressure during drilling and well completion. Further, wells would adhere to the appropriate BLM cementing policy.
10. Construct the reserve pits in cut rather than fill materials. Compact and stabilize fill material, as needed. Inspect the subsoil material of the pit to be constructed in order to assess soil stability and permeability and determine whether reinforcement and/or lining are required. If lining is required, line the reserve pit with a reinforced synthetic liner at least 12 mils in thickness and a bursting strength of 175 x 175 pounds per inch (ASTMD 75179). Consideration should be given to use of closed or semi-closed drilling systems in situations where a liner may be required.
11. Maintain two feet of freeboard on all reserve pits to ensure the reserve pits are not in danger of overflowing. Shut down drilling operations until the problem is corrected if leakage is found outside the pit.
12. Extract hydrostatic test water used in conjunction with pipeline testing and all water used during construction activities from sources having sufficient quantities and appropriation permits approved by the State of Wyoming.
13. Discharge hydrostatic test water in a controlled manner onto an energy dissipator. The water is to be discharged onto undisturbed land that has vegetative cover, if possible, or into an established drainage channel. Prior to discharge, treat or filter the water to reduce pollutant levels or to settle out suspended particles if necessary. If discharged into an established drainage channel, the rate of discharge would not exceed the capacity of the channel to safely convey the increased flow. Coordinate all discharge of hydrostatic test water with the WDEQ/WQD and the BLM.
14. Discharge all concentrated water flows within access road ROWs onto or through an energy dissipator structure (e.g., riprapped aprons and discharge points) and discharge into undisturbed vegetation.

15. Develop and implement a pollution prevention plan (PPP) for storm water runoff at drill sites as required per WDEQ storm water permit requirements under the National Pollution Discharge Elimination System (NPDES). All required WDEQ permits will be in place prior to discharge.
16. Exercise stringent precautions against pipeline breaks and other potential accidental discharges of toxic chemicals into adjacent streams. If liquid petroleum products are stored onsite in sufficient quantities (per criteria contained in 40 CFR Part 112), a Spill Prevention Control and Countermeasures (SPCC) plan would be developed in accordance with 40 CFR Part 112, dated December 1973.
17. Coordinate all crossings or encroachments of waters of the U.S. with the U.S. Army Corps of Engineers (COE).
18. Any changes in the produced water disposal method or location must have written approval from the BLM before the changes take place.

Vegetation/Wetlands/Noxious Weeds

Other mitigation measures under Soils and Water Resources of this EA would also apply to vegetation and wetlands.

1. File noxious weed monitoring forms with the BLM and implement, if necessary, a weed control and eradication program.
2. Evaluate all Project facility sites for occurrence and distribution of waters of the U.S., special aquatic sites, and jurisdictional wetlands. All Project facilities would be located out of these sensitive areas. If complete avoidance is not possible, minimize impacts through modification and minor relocations. Coordinate activities that involve dredge or fill into wetlands with the COE.
3. On BLM lands, an approved Pesticide Use Proposal would be obtained before the application of herbicides or other pesticides for the control of noxious weeds.
4. Disturbed areas would be seeded and stabilized in accordance with BLM-approved reclamation guidelines.

Range Resources and Other Land Uses

Mitigation requirements listed under Soils, Vegetation/Wetlands/Noxious Weeds, and Wildlife in this analysis also apply to Range Resources and Other Land Uses.

1. Pedco would coordinate with the affected livestock operators to ensure that livestock control structures remain functional (as directed by the livestock operator) during drilling and production operations, and to coordinate timing of planned activities.

2. When necessary, traffic control and speed limits would be used to limit potential conflicts.

Wildlife

1. During reclamation, establish a variety of forage species that will return the land to a condition approximate or equal to that which existed prior to disturbance .
2. Prohibit unnecessary off-site activities of operational personnel in the vicinity of the drill sites. Inform all Project employees of applicable wildlife laws and penalties associated with unlawful take and harassment.
3. Limit construction activities within big game crucial winter range from November 15 to April 30, per BLM authorizations.
4. Complete a raptor survey prior to construction to ensure that well sites are located away from potential conflict areas.
5. Survey and clear well sites within one mile of raptor nests identified in the raptor survey prior to the commencement of drilling and construction during the raptor nesting period (February 1 through July 31).
6. When an “active” raptor nest is within 0.75 to one mile (depending on species and line of sight) of a proposed well site, restrict construction during the critical nesting season for that species. For listed and BLM sensitive species (see Chapter 3) the distance should be increased to within one mile of a proposed well site.
7. To determine potential nesting activity, raptor nests must be inventoried annually in areas where work may be occurring during the raptor nesting period from February 1 to July 31.
8. Do not perform construction activities anytime within 0.25 mile of existing greater sage grouse leks.
9. Provide protection for greater sage grouse leks during the breeding, egg-laying and incubation period (March 1 through June 30) by restricting construction activities within a two-mile radius of active greater sage grouse leks. Exceptions may be granted if the activity would occur in unsuitable nesting habitat.
10. To eliminate any hazard to migratory birds or other wildlife, BLM would require netting (maximum two-inch mesh) be installed over any pits identified as containing oil or toxic substances.

Fisheries

1. No fisheries mitigation is needed beyond that indicated under Water Resources and Special Status Species.

Special Status Species

Special Status Plants

1. Employ site-specific recommendations developed by the BLM IDT for staked facilities.
2. Minimize impacts due to clearing and soil handling.
3. Monitor and control noxious weeds.
4. Comply with Section 404(b)(1) guidelines of the federal Clean Water Act (CWA).
5. Perform clearance surveys for plant species of concern.

Special Status Animals

1. If the Project will lead to a water depletion (consumption) in the Colorado River system, impacts to the Bonytail chub, Colorado pikeminnow, Humpback chub, and Razorback sucker will need to be evaluated. Any actions that may result in a water depletion to the Colorado River System will need to be described. Water data has been collected and tests are underway to determine if water from the Mesaverde Group is connected to surface waters associated with the Colorado River System. Results of the testing will be submitted to the BLM. BLM staff will review the data submitted, and if necessary, will submit the data to the USFWS for a final determination. If data indicate there is a connectivity between the waters produced concurrent with CBM production and the Colorado River system, and that the Project will result in depletion of waters, formal consultation with the USFWS will be initiated. The Project will be approved pending consultation as long as no discharge occurs.

Recreation

Measures under Wildlife, Transportation, Soils, Health and Safety, and Water Resources of the EA apply to Recreation.

1. Minimize conflicts between Project vehicles and equipment and recreation traffic by posting appropriate warning signs, implementing operator safety training, and requiring Project vehicles to adhere to low speed limits.

Visual Resources

1. Utilize existing topography to screen roads, pipeline corridors, drill rigs, wellheads, and production facilities from view.
2. Paint well and central facilities site structures with flat colors (e.g., Carlsbad Canyon or Desert Brown) that blend with the adjacent surrounding undisturbed terrain, except for structures that

require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.

Cultural Resources

1. If a site is considered eligible for, or is already on the National Register of Historic Places (NRHP), avoidance is the preferred method for mitigating adverse effects to that property.
2. Mitigation of adverse effects to cultural/historical properties that cannot be avoided would be accomplished by the preparation of a cultural resources mitigation plan.
3. If cultural resources are discovered at any time during construction, all construction activities would halt and the BLM would be immediately notified. Work would not resume until a Notice to Proceed is issued by the BLM.

Socioeconomics

1. Implement hiring policies that would encourage the use of local or regional workers who would not have to relocate to the area.
2. Coordinate Project activities with ranching operations to minimize conflicts involving livestock movement or other ranch operations. This would include scheduling of Project activities to minimize potential disturbance of large-scale livestock movements. Establish effective and frequent communication with affected ranchers to monitor and correct problems and coordinate scheduling.
3. Pedco and its subcontractors would obtain Carbon County sales and use tax licenses for purchases made in conjunction with the Project so that Project-related sales and use tax revenues would be distributed to Carbon County.

Transportation

1. Existing roads would be used as collectors and local roads whenever possible. Standards for road design would be consistent with BLM Road Standards Manual Section 9113.
2. Roads not required for routine operation and maintenance of producing wells and ancillary facilities would be permanently blocked, reclaimed, and revegetated.
3. Areas with important resource values, steep slopes and fragile soils should be avoided where possible in planning for new roads.
4. Permits are required from Carbon County for any road access to or across a county road or for any pipeline crossing of a county road. These permits should be acquired prior to construction of additional roads. All roads on public lands not required for operation and maintenance of field

production should be permanently blocked, re-contoured and seeded. Roads on private lands should be treated similarly, depending on the desires of the landowner.

5. Pedco would be responsible for preventive and corrective maintenance of roads in the Project Area throughout the duration of the Project. This may include blading, cleaning ditches and drainage facilities, dust abatement, noxious weed control, or other requirements as directed by the BLM or the Carbon County Road and Bridge Department.
6. Except in emergency situations, access would be limited to drier conditions to prevent severe rutting of the road surface. Culverts would be installed where needed to allow drainage in all draws and natural drainage areas. Low water crossings would be utilized where applicable. Onsite reviews would be conducted with BLM personnel for approval of proposed access prior to any construction.

Health and Safety

Measures listed under Air Quality and Water Quality also apply to Health and Safety.

1. Sanitation facilities installed on the drill sites and any resident camp site locations would be approved by the WDEQ.
2. To minimize undue exposure to hazardous situations, the operator would comply with all existing applicable rules and regulations (i.e., Onshore Orders, OSHA requirements, etc.) that would preclude the public from entering hazardous areas and place warning signs alerting the public of truck traffic.
3. Haul all garbage and rubbish from the drill site to a state-approved sanitary landfill for disposal. Collect and store any garbage or refuse materials on location prior to transport in containers approved by the BLM.
4. During construction and upon commencement of production operations, Pedco would have a chemical or hazardous substance inventory for all such items that may be at the site. Pedco would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA 29 CFR 1910.1200. These programs are designed to educate and protect the employees and subcontractors with respect to any chemicals or hazardous substances that may be present in the work place. It would be required that as every chemical or hazardous material is brought on location, a Material Safety Data Sheet (MSDS) would accompany that material and would become part of the file kept at the Blue Sky Pod field office as required by 29 CFR 1910.1200. All employees would receive the proper training in storage, handling, and disposal of hazardous substances.
5. Spill Prevention Control and Countermeasure Plans would be written and implemented as necessary, in accordance with 40 CFR Part 112, to prevent discharge into navigable waters of the United States.

6. If quantities exceeding 10,000 pounds or the threshold planning quantity (TPQ) as designated by the RFO are to be produced or stored in association with the Project, chemical and hazardous materials would be inventoried and reported in accordance with the Superfund Amendments and Reauthorization Act (SARA) Title III. 40 CFR Part 335. The appropriate Section 311 and 312 forms would be submitted at the required times to the state and county Emergency Management Coordinators and the local fire departments.
7. Any hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.
8. All storage tanks and compressor facilities, designed to contain oil, glycol, produced water, or other fluid which may constitute a hazard to public health or safety, shall be surrounded by a secondary means of containment for the entire contents of the largest single tank in use, plus one foot of freeboard. Pedco would utilize two-foot berms around affected storage tanks and facilities. The containment or diversionary structure shall be impervious to any oil, glycol, produced water, or other toxic fluid for 72 hours and would be constructed so that any discharge from a primary containment system would not drain, infiltrate, or otherwise escape to groundwater, surface water, or navigable waters before cleanup is completed.

Noise

1. Muffle and maintain all motorized equipment according to manufacturers' specifications.
2. In any area of operations (drill site, compressor station, etc.) where noise levels may exceed federal OSHA safe limits, Pedco would provide and require the use of proper personnel protective equipment by employees.

NO ACTION ALTERNATIVE

Section 1502.14(d) of the NEPA requires that the alternatives analysis "include the alternative of no action." "No Action" implies that ongoing natural gas production activities would be allowed to continue by the BLM in the Project Area, but the proposed Project would be disallowed. An estimated 1.25 acres in the Project Area have been disturbed by existing CBM drilling activities (**Table 2-3**). Additional APDs and ROW actions would be considered by the BLM for federal land on a case-by-case basis consistent with the scope of existing environmental analysis. Transport of natural gas products would be allowed from those wells within the Project Area that are currently productive. Additional gas development could occur on state and private lands within the Project Area under APDs approved by the WOGCC.

The U.S. Department of the Interior's (USDI) authority to implement a "No Action" Alternative is limited because the public lands have already been leased. An explanation of this limitation and the discretion the USDI has in this regard follows.

- An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased lands, subject to the terms and conditions incorporated in the lease (Form 3110-2). Because the Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions are imposed on the lease terms.
- Leases within the Project Area contain various stipulations concerning surface disturbance, surface occupancy and limited surface use. In addition, the lease stipulations provide that the USDI may impose "such reasonable conditions, not inconsistent with the purposes for which [the] lease is issued, as the [BLM] may require to protect the surface of the leased lands and the environment." None of the stipulations, however, would empower the Secretary of the Interior to deny all drilling activity because of environmental concerns.
- Provisions in leases that expressly provide Secretarial authority to deny or restrict APD development in whole or in part would depend on an opinion provided by the U.S. Fish and Wildlife Service (FWS) regarding impacts to endangered or threatened species or habitats of plants or animals that are listed or proposed for listing (e.g., bald eagle). If the FWS concludes that the Proposed Action and Alternatives would likely jeopardize the continued existence of any endangered or threatened plant or animal species, then the APD(s) and Atlantic Rim development may be denied in whole or in part.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The Project was developed around measures provided in the Interim Drilling Policy - Conditions and Criteria Under Which Development Activities May Occur Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project (**Appendix A**). Only alternatives addressing allowable actions specified in the Interim Drilling Policy are considered in this analysis, outside the Atlantic Rim EIS analysis. All other alternatives would only be considered in the Atlantic RIM EIS analysis. As a result, no alternatives to the Project, other than the No Action Alternative, were considered in this analysis.

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CHAPTER 3 AFFECTED ENVIRONMENT

INTRODUCTION

The Affected Environment for the proposed Blue Sky Project (Project) discusses environmental, social, and economic factors currently existing within the Blue Sky Project Area (Project Area). The material presented here has been guided by management issues identified by the RFO, public scoping, and by interdisciplinary field analysis of the area.

The critical elements, as listed in BLM's NEPA Handbook H-1790-1 (BLM 1988b), and other resource elements of the human environment have been considered. The elements of the human environment, including critical elements, their status in the Project Area, and their potential to be affected by the proposed Project are listed in **Table 3-1**. Those items listed as 'none present' would not be affected or impacted by the Project or the No Action Alternative and are not addressed further in this document.

Table 3-1 Elements of the Human Environment, Blue Sky Project Atlantic Rim Interim Drilling Program Carbon County, Wyoming - 2001		
Element	Project Area Status	Addressed in Text
Geology/Minerals/Paleontology	Potentially affected	Yes
Climate and Air Quality	Potentially affected	Yes
Soils	Potentially affected	Yes
Water Resources (including surface and groundwater quality)	Potentially affected	Yes
Vegetation/Wetlands/Noxious Weeds (including riparian zones, invasive species, threatened and endangered species, and special status species)	Potentially affected	Yes
Range Resources and Other Land Uses	Potentially affected	Yes
Wildlife/Fisheries (including threatened and endangered species, and other special status species)	Potentially affected	Yes
Recreation	Potentially affected	Yes
Visual Resources	Potentially affected	Yes
Cultural Resources	Potentially affected	Yes
Socioeconomics	Potentially affected	Yes
Environmental Justice	Potentially affected	Yes
Transportation	Potentially affected	Yes
Health and Safety	Potentially affected	Yes
Noise	Potentially affected	Yes
Areas of Critical Environmental Concern	None present	No

**Table 3-1
Elements of the Human Environment, Blue Sky Project
Atlantic Rim Interim Drilling Program Carbon County, Wyoming - 2001**

Element	Project Area Status	Addressed in Text
Prime or Unique Farmlands	None present	No
Floodplains	None present	No
Native American Religious Concerns	Potentially affected	Yes
Hazardous or Solid Wastes	Potentially affected	Yes
Wild and Scenic Rivers	None present	No
Wilderness	None present	No

GEOLOGY/MINERALS/PALEONTOLOGY

Physiography, Topography, and Landforms

The Project Area occupies the southeastern portion of the Greater Green River Basin, a large intermontane structural and topographic basin that is part of the Wyoming Basin Physiographic Province. The Project Area is located in an area of northwest/southeast trending ridges that have been greatly dissected by the numerous drainages of Muddy Creek, Cow Creek, Wild Cow Creek, and Dry Cow Creek. Landforms consist of ridges, finger ridges, knolls, hills, and gentle to moderate slopes. Elevations range from 6,200 feet to 7,630 feet (Hatcher and Davis 2001). State Highway 789, upgraded BLM roads, and two-track trails provide access to the Project Area.

Geology

The Greater Green River Basin began developing about 70 million years ago and filled with sediments eroded from surrounding highlands and mountains during the late Cretaceous and early Tertiary Periods. The Project Area lies within the northern part of the smaller Washakie Basin.

The Lewis Shale of Late Cretaceous age is exposed at the surface within the Project Area. This formation consists of a thick sequence of shale, siltstone and sandstone that accumulated in deltaic, interdeltic, and marginal marine environments within a shallow epicontinental sea that extended northward from the Gulf of Mexico to the Arctic Ocean in the Maestrichtian (Winn et al. 1985a, 1985b, 1985c). These sediments were derived from the eroded Wind River Range to the north. The Lewis Shale is underlain by approximately 12,000 feet of sedimentary rock, which in turn lies on a basement complex of Cambrian and Precambrian metamorphics and intrusives. The configuration of the basement rock forms the Washakie Basin at depth. At the surface, structural features define the basin margins. These structural features include the Great Divide Basin to the north, the Rock Springs Uplift to the west, the Danforth Hills to the south, and the Sierra Madre Mountains to the east.

By Late Cretaceous time this seaway had retreated eastward and the marine deposits of the Lewis Shale were replaced progressively upward by beach, estuarine, and continental deposits of the Fox Hills Sandstone and Lance Formation, respectively, that spread westward in response to the Sevier and Laramide orogenies. The Laramide orogeny, resulted locally in the uplift of the Sierra Madre Mountains and the subsidence of the Washakie Basin. The latter was filled with Tertiary deposits of the Fort Union and Wasatch Formations during Paleocene and Eocene time, respectively.

In places along the modern Muddy Creek and Cow Creek and atop modern terraces and buttes, the Lewis Shale is overlain by a thin veneer of much younger, unconsolidated sediments of Quaternary age. These sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands that are Late Pleistocene to Holocene in age.

Late Cretaceous rocks exposed at the surface and underlying the Project Area consist of a complex sequence of sedimentary units, including sandstone, shale, coal, and carbonaceous shale. These sediments were predominantly shed from the Sevier orogenic belt to the west and deposited along the western edge of the interior Cretaceous sea (Roehler 1990). Deposition occurred predominantly during two major transgression-regression periods of the sea.

Underlying the Lewis Shale in the Project Area is the Mesaverde Group, which contains abundant carbonaceous shale and coal. The Mesaverde Group, which outcrops along the western slope of the Sierra Madre Uplift, is more than 2,500 feet thick. Resistant sandstone beds of the Mesaverde Group form the Atlantic Rim escarpment located immediately north of the Project Area. The Mesaverde Group is overlain by the Lewis Shale and the Lance Formation in the western portion of the Project Area.

Numerous thin coal seams are present in the Allen Ridge and upper Almond Formations, members of the Mesaverde Group. These coal beds are targeted as having the greatest potential for CBM production. The lateral continuity of the coal seams is variable (Hamilton 1993). Geophysical logs from CBM test wells within the Project Area indicate that the coal beds are somewhat discontinuous laterally, however, data for coal seam correlation is limited.

Late Cretaceous and younger surface rocks are underlain by Phanerozoic sedimentary rocks that range from Cretaceous to Cambrian in age. The Phanerozoic sediments are underlain by Precambrian metamorphic bedrock that comprises part of the ancient North American shield.

Mineral and Energy Resources

The three primary mineral commodities occurring in Carbon County are coal, natural gas, and oil (Hoffman and Nunley 2000). All three occur in the Project Area, although coal mining has been of least significance to date. Additional mineral resources occurring within the Project Area include uranium, construction aggregate, and geothermal resources.

Coal reserves in the Greater Green River Basin have been estimated at nearly 1,300 trillion tons (Scott et al. 1995). In the Washakie Basin, coal occurs in the Mesaverde Group and the Fort Union Formation. Within the Project Area, coal primarily occurs in the Allen Ridge and Almond

Formations within the upper part of the Mesaverde Group. The coal is sub-bituminous to high-volatile C bituminous in rank (Tyler et al. 1995). Coincident with the Fort Union and Mesaverde coal seams of the Washakie Basin are significant quantities of CBM. Scott (et al. 1994) estimate total reserves in the Greater Green River Basin at approximately 300 trillion cubic feet. Two CBM fields have been explored for CBM resources in the eastern Washakie Basin: the Dixon Field (T.12N. R.90W.), and the Cow Creek Field (T.16N. R.92W.), both of which target Mesaverde coal seams.

The Washakie Basin has been explored and developed for oil and gas resources for many years. A number of formations have proven production, however Cretaceous-age formations have been the most productive. The coalbeds of the Mesaverde Group, underlying the Lewis Shale, are the formation objective for the proposed CBM exploratory wells. Two abandoned wells, the Unit 34-10 and Federal Cherokee Creek 23-15, are located within the Project Area. These wells are conventional oil wells that were plugged and abandoned in the mid-1960s.

Geologic Hazards

Potential geologic hazards include landslides, subsidence, and known or suspected active faults. Landslide potential is greatest in areas where steep slopes occur, particularly where the geologic dip of rock formations is steep and parallel to slope, or where erosional undercutting may occur. Landslides occur east of the Project Area in steeper regions of the Sierra Madre Mountains, but none have been mapped in the Project Area (Case et al. 1991). Slope gradients are mild to steep in the Project Area. Although not specifically mapped, unstable soils in steep areas may be susceptible to slumping, sliding, and soil creep. Generally, slope gradients within the Project Area are best described as mild.

Paleontology

Paleontologic resources include the remains or traces of any prehistoric organism which have been preserved by natural processes in the earth's crust (BLM Information Bulletin WY-93-371). Energy minerals such as coal, oil shale, lignite, bitumen, asphalt, and tar sands, as well as some industrial minerals such as phosphate, limestone, diatomaceous earth, and coquina, while of biologic origin are not considered fossils in themselves. However, fossils of scientific interest may occur within or in association with such materials. Fossils of scientific interest include those of particular interest to professional paleontologists and educators. Vertebrate fossils are always considered to be of scientific interest. Other kinds of fossils may be placed in this category by the State Director and field managers, in consultation with BLM staff paleontologists or other expertise.

Paleontologic resources within sedimentary deposits in the Project Area record the history of animal and plant life in Wyoming during the Late Cretaceous- the time represented by the Lewis Shale. The Lewis Shale is known to yield scientifically significant vertebrate fossils in several areas of Wyoming, but no specific localities have been reported from the Project Area. Fossils known from the Lewis Shale comprise a large and varied marine invertebrate fauna, including many genera of bivalves, baculites, scaphites, and ammonites (Gill et al. 1970) and isurid shark teeth (Breithaupt

1985). Although significant fossils are known from the Lewis Shale from some areas of Wyoming, the potential for discovery of scientifically significant fossils in the Project Area is considered to be moderate to low, when compared with other Late Cretaceous age formations in Wyoming.

CLIMATE AND AIR QUALITY

Climate

The Project Area is located in a semiarid, mid-continental, (dry and cold) climate regime. The area is typified by dry, windy conditions, limited rainfall and long, cold winters. The nearest meteorological measurements were collected at Baggs, Wyoming (1979 to present), approximately 18 miles southwest of the Project Area, at an elevation of 6,240 feet (WRCC 2001).

The average annual precipitation at Baggs is 11.20 inches, ranging from 18.5 inches (1983) to 4.63 inches (1989). Precipitation is evenly distributed throughout the year, with minor peaks occurring in May, July, and October. An average of 41.3 inches of snow falls during the year (annual high 104.0 inches in 1983), with December and January being the snowiest months. In the Project Area, annual average precipitation is estimated to be about 8 to 9 inches, based on local BLM precipitation information and Natural Resource Conservation Service (NCRS) range site descriptions.

Temperatures are generally cooler, frost-free periods shorter, and both precipitation and snowfall greater at higher elevations. The region is typically cool, with average daily temperatures ranging between 5°F (low) and 33°F (high) in mid-winter and between 48°F (low) and 86°F (high) in mid-summer. Extreme temperatures have ranged from -50°F to 100°F (both occurring in 1984). The frost-free period (at 32°F) generally occurs from mid-May to mid-September.

The Project Area is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During the winter months strong winds are often accompanied by snow, producing blizzard conditions and drifting snow. The closest comprehensive wind measurements are collected at the Rawlins, Wyoming, airport nearly 60 miles north-northeast of the Project Area. However, hourly wind data measurements for December 1994 through November 1995 were collected near Baggs, Wyoming, during the Mount Zirkel Wilderness Area Visibility Study. Winds originate from the south to southwest nearly 37 percent of the time. The annual mean wind speed is nearly 10 mph.

The frequency and strength of the winds greatly affect the dispersion and transport of air pollutants. Because of the strong winds in the Project Area, the potential for atmospheric dispersion is relatively high (although nighttime cooling will enhance stable air, inhibiting air pollutant mixing and transport). Dispersion conditions will be the greatest to the north and along the ridge and mountain tops.

Mean annual evaporation ranges from 38 inches (lake) to 55 inches (pan) and potential annual evapotranspiration is 18 inches (U.S. Department of Commerce 1979). Compared to the average annual precipitation of 11 inches, this gives an average annual deficit of approximately 9 inches.

These meteorological and climatological characteristics of the Project Area combine to produce a predominantly dry climate where evaporation exceeds precipitation.

Air Quality

Although specific air quality monitoring is not conducted throughout Project Area, air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations.

The Wyoming and National Ambient Air Quality Standards set absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The New Source Review-Prevention of Significant Deterioration Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined “baseline” level (depending on the location’s classification). Incremental increases in Class I areas are strictly limited, while increases allowed in Class II areas are less strict. The Project Area and the surrounding areas are classified as Class II.

While no criteria air pollutant concentration monitoring has occurred in the Project Area, background values measured in the region are well below established standards. Measured air pollutants include: carbon monoxide (CO), nitrogen dioxide (NO₂), ozone, particulate matter less than ten microns in effective diameter (PM₁₀), and sulfur dioxide (SO₂). Assumed background air pollutant concentrations, applicable Wyoming and National Ambient Air Quality Standards, and Class I and II increments (measured in micrograms per cubic meter, or µg/m³) are provided in **Table 3-2**.

The background concentration data were provided by the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ AQD 1997) and Colorado Department of Public Health and Environment, Air Pollutant Control Division (CDPHE APCD 1996). These values reflect the most recently available air quality monitoring data collected in the vicinity of the Project Area. An estimate of background air quality concentrations is needed to combine with modeled Project-related air quality impacts and to compare the total predicted impacts with applicable air quality standards. It is important that each pollutant’s background concentration, model predictions, and air quality standards are all based on the same averaging times.

Table 3-2 Air Pollutant Background Concentrations, State and Federal Ambient Air Quality Standards, and PSD Increments ($\mu\text{g}/\text{m}^3$)				
Pollutant/Averaging Time	Measured Background Concentration	State and National Ambient Air Quality Standards	Incremental Increase Above Legal Baseline PSD Class I	Incremental Increase Above Legal Baseline PSD Class II
Carbon Monoxide (CO)				
1-hour	2,299 a	40,000	n/a	n/a
8-hour	1,148 a	10,000	n/a	n/a
Nitrogen Dioxide (NO ₂)				
Annual	10 b	100	2.5	25
Ozone				
1-hour	117 c	235	n/a	n/a
Particulate Matter (PM ₁₀)				
24-hour	20 c	150	8	30
Annual	12 c	50	4	17
Sulfur Dioxide (SO ₂)				
3-hour (National)	29 e	1,300	25	512
24-hour (National)	18 e	365	5	91
24-hour (Wyoming)	18 e	260	n/a	n/a
Annual (National)	5 e	80	2	20
Annual (Wyoming)	5 e	60	n/a	n/a

Note:

Measured background ozone concentration data is top tenth percentile maximum 1-hour value; other short-term background concentrations are second-maximum measured values.

n/a = not applicable

Wyoming Ambient Standards from *Wyoming Air Quality Standards and Regulations, Chapter 2– Ambient Standards*.

National Ambient Standards from 40 CFR Part 50.

PSD Increments from *40 CFR Parts 51 and 52 Prevention of Significant Deterioration for Particulate Matter, EPA Final Rule*. Federal Register Vol. 58, No. 105, Thursday, June 3, 1993.

In recent years there has been concern regarding the potential impacts of oil, gas, and other activities to air quality and air quality related values (acid deposition) in distant Class I and sensitive Class II airsheds. The closest federally-mandated Class I areas located potentially downwind (northeast or southeast) of the Project Area are the Mount Zirkel Wilderness and the Rawah Wilderness located an estimated 46 and 82 miles southeast of the Project Area, respectively, in northern Colorado. The U.S. Forest Service manages both of these areas. **Table 3-3** shows Distant Class I and Class II wilderness areas or monuments located within 100 miles of the Project Area.

**Table 3-3
Class I and II Wilderness Areas and National Monument
Within 100 Miles of the Project Area**

Area	State	Federal Classification	Distance¹ (miles)	Managed By
Huston Park	Wyoming	II	29	USFS
Encampment River	Wyoming	II	43	USFS
Mount Zirkel	Colorado	I	46	USFS
Savage Run	Wyoming	II ²	62	USFS
Platte River	Wyoming and Colorado	II	64	USFS
Dinosaur National Monument	Colorado and Utah	II ³	72	NPS
Rawah	Colorado	I	82	USFS

Notes:

¹ Distances are south and east of the Project Area, except for Dinosaur National Monument, which is southwest of the Project Area.

² The State of Wyoming manages the Savage Run Wilderness as a Class I air quality area.

³ The State of Colorado manages this Monument as a Class I air quality area.

Continuous visibility-related optical background data were collected at the Class I Bridger Wilderness Area in Wyoming and the Class I Rocky Mountain National Park (just south of the Class I Rawah Wilderness Area) in Colorado, as part of the Interagency Monitoring of Protected Visual Environments program. Visibility in the Central Rocky Mountains is very good (averaging over 70 miles Standard Visual Range), with fine particle impacts accounting for nearly half of the average degradation (Sisler 1996). In addition, background atmospheric deposition (acid rain) impacts were monitored at the National Acid Deposition Program/National Trends Network sampling station near Pinedale, Wyoming, and site-specific lake chemistry (pH, acid neutralizing capacity, elemental concentrations, etc.) background data have been collected by the U.S. Geological Survey (Water Quality Division) in several high mountain lakes in the nearby wilderness area.

The WDEQ AQD is the primary air quality regulatory agency responsible (under their EPA approved State Implementation Plan) for determining potential impacts once detailed development plans have been made, subject to applicable air quality laws, regulations, standards, control measures and management practices. Therefore, the State of Wyoming has the ultimate responsibility for reviewing and permitting Project Area air pollutant emission sources before they become operational. Unlike the conceptual “reasonable, but conservative” engineering designs used in this EA, the WDEQ AQD air quality preconstruction permitting would be based on very site-specific, detailed engineering values, available as part of the permit application.

SOILS

Soils in the Project Area are deep and well drained and formed in alluvium and colluvium derived predominantly from sandstone with some influence from shales. Many of these soils have a sandy loam surface overlying sandy clay loam and sand. Depth to bedrock is generally greater than 20 inches, with depth generally increasing with distance from ridges and outcrops.

Generally, soils in the Project Area are of moderate strength, permeability, and productivity. Productivity can be affected by changes in precipitation, vegetative cover, and compaction. Removing vegetation will increase the potential for wind and water erosion, depending on clay content and grain size. Soils with more clay could be strengthened through compaction, but the reduction in pore spaces would reduce productivity. Clay in lower strata of the soil retards permeability and may cause salt to build up in the soil, reducing productivity.

The soils in this portion of Carbon County were studied and mapped to an Order 3 scale by the BLM in 1979 and 1980. This survey covers the Project Area. Mapping by the NRCS is available in this portion of Carbon County on a contracted basis of agricultural lands. No lands within the proposed Project Area were generally part of any NRCS mapping. Only BLM information was utilized. Soil series within the survey area were verified according to previously established information, i.e., previously established soil series or mapping units, wherever possible.

The predominant map units in the Project Area were Absher-Forelle complex and Rallod-Abston-Pinelli complex. The Absher-Forelle complex occurs on nearly level and gently sloping footslopes and alluvial fans. Slopes are smooth. The Rallod-Abston-Pinelli complex occurs on underlying to hilly residual uplands on shale bedrock. Slopes are predominantly convex with concave slopes along drainageways. Most have aridic moisture regimes and frigid temperature regimes. Climates are usually dry and cold. According to established range site descriptions for the associated soil series descriptions, 10-14 inches of rainfall occur during the year, with an average air temperature of 35-40°F.

Plant growth begins about April 15 and continues up to July 15, approximately. Fall growth will usually occur if moisture is available. Because of the high, dry air, nighttime radiation cooling can produce freezing temperatures any month of the year. The climax plant community is characterized by species having high tolerance to salt and capable of withstanding drought conditions. The potential plant communities on the Absher and Rallod soils are mainly western wheatgrass, bottlebrush squirreltail, Indian ricegrass, and Gardner saltbrush. The vegetation of this area is a mixture of 55 percent grasses and grass-like plants, 5 percent forbs, and 40 percent woody plants.

The Absher-Forelle complex map unit is 50 percent Absher silty clay and 30 percent Forelle loam. The Rallod-Abston-Pinelli complex map unit is 40 percent Rallod clay, 25 percent Abston clay and 20 percent Pinelli loam. In general, the soils in this area may be light or dark-colored and usually exceed 20 inches in depth. The topsoil is high in exchangeable salt and/or sodium. Internal water movement and permeability is slow to moderate. Soil genesis classification of the majority of soils within this area are haplargids, torriorthents, camborthids, natrargids, and torrifuvents.

Runoff is medium to rapid and the hazard of water erosion is moderate to severe. The hazard of soil blowing is moderate. In addition to these physical limitations of the soils in many areas, chemical limitations exist primarily in terms of salinity or sodium-affected soils. A list of the BLM map units found in and adjacent to the Project Area is presented in **Table 3-4**.

**Table 3-4
BLM Map Units Found in and Adjacent to the Project Area**

Mapping Unit Number	Mapping Unit Description
225	Cushool-Rock River sandy loams, 3-10%
232	Blazon-Delphill-Diamondville complex, 6-30%
234	Rock River-Ryark-Cushool complex, 3-15%
237	Seaverson-Blazon complex, 3-15%
247	Cushool-Diamondville-Worfman complex, 3-15%
273	Elk Mountain-Yamac Variant sandy loams, 0-15%
289	Absher-Forelle complex, 1-6%
295	Rallod-Abston-Pinelli complex, 2-25%
333S	Laclede alkali-Laclede complex, 0-3%
449	Dines-Dines overflow complex, 0-2%

WATER RESOURCES

The Project Area is located in the Muddy Creek watershed of the Little Snake River drainage, which is a part of the Colorado River Basin. Surface waters include the perennial Little Snake River, the intermittent to perennial Muddy Creek, ephemeral Dry Cow Creek and Wild Cow Creek and several unnamed ephemeral channels and manmade ponds. A public water reserve is located upstream from the Project Area. Groundwater resources include free water contained within relatively shallow aquifers that are used or could be utilized for culinary, agricultural, and/or industrial purposes. Overall, 0.09 Mgal/d (million gallons per day) of groundwater are used, divided equally among domestic, livestock, and irrigation uses. A total of 5.97 Mgal/d of surface water is used, with 0.11 Mgal/d used for livestock and the rest used for irrigation within the watershed.

Surface Water

Quantity

The Project Area is located within the Little Snake River drainage basin. Dry Cow Creek and Wild Cow Creek ephemeral tributaries to Muddy Creek, are found within the Project Area. Muddy Creek is an intermittent to ephemeral stream that carries water most of the year to its confluence with the Little Snake River near Baggs.

Annual peak flows for all streams within the Project Area generally occur in late May through early June in response to snowmelt. Baseflows are reached in the fall and continue through March until low elevation snowmelt initiates the rising limb of the hydrograph. A United States Geological Survey (USGS) continuous gaging station on the Little Snake River near Dixon recorded a maximum peak discharge of approximately 13,000 cfs on May 16, 1984, while minimum flows of near 0 cfs occur in late summer and early fall at the end of the irrigation season (Druse et al. 1994).

Quality

There are seven USGS surface water quality stations in and around the Project Area, including two on the Little Snake River, two on Muddy Creek, and one each on Cow Creek, Dry Cow Creek, and Wild Cow Creek. Average sample data from each of the stations are shown in **Table 3-5**. The data suggest that surface waters in the Project Area are of moderately high pH (8.1 to 9.2) and contain moderate quantities of dissolved oxygen (9 to 11 mg/l).

	USGS Surface Water Quality Station ¹						
	Cow Creek	Dry Cow Creek	Wild Cow Creek	Muddy Creek	Muddy Creek	Little Snake River	Little Snake River
Station Number	09115080	09258200	WLD CWC K:0	09258900	09259000	09257000	09259050
Sample Period	1978-1979	1975-1980	1986-1993	1976-1978	1957-1991	1957-1988	1980-1997
Number of Samples ²	20	9	42	3	41	107	100
pH, standard units	9.2	8.6	9.0	8.6	8.2	8.1	8.1
Conductance, mmhos/cm	2925	2162	2663	1350	966	259	366
Total Dissolved Solids ³	1801	1438 ⁴	1955	913	630 ⁴	158	243
Suspended Solids	133	1111	NM ⁵	6198	3191	154	228
Turbidity	284 NTU	1013 JTU	NM	1260 NTU	NM	13 JTU	167 NTU
Hardness as CaCO ₃	174	37	334	315	270	111	151
Oxygen	9	11	NM	11	10	9	10
Sodium	560	98	550	200	286	11	26
Calcium	19	9	20	54	42	30	34
Magnesium	31	4	68	44	40	8	12
Potassium	11	4	7	7	9	2	2
Bicarbonate	870	170	1000	373	308	159	190
Carbonate	186	4	91	0.5	NM	0	1
Sulfate	181	65	438	380	320	25	54
Chloride	132	21	60	65	32	3	2
Fecal coliform, #/100 ml	535	NM	NM	NM	8	NM	351

¹ Data available on the Internet at <http://www.wrds.uwyo.edu>

² Total number of grab samples analyzed; not every parameter was analyzed in every sample

³ All units are mg/l except as noted

⁴ TDS calculated from specific conductance due to lack of sample data

⁵ NM = not measured

Generalizations among other sample parameters are made difficult by high variability between stations. Trends become apparent, however, when the stations are divided according to the surface water designation. **Table 3-6** averages select parameters from **Table 3-5** into ephemeral, intermittent, and perennial classes.

**Table 3-6
Surface Water Quality Comparison**

Representative Surface Waters	Stream Class		
	Ephemeral	Intermittent	Perennial
	Cow Creek, Dry Cow, and Wild Cow Creek	Muddy Creek	Little Snake River
Total Dissolved Solids ¹	1,731	772	201
Sodium	403	243	19
Calcium	16	42	10
Magnesium	34	48	32
Potassium	7	8	2
Bicarbonate	680	341	175
Carbonate	93	0.5	0.5
Sulfate	228	350	40
Chloride	71	49	3
SAR	14.1	6.1	0.7

¹ All units are mg/l except SAR, which is unitless

Water quality in ephemeral streams is represented by the Cow Creek, Dry Cow Creek, and Wild Cow Creek monitoring stations. The ephemeral quality is characterized by high TDS (1,731 mg/l) and sodium and bicarbonate dominance as the major dissolved ions. Sodium dominance is reflected in the relatively high sodium adsorption ratio (SAR) of 14.1.

The two Muddy Creek monitoring stations represent intermittent surface water quality. Muddy Creek has actually been classified as an intermittent to perennial stream (Higley 1996), but its classification has been simplified for **Table 3-6**. Intermittent streams in the Project Area are characterized by moderate TDS (772 mg/l) and the replacement of bicarbonate by sulfate as the major anionic species. Sodium dominance is reflected in the SAR of 6.1, but is less marked than in ephemeral flows.

Two Little Snake River stations monitor perennial water quality in the Project Area. Perennial quality is characterized by a significantly reduced TDS (201 mg/l) from intermittent and ephemeral streams. Sodium is also displaced by calcium as the major cationic species. This is reflected in the low SAR (0.7 mg/l).

The WDEQ classifies Wyoming streams according to quality and degree of protection. Four classes have been identified as follows (WDEQ 2000).

- Class 1: Those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Considerations employed during the designation of these waters include water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people.
- Class 2: Surface water other than Class 1 determined to be presently supporting game fish, have the hydrologic and natural water quality potential to support game fish, or include nursery areas or food sources for game fish.
- Class 3: Those surface waters, other than those classified as Class 1, which are determined to be presently supporting nongame fish only, have the hydrologic and natural water quality potential to support nongame fish only, or include nursery areas or food sources for nongame fish only.
- Class 4: Those surface waters, other than those classified as Class 1, which are determined to not have the hydrologic or natural water quality potential to support fish and include all intermittent and ephemeral streams.

Cow Creek and Muddy Creek are identified by the WDEQ as Class 3 waters, as noted in the RMP. Dry Cow Creek and Wild Cow Creek are intermittent streams that are not able to support fish and are classified as Class 4 streams. WDEQ Rules and Regulations state that no pollutant shall be permitted if it adversely affects surface water. Mesaverde aquifer water exceeds SAR, specific conductance, pH, dissolved chloride and dissolved sulfate levels occurring in surface waters of Muddy Creek.

The RFO has identified the Muddy Creek drainage as requiring special management due to unacceptable existing levels of salt and sediment. Causes of this are mainly natural, but have been increased by human activity. Without using BMPs, surface disturbance would increase erosion, adding sediment and salt to the drainage.

Waters of the U.S.

Most of the surface water features in the Project Area qualify as waters of the United States. Waters of the U.S. include territorial seas; interstate waters; navigable waterways (such as lakes, rivers, and streams); special aquatic sites and wetlands that are, have been, or could be used for travel, commerce, or industrial purposes; tributaries; and impoundments of such waters. All channels that carry surface flows and that show signs of active water movement are waters of the U.S. Similarly, all open bodies of water (except ponds and lakes created on upland sites and used exclusively for agricultural and industrial activities or aesthetic amenities) are waters of the U.S. (EPA 33 CFR § 328.3(a)). Such areas are regulated by the EPA and COE. Many of the drainage channels identified on the USGS topographic maps are vegetated swales that are not considered to be waters of the U.S. by the COE. Any activity involving excavation or discharge of dredge or fill material in a manner

that affects waters of the U.S. is subject to regulation by the COE pursuant to Section 404 of the CWA. Activities that modify the morphology of stream channels are also subject to regulation by the WSEO. Special aquatic sites and wetlands are discussed in greater detail in the Vegetation Section 3.5.

Groundwater

The Project Area is located in the Colorado Plateau and Wyoming Basin groundwater regions described by Heath (1984); the Upper Colorado River Basin groundwater region described by Freethy (1987); and Washakie Basin described by Collentine et al. (1981) and Welder and McGreevy (1966). Groundwater resources include deep and shallow, confined and unconfined aquifers. Site-specific groundwater data for the Project Area are limited. Existing information comes primarily from WOGCC oil and gas well records, WSEO water-well records, and the USGS (Weigel 1987). Regional aquifer systems pertinent to the Project Area are discussed by Heath (1984), Freethy (1987), and Driver et al. (1984). Basin-wide evaluations of hydrogeology specific to the Project Area have been investigated by Collentine et al. (1981). The most relevant hydrogeologic study specific to the Project Area is by Welder and McGreevy (1966).

Location and Quantity

Groundwater in the Washakie Basin is generally found in artesian aquifers, although it is also present in unconfined alluvial valleys and in isolated, saturated outcrops (Welder and McGreevy, 1966). **Table 3-6** summarizes the water-bearing characteristics of the geologic formations present in the Project vicinity. Of the geologic units listed in the table, Welder and McGreevy (1966) suggest that those capable of producing the greatest quantity of water include the following: Quaternary alluvium; Tertiary deposits in the Browns Park, Wasatch, and Fort Union Formations; Cretaceous formations, including Mesaverde, Frontier, and Cloverly; the Sundance-Nugget Sandstone of the Jurassic Age; and the Tensleep and Madison Formations of the Paleozoic Era. **Table 3-7** contains a brief description of the major aquifers in the Project Area.

Quaternary aquifers in the Washakie Basin are comprised of alluvial deposits along major floodplains and isolated windblown and lake sediments. The major Quaternary aquifers in the vicinity of the Project Area occur in alluvial deposits along the Little Snake River and Muddy Creek and in windblown segments along the Sand Hills. Groundwater flow within the sandy Quaternary aquifers is typically downward toward permeable underlying formations (Collentine et al. 1981).

**Table 3-7
Water-Bearing Characteristics of Geologic Formations in the Washakie Basin¹**

Era	Period	Geologic Unit	Thickness	Hydrologic Properties			
				Well Yield (gpm)	Transmissivity (gpd/ft)	Permeability (gpd/ft ²)	
Cenozoic	Quaternary		0-70	<30	168-560	21-62	
	Tertiary	Browns Park Fm.	0-1,200	3-30	100-10,000	NM	
		Wasatch Fm.	0-4,000+	30-50	150-10,000	0.04-18.2	
		Fort Union Fm.	0-2,700+	3-300	<2,500	<1	
Mesozoic	Upper Cretaceous	Lance Fm.	0-4,500+	<25	<20	0.007-8.2	
		Fox Hill Sandstone	0-400	NM	10-20	0.9	
		Lewis Shale	0-2,700+	2-25 ²	0.03-50	0.002-0.9	
		Almond Fm. ³	0-600	NM	2,000-8,000	100-800	
		Mesaverde Group (incl. Almond Fm.)	300-2,800	<100	<3,000	NM	
		Baxter Shale (incl. Steele Shale and Niobrara Fm.)	2,000-5,000+	major regional aquitard between Mesaverde and Frontier aquifers. Hydrologic data unavailable.			
		Frontier Fm.	190-1,900+	1-100+	<100-6,500	NM	
	Lower Cretaceous	Mowry Shale	150-525	Regional aquitard. Hydrologic data unavailable.			
		Thermopolis Shale (inclu. Muddy Sandstone)	20-235	Considered a leaking confining unit. Hydrologic data unavailable.			
		Cloverly Fm.	45-240	25-120	340-1,700	1-177	
	Upper Jurassic	Morrison Fm.	170-450+	Confining unit between Cloverly and Sundance-Nugget aquifers. Hydrologic data unavailable.			
		Sundance Fm.	130-450+	27-35	12-3,500	NM	
	Lower Jurassic-Upper Triassic	Nugget Sandstone	0-650+	35-200	<2,166	NM	
	Triassic	Chugwater Fm.	900-1,500+	Confining unit between Sundance-Nugget and Paleozoic aquifers. Hydrologic data unavailable.			
Mesozoic-Paleozoic	Lower Triassic Permian	Phosphoria Fm. (incl. Goose Egg Fm.)	170-460	Probable poor water-bearing capabilities due to low permeability. Hydrologic data unavailable.			
Paleozoic	Permian-Pennsylvanian	Tensleep Fm.	0-840+	24-400	1-374	NM	
	Lower and Middle Pennsylvanian	Amsden Fm.	2-260+	Probably poor water-bearing capabilities due to predominance of fine-grained sediments.			
	Mississippian	Madison Limestone	5-325+	<400	Variable	NM	
	Cambrian	Indef. Rocks	0-800+	4-250	NM	NM	
Precambrian	N/A	Igneous and metamorphic rocks	Unknown	10-20	<1,000	Generally high in upper 200 ft of unit	

¹ Adapted from Table V-1 in Collettine et al. (1981). Formations not encountered in Project Area have been omitted.

² From well completion records on file with SEO

³ From Atlantic Rim CBM well test data

Tertiary aquifers in and near the Project Area occur in the Browns Park Formation along the Little

Snake River flood plain and adjacent to the Sierra Madre Uplift, the Fort Union Formation near the Muddy Creek flood plain to the west, and isolated Wasatch Formation outcrops near the center of the Project Area. Groundwater generally flows west-southwest from the higher elevations along the Sierra Madre Uplift toward the low-lying Washakie Basin center and the major streams (Collentine et al. 1981).

Cretaceous aquifers in the Project Area occur in three major geologic formations. From youngest to oldest they are the Almond Formation of the Mesaverde Group, the Frontier Formation, and the Cloverly Formation. The Mesaverde Group is exposed along the eastern slopes of the Project Area, although a mantle of Tertiary deposits unconformably overlies large areas of Late Cretaceous strata. No outcrops of the Frontier or Cloverly Formations are present within the Project Area.

The Cretaceous aquifers are composed of interbedded sandstone, shale, and coal and have demonstrated considerable yields in existing wells (Collentine et al. 1981). Recharge to these water-bearing strata is principally from precipitation infiltration and the movement of groundwater from the overlying Tertiary sediments at their outcrops and subcrops along the elevated eastern margin of the Washakie Basin. Regional groundwater flow direction is toward the west in response to the structural dip and surface topography.

Separated from the Cretaceous aquifers by the impermeable Morrison Formation is the Sundance-Nugget Aquifer of the Jurassic Age. The Sundance-Nugget aquifer is comprised of permeable sandstone with minor quantities of shale, siltstone, and limestone (Collentine et al. 1981). The flow characteristics of the Sundance-Nugget aquifer are not well defined.

The remaining two major aquifers occur in Paleozoic Era rocks. The Tensleep Formation from the Pennsylvania Age consists of fine- to medium-grained sandstone between confining layers of the Chugwater Formation (Triassic) and the Amsden Formation (Pennsylvanian) (Collentine et al. 1981). The Madison aquifer is comprised of limestone and dolomite bordered on the top by the fine-grained Amsden sediments and on the bottom by Cambrian rocks. Wells completed within both of these Paleozoic aquifers have demonstrated yields up to 400 gpm. Groundwater flow is west-southwest in the Project Area.

Driver et al. (1984) suggest that the Browns Park Formation would be the best candidate for large-scale groundwater development. Recharge to the aquifers is generally by precipitation and surface water seepage percolating through permeable overlying materials (Welder and McGreevy 1966).

As shown in **Table 3-8**, one permitted water well exists within one mile of the Project Area. The right to this well is owned by the BLM, however, no Water Well Agreement was required as this well is located outside the one-half mile circle of influence (**Appendix D**).

This well draws water from the Mesaverde aquifer to feed a stock pond. Water quality from this well is indicative of the water that would be produced by Pedco's wells. Water from this well meets standards set by the WDEQ, except Sodium Adsorption Ratio (SAR) and Total Dissolved Solids (TDS). Water from the Mesaverde aquifer exceeds SAR standards for agriculture and TDS

standards for domestic consumption (WRDS 1998).

Formation	Number of Wells	Yield ¹ (gpm)
Mesaverde	1	20

¹ WSEO well completion permits

Quality

Groundwater quality is related to the depth of the aquifers, flow between aquifers, and the rock type. Groundwater quality is variable in the Project Area. TDS, an indicator of salinity, is generally less than 2,000 mg/l (slightly saline to saline) in the Project Area, with local concentrations of less than 500 mg/l (considered fresh).

As most existing groundwater wells and the proposed CBM wells of the Project Area occur in Mesaverde aquifers, a detailed Mesaverde groundwater quality analysis has been included. **Table 3-9** lists the major cation and anion composition of Mesaverde groundwater in the Project Area. Sodium and bicarbonate dominate as the major ionic species. Collentine et al. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction resulting in bicarbonate generation; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

Cation	Concentration (mg/l)	Anion	Concentration (mg/l)
Sodium	513	Bicarbonate ²	1,284
Calcium	7	Carbonate ¹	9
Magnesium	3	Chloride	56
Potassium ¹	5	Sulfate	11

¹ potassium and carbonate concentrations were not measured in CBM samples; values represent composite of USGS data for Mesaverde wells in Project vicinity (USGS 1980)

² bicarbonate was not measured; value shown was calculated from ion balance.

Table 3-10 presents a comparison of Mesaverde groundwater with WDEQ suitability standards. The composite results of the three CBM wells analyzed indicate water that is generally suitable for livestock use, but is unsuitable for domestic supply or irrigation without treatment or dilution. Parameters with measured concentrations in excess of Wyoming drinking water standards include iron, manganese, and TDS. Calculated SAR (47.3) and residual sodium carbonate (41 meq/l) exceed the agriculture suitability limits of 8 and 1.25, respectively. Unless the water were mixed with an existing water source of lower sodium and bicarbonate and lower total salinity, irrigation would result in reduction in infiltration in the affected soil.

Table 3-10
Groundwater Quality for Mesaverde Wells in Project Area

Parameter	Concentration ¹	Unit	Groundwater Suitability Standards ²		
			Domestic	Agriculture	Livestock
Aluminum	0.045	mg/l	---	5	5
Ammonia	0.9	mg/l	0.5	---	---
Arsenic	0.0006	mg/l	0.05	0.1	0.2
Barium	0.36	mg/l	1	---	---
Beryllium	<0.002	mg/l	---	0.1	---
Boron	0.25	mg/l	0.75	0.75	5
Cadmium	<0.0002	mg/l	0.01	0.01	0.05
Chloride	56	mg/l	250	100	2000
Chromium	0.002	mg/l	0.05	0.1	0.05
Cobalt	NM	mg/l	---	0.05	1
Copper	0.03	mg/l	1	0.2	0.5
Cyanide	<5	mg/l	0.2	---	---
Fluoride	1.0	mg/l	1.4 - 2.4	---	---
Hydrogen Sulfide	NM	mg/l	0.05	---	---
Iron	3.06	mg/l	0.3	5	---
Lead	0.004	mg/l	0.05	5	0.1
Lithium	NM	mg/l	---	2.5	---
Manganese	0.102	mg/l	0.05	0.2	---
Mercury	<0.0004	mg/l	0.002	---	0.00005
Nickel	0.041	mg/l	---	0.2	---
Nitrate	<0.03	mg/l	10	---	---
Nitrite	<0.03	mg/l	1	---	10
Oil & Grease ³	<1	mg/l	Virtually Free	10	10
Phenol	65	mg/l	0.001	---	---
Selenium	<0.005	mg/l	0.01	0.02	0.05
Silver	<0.003	mg/l	0.05	---	---
Sulfate	11	mg/l	250	200	3000
TDS	1,322	mg/l	500	2000	5000
Uranium	NM	mg/l	5	5	5
Vanadium	NM	mg/l	---	0.1	0.1
Zinc	0.3	mg/l	5	2	25
pH	8.2	s.u.	6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
SAR	47.3	<none>	---	8	---
RSC ⁴	41	meq/l	---	1.25	---
Radium 226 + Radium 228	0.9	pCi/l	5	5	5
Strontium 90	NM	pCi/l	8	8	8
Gross alpha	NM	pCi/l	15	15	15

¹ boron, ammonia, fluoride, and nitrate/nitrite concentrations from 11 Mesaverde ground water wells (USGS 1980); remaining concentrations from three Mesaverde CBM wells in Project Area

² from WDEQ Water Quality Rules and Regulations, Chapter VIII

³ reported as total petroleum hydrocarbons

⁴ residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated bicarbonate concentration

The confining beds slow the movement of water, and hence, movement of potential contaminants between aquifers. Although there is some downward movement of the water from the surface units,

most of the groundwater movement, if any, is upward from the deeper aquifers to the shallower aquifers. Concerns have been raised for several gas field projects in southwest Wyoming regarding groundwater quality degradation due to the piercing of confining layers and vertical and horizontal migration and mixing of water of variable qualities. Data suggesting this is a current problem in the Project Area are not available. Improperly completed injection wells could be a potential source of contamination.

VEGETATION/WETLANDS/NOXIOUS WEEDS

Vegetation Cover Types

A biological survey of the Project Area has been conducted (HWA 2001). The Project Area is located in the sagebrush steppe plant community that is typical of the high intermountain desert of south central Wyoming. The primary vegetation cover types, as identified by the Wyoming Gap Analysis Program, are Wyoming big sagebrush (2,240 acres), desert shrub (142 acres), and shrub-dominated riparian (178 acres). The Wyoming big sagebrush cover type typically consists of a mixture of greasewood, Wyoming big sagebrush, rabbitbrush, and saltbush. The desert shrub cover type is often dominated understory grasses and forbs similar to the Wyoming big sagebrush type, with common species including western wheatgrass, little bluegrass, Indian ricegrass, bottlebrush squirreltail, needleandthread, phlox, buckwheat, penstemon, and prickly-pear cactus. Common species in shrub-dominated riparian areas include sagebrush, greasewood, and willow.

The principal riparian habitat within the Project Area consists of a narrow band of vegetation along Cow Creek. Key species in riparian areas include spikesedge, redtop, tufted hairgrass, Kentucky bluegrass, and saltgrass. This cover type typically has very few, if any, trees.

Threatened and Endangered Species

One federally endangered species of plant, blowout penstemon (*Penstemon haydenii*), has the potential to occur in sandy blowouts in or near the Project Area (HWA 2001). Very small and limited areas of sandy blowouts, the penstemon's prime habitat, may occur in the vicinity of the Project Area. However, no blowout penstemons and no suitable habitat were found in the Project Area during the biological survey.

Species of Concern

Eleven special-concern species of plants may occur within or near the Project Area (HWA 2001). Five of the species (Crandall's rock-cress, little golden-aster, Weber's scarlet-gilia, Rusby's stickleaf, and Rydberg twinpod) are unlikely to occur in or near the Project Area because their preferred habitat types are not present. The remaining six special-concern species (smallflower androstephium, Hayden's milkvetch, Wolf's orache, Payson's tansymustard, Gibben's beardtongue, and many-headed broom groundsel) have low to moderate potential to occur in or near the Project Area. None of these species was found during the biological survey of the Project Area. Appendix

E provides information on the names, sensitivity status, counties in which these species have been documented, notes on their overall range and distribution within Wyoming, probability of occurrence in the Project Area, and descriptions of habitat types in which these special concern plants are found.

Noxious Weeds/Invasive Species

The Project Area is vulnerable to infestations of invasive/noxious weeds such as Canada thistle, musk thistle, black henbane, and halogeton. Infestations of invasive/noxious weeds are relatively minimal within the Project Area at present. However, any newly-disturbed surface would be susceptible to infestations of invasive/noxious weeds. Monitoring for weed infestations and spraying for two consecutive seasons, after emergence but before seeding, has been an effective method of controlling these species.

RANGE RESOURCES AND OTHER LAND USES

Range Resources and Other Land Uses

The Project Area is split between the Doty Mountain Allotment (#00415) in the north and the Cherokee Allotment (#00408) in the south. The Doty Mountain Allotment includes approximately 83,368 acres, 71 percent of which is public land, and supports 6,974 AUMs. The Cherokee Allotment includes approximately 73,966 acres, 89 percent of which is public land, and supports 9,500 AUMs.

About two thirds of the ranges are considered to be in good condition, the remainder are considered to be in excellent, fair, or undetermined condition; less than one percent of the ranges are considered to be in poor condition. The average stocking rate is 12 acres per AUM for the Doty Mountain Allotment and eight acres per AUM for the Cherokee Allotment.

The season of use for both allotments extends from April 1 to December 1. The Project Area lies partially within the winter pasture of the Doty Mountain Allotment where cattle use is rotated within a nine pasture system. The winter pasture is used with a low stocking rate during May, with the principle use period occurring in September through October. No pasture rotation has yet been established for the Cherokee Allotment, but a schedule is expected soon. Spring and fall are currently the principal use periods for both sheep and cattle (BLM 1972, Warren 2000).

The Project Area contains an estimated 1,921 acres of federal surface ownership lands. There are no State of Wyoming or privately-owned lands within the Project Area. The Project is located on federal lands administered by the RFO in accordance with the Great Divide RMP.

Other land uses within and adjacent to the Project Area are agriculture (primarily cattle and sheep grazing), wildlife habitat, oil and natural gas exploration, development, and transmission, and dispersed outdoor recreation (primarily hunting in the fall).

WILDLIFE/FISHERIES

Wildlife

The Project Area includes sagebrush/saltbrush steppe and greasewood wildlife habitats. Many common species of birds, mammals, amphibians, and reptiles may be found within the Project Area. The proposed development is not expected to significantly impact the common species found in the Project Area, therefore, they are not considered in this analysis. Those species being considered for threatened or endangered status, big game species, raptors, and greater sage grouse are considered in this analysis. The area of analysis for wildlife concerns consists of the Project Area, plus a two-mile buffer for greater sage grouse leks, and a one-mile buffer for raptor nests. Wildlife surveys discussed and summarized herein were conducted as part of larger-scale surveys being performed in preparation of the Atlantic Rim CBM Project EIS.

Information regarding the occurrence of species being considered for threatened or endangered status, big game species, raptors, and greater sage grouse near the Project Area was obtained from several sources. Sage grouse lek locations, seasonal big game range designations, raptor nest locations, and locations for threatened and endangered species were obtained from the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System. WGFD big game herd unit annual reports were used for herd unit population statistics. Figure 2 provides locations and ranges in relation to the Project. This existing wildlife information for the Project Area was supplemented through survey data collected by Hayden-Wing Associates (HWA) biologists in 2000 and 2001. These data collections consisted of aerial and ground surveys to: (1) determine occurrence of threatened, endangered, proposed, or candidate species for listing; (2) determine the occurrence, location, size, and burrow density of white-tailed prairie dog colonies; (3) determine the location and activity status of raptor nests; (4) search for previously undocumented greater sage grouse leks and determine the activity status of all leks in the area; (5) locate winter greater sage grouse concentration areas; and (6) determine the occurrence, location, and size of mountain plover habitat and conduct a preliminary presence/absence survey for the species.

Big Game

Three big game species, pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*), occur in the Project Area during all or parts of the year. Winter ranges are used by substantial numbers of animals only during the winter months (December through April). Winter/year-long ranges are occupied throughout the year, but during winter these ranges are used by additional animals that migrate from other seasonal ranges. Crucial big game range (e.g., crucial winter/year-long range) describes any seasonal range or habitat component that has been documented as a determining factor in a population's ability to maintain itself at a specified level over the long-term. Crucial winter ranges are typically used eight out of ten winters.

Pronghorn Antelope

The Project Area is within the 1,394-square-mile Baggs Herd Unit. The Project Area contains pronghorn seasonal ranges designated as winter and crucial winter/year-long. Pronghorn likely migrate across the southern portion of the Project Area onto the crucial winter/year-long range located in the western portion of the Project Area (HWA 2001). During years with higher snowfall across the winter range, pronghorn congregate on the crucial winter range, resulting in heavy browse use here and only light use of the transition area in the fall and spring. In years with low amounts of snow, the pronghorn are not forced to spend as much time on the crucial winter range. Utilization of important shrub species is then more evenly distributed across this transition area with less use on the plants in the crucial winter range. The current population estimate of 7,000 animals is 22 percent below the Wyoming Game and Fish Department's (WGFD) management objective (HWA 2001). The Baggs antelope herd had experienced low fawn production resulting in slow growth, but production has improved during recent years and the population appears to be rebounding (HWA 2001). The Project Area is located within Hunt Area 53, where the hunter success rate in 1999 was 95.4 percent. The 1999 post hunt season population estimate for the Baggs Herd Unit was 7,000 animals, which is 24.6 percent higher than the 1994-1998 estimated population average of 5,620 (WGFD 2000a). The population objective was increased 25 percent in 1994, from 7,200 to 9,000 animals.

Mule Deer

The Project Area is within the Baggs Herd Unit. The Baggs Herd Unit is very large (3,440 square miles) and contains habitats ranging from subalpine and montane coniferous forests to desert scrub. The Project Area is within the portion of the Unit designated as winter/year-long mule deer range. No mule deer migration routes pass through the Project Area. The 1999 post-hunt population estimate for the Baggs Herd Unit was 18,300 animals. This estimate is slightly below the WGFD's management objective of 18,700 animals (HWA 2001). The Project Area is within Hunt Area 82, where the hunter success rate in 1999 was 56 percent.

Elk

The Project Area is located within the Sierra Madre Herd Unit (2,425 square miles). Most elk in the herd unit utilize spring/summer/fall ranges in the Sierra Madre Mountains, although there are groups using habitats on Atlantic Rim and around McCarty Canyon. During winter, the elk migrate to lower elevation winter range habitats on the west side of the Sierra Madre Mountains and into the Atlantic Rim/Sand Hills areas. Some animals may migrate as far west as the Powder Rim (~ 40 miles west of Baggs; Porter 1999). However, no major elk migration routes pass through the Project Area (WGFD 2000a). The habitat in the Project Area is designated as elk winter range (1,000 acres). The 1999 post hunt season population estimate for the Sierra Madre Herd Unit of 7,300 animals is 73.8 percent above the WGFD management objective of 4,200. The Project Area is located within Hunt Area 21, where the hunter success rate for 1999 was 37.7 percent.

Upland Game Birds

Sage Grouse

The greater sage grouse receives special consideration because populations are declining over much of its range and it is an important upland game bird in the State of Wyoming. Aerial surveys were conducted during March 2001 to delineate greater sage grouse concentration areas during winter. No greater sage grouse winter locations were identified within the Project Area, however, there were two greater sage grouse winter locations within 0.5 miles of the western boundary of the Project Area. No active greater sage grouse leks were found within the Project Area during a March and April 2001 survey. However, one active lek was located approximately 1.75 miles north of the Project Area. The two-mile nesting buffer area around that lek encompasses about 536 acres of the northern and eastern portions of the Project Area.

Raptors

Several species of raptors occur or potentially occur within the Project Area. They include the golden eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl.

Helicopter surveys in and around the Project Area were conducted during late May 2001 to locate raptor nests. No active raptor nests were found within the Project Area or a one-mile buffer around the Project Area. One inactive ferruginous hawk nest was found within the Project Area. Six additional inactive ferruginous hawk nests were found within one mile of the Project Area. One inactive golden eagle nest and one inactive unknown raptor nest were also found within one mile of the Project Area.

Threatened and Endangered Species - Wildlife and Fish

Wildlife Species

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies

In Wyoming, large white-tailed prairie dog (*Cynomys leucurus*) colonies provide habitat for black-footed ferrets. Aerial surveys for prairie dog colonies were conducted over the Project Area in late March and early April 2001. Portions of four prairie dog colonies occur within the Project Area. These four colonies are part of a larger prairie dog complex that stretches north, south, and west of the Project Area. During a July 2001 survey all four colonies were found to exceed 200 acres in size and to have burrow densities of eight burrows per acre. Therefore, these colonies are considered potentially suitable habitat for black-footed ferrets (HWA 2001). A nocturnal survey for black-footed ferrets was conducted in August 2001 over the entire prairie dog town and no ferrets or their sign were found (HWA, 2001).

Mountain Plover

The Project Area was surveyed for mountain plover habitat in May 2001. No mountain plovers were observed in habitat patches during surveys, although the presence of prairie dog towns indicates that plovers may use these areas some times.

Bald Eagle

Incidental sightings of bald eagles have been recorded in the vicinity of the Project Area (HWA 2001). Most observations were documented between November and March, indicating that the area is commonly hunted by bald eagles during the winter months. However, the occurrence of communal winter roosts in or near the Project Area has not been documented. Inspection of BLM and WGFDRaptor nest records and the results of aerial and ground raptor nest surveys conducted suggest bald eagle nests do not occur within two miles of the Project Area. The closest known nest occurs approximately 21 miles southwest of the Project Area. This nest has been active each of the last five years.

Canada Lynx

It is unlikely that Canada lynx occur within or near the Project Area. The Project Area does not include habitat types preferred by this species and does not support a population of snowshoe hares (preferred prey). Additionally, the occurrence of recorded lynx sightings in or near the Project Area has not been documented. The closest potentially suitable habitats are located more than ten miles away in the Sierra Madre Mountains (HWA 2001).

Fish Species

Four federally endangered fish species may occur within the Project Area or as downstream residents of the Little Snake River system: Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) (FWS 2000). These fish species have not been found in the Project Area and are not likely to be found downstream in the mainstem of the Little Snake River and its tributaries. Critical habitat for these species has not been designated in Wyoming (Upper Colorado River Endangered Fish Recovery Program 1999). Suitable habitat for spawning, age-0, and juveniles of these species may be present in the Project Area or downstream in Muddy Creek or the Little Snake River. The potential for downstream impacts to these tributaries of the Colorado River warrants their inclusion in this analysis.

The Colorado pikeminnow, bonytail, and humpback chub are all members of the minnow family. The razorback sucker is a member of the sucker family. All four of these fish species share similar habitat requirements and historically occupied the same river systems. Declines in populations of these species are mainly attributed to impacts of water development on natural temperature and flow regimes, creation of migration barriers, habitat fragmentation, the introduction of competitive and predatory non-native fishes, and the loss of inundated bottom lands and backwater areas (Minckley and Deacon 1991, FWS 1993).

Colorado Pikeminnow

Although one adult was collected from the Little Snake River in Carbon County, Wyoming, in 1990, subsequent survey attempts to collect Colorado pikeminnow from this area of the Little Snake River by WGFD personnel failed to yield any other specimens (Baxter and Stone 1995). Muddy Creek and the Little Snake River may potentially support this species of fish at certain times, but the pikeminnow appears to be absent downstream from the Project Area at this time.

Bonytail and Humpback Chub

Neither of these species has ever been reported within waters of the Project Area or immediately downstream. However, the Little Snake River, and although very unlikely, parts of Muddy Creek, may have the potential to provide habitat for both bonytail and humpback chub.

Razorback Sucker

Suitable habitat for this species is not available in the Project Area and the species is not known from the Little Snake River drainage.

Species of Concern - Wildlife and Fish

Wildlife Species of Concern

Nine special-concern species of wildlife occur or potentially occur in the Project Area. They are the Wyoming pocket gopher, swift fox, northern goshawk, Columbian sharp-tailed grouse, snowy plover, burrowing owl, Brewer's sparrow, Sage sparrow, and smooth green snake (HWA 2001).

Burrowing owls are typically associated with prairie dog burrows. Burrowing owls may utilize prairie dog towns, however, the total disturbance that would occur in prairie dog towns is small, and burrowing owls are not expected to occur in the Project Area. No Columbian sharp-tailed grouse leks are located within two miles of the Project Area. No winter habitat (upland shrub communities and wooded riparian areas) for Columbian sharp-tailed grouse is located in the Project Area. The Wyoming pocket gopher is typically associated with loose gravelly soils in greasewood plant communities and may be present in the Project Area. Brewer's sparrow and the Sage sparrow are sagebrush obligate species. These species and their sensitivity status/rank are listed in **Appendix E**.

Fish Species of Concern

Fish species that are not listed as endangered or threatened by the FWS, but have been identified for possible listing in the future, are classified as candidate species and are included on the BLM (2001) Sensitive Species List. Four fish species that have the potential to occur, or are known to occur downstream of the Project Area, are designated as "species at risk" by the FWS and are considered sensitive by the BLM. These species are described below.

The four BLM sensitive fish species that may occur within as well as downstream from the Project

Area are the roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) (WYNDD 2000, BLM 2001). All four of these species can be found within Muddy Creek or immediately downstream from its confluence with the Little Snake River. Recent sampling of Muddy Creek by the BLM does not indicate that the bluehead sucker is found in large numbers. Recent sampling by the BLM also showed that the flannel mouth sucker is the least abundant fish in Muddy Creek. Suitable habitat for spawning, age-0, and juveniles of these species may be present in the downstream reach of Muddy Creek or in the Little Snake River. Wild Cow Creek, Dry Cow Creek and Cow Creek may also provide adult spawning habitat and age-0 rearing habitat. The potential for downstream impacts to these tributaries of the Colorado River warrants their inclusion in this analysis. Similar to the endangered fish species discussed previously, original numbers and distribution of these special-concern fishes have been reduced through the introduction of competitive and predatory non-native fish, habitat alterations that reduce or impair fish habitat and migration abilities, and unregulated fishing pressure.

The roundtail chub is a close relative of the federally endangered humpback chub and bonytail and is common within the Little Snake River drainage and can also be found in Muddy Creek (Carbon County, Wyoming). The bluehead sucker is restricted to the Little Snake and Green River basins in Wyoming (Baxter and Stone 1995) and occupies habitat similar to that of the roundtail chub. The species is known to occur in the Little Snake River and is found in large numbers in Muddy Creek (Baxter and Stone 1995). However, populations of the species in Wyoming are considered rare in comparison with other sucker species. The flannelmouth sucker is one of the most abundant and widely-distributed candidate fish species of the tributaries and mainstream portions of the Upper Colorado River Basin (Tyus et al. 1982) and is a limited resident of Muddy Creek (Baxter and Stone 1995). Colorado River cutthroat trout is one of five subspecies of cutthroat trout found in Wyoming and was the only trout native to the Green and Little Snake River drainages in Wyoming (Baxter and Stone 1995). The current populations of Colorado River cutthroat trout occupy less than one percent of the subspecies' original range. Some of the most genetically "pure" of the remaining populations of this trout subspecies are found in the Little Snake River in Carbon County, Wyoming (Baxter and Stone 1995).

RECREATION

The most popular recreational activities occurring in or near the Project Area are hunting, camping, and off-road vehicle use. No developed recreational sites, facilities, or special recreational management areas exist within or adjacent to the Project Area. Most recreation activities occur during the fall hunting seasons. The area attracts hunters during September and October for the greater sage grouse season. Pronghorn hunting also occurs in September. Other hunting use occurs during the mule deer season in mid-to-late October. Rabbits and predators are hunted later during the fall and winter. During other seasons, the area attracts small numbers of visitors engaged in rock collecting, camping and hiking, wild horse and wildlife observation, outdoor photography and picnicking. The area also receives a limited amount of use by off-road vehicle enthusiasts. Although data on recreational visitation are not available, overall use levels are generally low (BLM 2000). Low visitation is a function of the small number of local residents, long drives from major population centers, lack of publicized natural attractions, and road conditions that limit vehicle

access into many back country areas.

VISUAL RESOURCES

The Project Area is typical of the more rugged sections of Wyoming Red Desert region. The characteristic landscape within the Project Area and adjacent lands is moderately undulating. Numerous small drainages dissect the landscape, adding diversity. Larger views encompassing several viewsheds are available from high points. The sky/land interface is a significant aspect of all distant views. The predominant vegetation types, typical of cold desert steppe, are alkali and low sagebrush, mixed desert scrub, and grasses and forbs with scattered patches of big sage/rabbit brush on flatter north and east facing slopes, along drainage ways and in large depressions. Small established stands of juniper also exist within the Project Area. The combination of plant communities creates a subtle mosaic of textures and colors. Predominant vegetation colors in early spring are green and gray green changing to gray/green and buff/ochre as grasses and forbs cure in the summer and fall. Reddish brown and buff colors of the badland formations add contrast and dominate in areas of steep topography. Evidence of cultural modification in the Project Area includes unimproved roads and some oil and gas production facilities. Motorists traveling Wyoming Highway 789 would not have visual access to the Project Area because of the viewing distance (three to six miles) and intervening elevated topography. However, facilities and activities located on ridge lines or buttes are visible over longer viewing distances. The quality of the visual resource is an important part of the recreational experience for many of these users. Other non-recreational users of the area, including grazing permit holders and those working in the oil and gas industry, would also be affected by changes to the visual landscape.

The visual resource management class of the Project Area is Class III. Class III includes areas where changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. The objective of this class is to provide for management activities that may require modification of the existing character of the landscape. However, changes should remain subordinate to the visual strength of the existing character.

CULTURAL RESOURCES

Culture Chronology

Archaeological investigations in the Washakie Basin indicate the area has been inhabited by prehistoric people for at least 10,000 years from Paleoindian occupation to the present. The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The Wyoming Basin prehistoric chronology is documented in **Tables 3-11** and **3-12**.

Table 3-11 Prehistoric Chronology of the Wyoming Basin		
Period	Phase	Age (B.P.)
Paleoindian		12,000 - 8,500
Early Archaic	Great Divide	8,500 - 6,500
	Opal	6,500 - 4,300
Late Archaic	Pine Spring	4,300 - 2,800
	Deadman Wash	2,800-2,000/1,800
Late Prehistoric	Uinta	2,000/1,800 - 650
	Firehole	650 - 300/250
Protohistoric		300/250 - 150

Source: Metcalf (1987), as modified by Thompson and Pastor (1995)

Table 3-12 Historic Chronology of the Washakie Basin	
Phase	Age A.D.
Pre-Territorial	1842 - 1868
Territorial	1868 - 1890
Expansion	1890 - 1920
Depression	1920 - 1939
Modern	1939 - Present

Source: Massey 1989

Historic use of the Washakie Basin area is limited by the formidable topographic relief. Steep canyons, inadequate water supply, badlands, and escarpments make the area inhospitable for settlement with only limited ranching activities present.

Block cultural inventory of the Blue Sky Project Boundary and surveys of a proposed pipeline route and existing access road that would be upgraded located three previously recorded sites, 16 newly recorded prehistoric sites, and 11 isolated finds (Hatcher and Davis 2001). Site types included the historic Rawlins-Baggs Stage Road and prehistoric open camps and lithic scatters.

Summary of Cultural Resources

Prior to fieldwork, the Wyoming Cultural Records Office was contacted to request a file search. Limited amounts of field work have resulted in the documentation of cultural resources through survey, examination of ethnographic records, and historic record research. No excavations have been conducted in the Project Area.

In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely

to contain cultural material. The Project Area is located in an area of dominant northwest/southeast trending ridge systems that have been heavily cut with numerous drainages of Muddy Creek, Cow Creek, Wild Cow Creek, and Dry Cow Creek. These drainages have dissected the surrounding ridge systems, resulting in variable topography containing lesser ridges, finger ridges, knolls, hills, and gentle to moderate slopes. This topographic setting is conducive to prehistoric occupation.

A Class III block inventory for the Project Area was conducted in May 2001 by Pronghorn Archaeology (Pronghorn). At the conclusion of the survey, one prehistoric lithic scatter, 14 prehistoric open camps, one isolated hearth, and 11 isolated finds were identified and recorded. Eleven sites are considered eligible for the National Register of Historic Places. In addition, three previously recorded sites, two of which are eligible for the National Register of Historic Places, were relocated and re-recorded.

Two archaeological projects near the Project Area have investigated prehistoric site distribution and site density in the Savery Creek drainages. In *Archaeological Investigations Within the Little Snake River Basin Colorado and Wyoming*, H.D. Hall (1987) “reevaluated the nature and distribution of aboriginal sites” in Savery Creek, Slater Creek, Ridge and Valley geographic zones, Juniper Ridge, and the Little Snake Valley. The Savery Creek investigations indicate that sites are generally located in the valley bottom or lower valley terrain, on gentle inclines, near water and near major confluences. The Savery-Pothook study area is located in northwestern Colorado and south-central Wyoming. Situated along a 30-mile stretch of the Little Snake River in the vicinity of Baggs, Wyoming, the study area includes several major tributaries. The tributaries are: Slater Creek, Four-Mile Creek, Thornburgh Gulch, Savery Creek, and Cottonwood Creek.

In the Class III Cultural Resource Inventory and Evaluation of Eleven Prehistoric Sites within the High Savery Locality at the Proposed High Savery Dam and Reservoir Alternative, Carbon County, Wyoming, Latham (1999) states, “The analysis domain is characterized by nondissected to moderately-dissected uplands with mostly moderate-to-steep slopes and broad-to-narrow benches and flood plains along the many streams that pass through the area.” Most of the prehistoric sites within the analysis domain are situated on benches or ridges overlooking one of the main tributaries. The High Savery Dam project is located approximately 12 miles east of the of the Project Area.

Site Types

Site types previously identified, recently located, or predicted to be in the Project Area are discussed below.

- Prehistoric open camps contain evidence of a broad range of activities including subsistence-related activities. Cultural remains include formal features, lithic debris, chipped stone tools, evidence of milling/vegetable processing activities including ground stone, and pottery.
- Lithic scatters consist of sites containing lithic debris such as debitage or stone tools.

- Quarries are sites where lithic raw material was obtained and initially processed. Primary and secondary lithic procurement areas are geologic locations where chert and quartzite cobbles have been redeposited and later used by prehistoric inhabitants for tool manufacture.
- Human burials, rock art, both pictographs and petroglyphs, and rock alignment sites are unknown in the Project Area, but have been identified as sensitive or sacred to Native Americans. Few of these types of sites have been located in southwestern Wyoming.
- Pottery/ceramics are as yet undocumented in the Project Area. Pottery is associated with the Uinta phase of the Late Prehistoric period. There are numerous pottery sites in southwestern Wyoming and northwestern Colorado.
- The Rawlins-Baggs Stage Road is a historic route considered eligible for inclusion within the National Register of Historic Places (Hatcher and Davis 2001). However, despite an intense search during the block survey, no physical evidence of this trail was found.

Excavation Data

No sites have been extensively tested or excavated in the Project Area. However, several excavations have been conducted in the surrounding area, contributing data about the prehistory and history of the area.

The Sheehan site is a multi-component prehistoric site (Bower et al. 1984) located in the Washakie Basin, east of the Project Area. Component I dates to the Archaic period and Component II dates to the Late Prehistoric period. Data suggests both components reflect short-term winter camps with meat processing activities identified and locally available lithic materials exploited. The Yarmony site in northwest Colorado contained a housepit dating to approximately 6300 B.P. (Metcalf and Black 1991). The Early Archaic period housepit is a large, semi-subterranean, two-room dwelling containing four slab-lined storage bins, interior hearths and other floor features, and is postulated as a long-term winter base camp. The Nova Site is located approximately four miles northwest of the Project Area block. The site is a Uinta phase housepit dating from 1098 to 1285 B.P. and represents Component I as a short-term spring/late summer occupation. Component II was not dated but is believed to occur as the reuse of the Component I housepit.

Summary

The proximity of the block survey areas to important drainages suggest that the survey area is located where the potential for open camps, and lithic scatter is fairly high. The sampling included ridges, drainages, and areas with limited sand deposits. Certain topographic settings have greater archaeological sensitivity including eolian deposits (sand dunes, sand shadows, and sand sheets), and to a limited degree, colluvial deposits along lower slopes of ridges. Previous investigations along the Savery Creek drainages, east of the Project Area, support a higher site potential along streams.

At the conclusion of the inventory, three previously-recorded sites, 16 newly recorded prehistoric sites, and 11 isolated finds were discovered. Eleven of these newly discovered sites are considered eligible for the National Register of Historic Places. No evidence of the Rawlins-Baggs Stage Road was found.

SOCIOECONOMICS

The primary geographic area of analysis for potential socioeconomic effects is Carbon County, Wyoming, and the communities of Baggs, Dixon, and Rawlins. Temporary housing availability is also described for the Moffat County, Colorado community of Craig, and the Sweetwater County, Wyoming, community of Wamsutter. Carbon County socioeconomic conditions characterized for the assessment include economic and population conditions, temporary housing resources, law enforcement and emergency management services, certain local and state government revenues and local attitudes and opinions.

Economic Conditions

Carbon County has a natural resource-based economy. Basic economic sectors, which bring revenues into the county, include oil and gas production and processing, coal mining, electric power generation, agriculture (primarily ranching and logging), some manufacturing and transportation (primarily the Union Pacific railroad). Those portions of the retail and service sectors which serve travelers and tourism and recreation visitors are also basic. Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by CBM exploration or development.

In 1998, Carbon County employment totaled 9,780 full and part-time jobs, which was about one percent lower than the 1990 level (WDAI 2000a) and about 28 percent lower than the 1980 level of 13,560 jobs. Mining sector employment, which includes oil and gas jobs, decreased 46 percent from 1990 to 1998, from 934 to 501 jobs. The 1998 level was 86 percent lower than the 1980 level of 3,563 jobs mining jobs (UW 1997). The mining sector losses and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe # 2 mines (BLM 1999a) and more recently the RAG Shoshone mine near Hanna (Rawlins Daily Times 2000a). Other mine workforce reductions and the delay in opening of an anticipated mine have further affected mining sector employment in the county, however, increased natural gas drilling has resulted in increases in oil and gas employment in recent years (Schnal 2000).

In Carbon County, ten-year unemployment rates ranged from a low of 5.2 percent (1997) to a high of 6.1 percent (1993). The 1999 Carbon County unemployment rate was 5.3 percent, based on 446 unemployed persons out of a total labor force of 8,475 (Wyoming Department of Employment 2000).

Carbon County earnings increased from \$202 million to \$211 million between 1990 and 1998, a 5 percent increase. However, when adjusted for inflation, Carbon County earnings decreased by 21 percent from their 1990 level during the eight-year period.

Oil and Gas Activities

Carbon County natural gas production increased from 76 million MCF in 1995 to about 80 million MCF during 1999. Carbon County oil production in 1999 was within 0.2 percent of the 1995 level of 1.3 million barrels.

One indicator of future production, approved Applications for Permits to Drill, increased steadily in Carbon County in recent years, from 50 in 1995 to 127 in 1999. Increased drilling may result in increased production in the county if drilling efforts are successful and commodity prices increase or stabilize at economic levels. During 1999, there were a total of 742 producing oil and gas wells in Carbon County (WOGCC 1995-1999).

Economic Activities

Other economic activities occurring in and near the Project Area include oil and gas exploration (Vosika Neuman 2000), cattle grazing (Warren 2000) and outdoor recreation activities such as hunting (pronghorn antelope, mule deer, elk and upland birds), hiking, off-road vehicle use, camping and sightseeing. Many commercial hunting outfitters hold permits for the hunt areas where the Project Area is located, although the Project Area comprises only a small portion of these hunt areas (Clair 2000).

Population

Carbon County population growth and decline parallels the employment boom and bust cycle outlined at the beginning of this section. For example, the 2000 Carbon County population (15,639) was 29 percent lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538, although the city is growing as a result of the opening of a new state prison facility. The Town of Baggs gained 76 residents or 28 percent of its 1990 population, and the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79.

Temporary Housing Resources

CBM interim drilling activities typically involve relatively short duration tasks performed primarily by contractors. The nature of these activities results in demand for temporary housing resources such as motel rooms and mobile home and recreational vehicle (RV) spaces near the Project Area.

In the Baggs/Dixon area, most temporary housing resources are fully-occupied by oil and gas workers during the summer. During winter more units become vacant. A 26-space mobile home park in Baggs is equipped to accommodate RVs as well as mobile homes. Within the park there are several rental mobile homes. There is a small four-space mobile home park in Savery and a number of mobile home lots scattered throughout the Little Snake River Valley (Grieve 2000).

There are two motels in Baggs with a total of 64 rooms, most of which can accommodate several guests. Both motels routinely accommodate oil and gas industry workers as well as tourists, travelers and hunters. As with mobile home parks, the motels are filled to capacity during the summer and fall and are partially vacant during the winter. Most oil and gas occupants are relatively short-term in nature, moving in and out of the community as work assignments are completed (Willis 2000, Hawkins 2000). Longer-term rental housing in the Baggs/Dixon area consists primarily of an apartment building and a newly constructed rental duplex which was vacant in the spring of 2001.

There are temporary housing resources available in the Town of Wamsutter, including several mobile home parks and two motels (Carnes 2000). The town is the center of a 200-well per year BP drilling and field development program. Wamsutter town officials recently stated that there was no available housing in the town to accommodate workers and their families associated with the current drilling and field development activity (Rock Springs Rocket Miner 2001).

Temporary housing resources in the Craig, Colorado, and Rawlins, Wyoming, areas are more extensive. The Craig Chamber of Commerce lists 12 motels with a total of 467 rooms and 2 campground/RV parks with a total of 128 spaces (Craig Chamber of Commerce 2000). Rawlins has 19 motels and 4 RV parks (Hiatt 2000). There are also a substantial number of apartment buildings with some availability (Hewitt 2000, Rawlins Daily Times 2000b).

Local Government and State Government Revenues

Local and state government fiscal conditions most likely to be affected by the interim drilling activities include county, school and special district ad valorem property tax revenues, state, county and municipal sales and use tax revenues, state severance taxes, and federal/state mineral royalty distributions. Some county, municipal and special district service expenditures may also be minimally affected.

Ad Valorem Property Tax

Carbon County assessed valuation in fiscal year (FY) 2000 totaled about \$337 million, which yielded total property tax revenues of \$21.3 million. Total mill levies within Carbon County communities ranged from 65 to 75.3. FY 2000 assessed valuation from 1999 natural gas production totaled \$159 million or about 47 percent of total assessed valuation. Assessed valuation from oil production totaled 16.9 million or about five percent of total valuation (WTA 2000).

Sales and Use Tax

FY 2000 sales and use tax collections in Carbon County totaled about \$21 million. These include collections from a four percent statewide sales and use tax, a one percent general purpose local-option sales and use tax and a one percent specific-purpose local option sales and use tax, which expired in the summer of 2001 (WDAI 2000b).

Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the state, including a six percent severance tax on natural gas. In FY 2000, severance tax distributions totaled \$275 million (WDAI 2000c). Of the total, 44 percent was attributable to severance taxes on natural gas.

Federal Mineral Royalties

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. After certain costs are deducted, half of those royalties are returned to the state where the production occurred. In Wyoming, the state's share is distributed to a variety of accounts, including the University, School Foundation Fund, Highway Fund, Legislative Royalty Impact Account, and cities, towns and counties. During FY 2000, a total of \$309 million in federal mineral royalty funds were distributed to Wyoming entities (WDAI 2000d).

State Mineral Royalties

The State of Wyoming collects a 16.7 percent royalty on the fair market value of gas produced from state leases, less production and transportation costs. During FY 2000 state leasing income was \$35 million (PRCBMIC 2001).

Attitudes and Opinions

A 1996 survey conducted in conjunction with the preparation of the Carbon County Land Use Plan provides some insight into resident attitudes and opinions regarding land use, oil and gas development, natural resource conservation and use and other topics. Just over 300 residents completed the survey, yielding an estimated statistical reliability of about 95 percent (Pederson Planning Consultants 1998).

Water resource conservation and concern for government regulation of land use were the most frequently listed important land use issues, followed closely by the availability of water to support future land uses, the economic viability of ranching, timber, and oil and gas industries, and the need to conserve wildlife habitat.

County-wide, 54.9 percent of survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water, and wildlife resources was more important than increased oil and gas production, while 36.9 percent indicated that increased oil and gas production was more important. However, among Baggs respondents, the reverse was true. About 54 percent indicated that increased oil and gas production was more important than conservation of land, water and wildlife resources while 36 percent indicated that resource conservation was more important. The land use plan attributes this difference to Baggs' greater economic dependence on future oil and gas employment.

Concerning management of federal lands, the largest number of respondents (69.5 percent) indicated that more federal lands within the county should be designated for the purpose of conserving fish and

wildlife habitat and surface and groundwater resources. In addition, 60.8 percent of respondents indicated that more land should be designated for public recreation, 48.8 percent indicated more land should be leased for oil and gas industry exploration and production, 48.7 percent indicated more land should be leased for commercial mining, and 44.5 percent indicated more land should be made available to local timber companies for commercial timber harvest.

Coalbed methane development was not considered during the survey. Resident attitudes and opinions about unique aspects of CBM are not known (Hewitt 2000).

Environmental Justice

Executive Order (EO) 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the Federal Register (59 FR 7629 on February 11, 1994). EO 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The EO makes clear that its provisions apply fully to American Indian populations and Indian tribes, specifically to affects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Indian communities.

Communities within Carbon County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of CBM development within the Project Area. Communities potentially impacted by the presence or absence of the proposed development have been identified above in this section. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated to social and economic impacts as well.

Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right. With regard to environmental justice issues affecting Native American tribes or groups, the Project Area contains no tribal lands or Indian communities, and no treaty rights or Indian trust resources are known to exist for this area.

TRANSPORTATION

The regional transportation system serving the Project Area includes an established system of interstate and state highways and county roads. Local traffic on federal land is served by improved and unimproved BLM roads.

Access to the Project Area is provided by a combination of interstate highway, state highways, and county and BLM roads. **Table 3-13** displays specific access routes to the Project Area. The Wyoming Department of Transportation (WYDOT) measures average daily traffic (ADT) on federal and state highways. ADT on highways providing access to the Project Area are shown in **Table 3-13**.

**Table 3-13
Access Routes to the Project Area**

Highway or Road		
Highway or Road	ADT	Level of Service / Accidents
I-80	Rawlins - Wamsutter: 10,670 (6,170 trucks)	A 1999: 89 5 yr average: 112.4
SH 789	(1) @ I80/ Crestone Junction: 850 (160 trucks); (2) @ Baggs Corporate Limit: 1650 (190 trucks)	B 1999: 27 5 yr average 16.4
CCR 608 (Dad Road)	n/a	n/a

Sources: Wyoming Department of Transportation, Carbon County Road and Bridge Department

WYDOT assigns levels of service to highways in the state system. Levels of service (A through F) are assigned based on qualitative measures (speed, travel time, freedom to maneuver, traffic interruptions, comfort and convenience) that characterize operational conditions within traffic streams and the perceptions of those conditions by motorists. A represents the best travel conditions and F represents the worst. Levels of service for highways providing access to the Project Area are also shown in **Table 3-13**.

The Project Area would be accessed from SH 789 and CCR 608 (Dad Road). A new improved dirt road (less than one-quarter mile in length) would be constructed into the southern boundary of the Project Area. CCR 608 is a two-lane improved and unimproved native material road. CCR 608 currently provides access to oil and gas fields in the area (Evans 2000).

HEALTH AND SAFETY

Existing health and safety concerns in and adjacent to the Project Area include occupational hazards associated with CBM exploration and operations; risk associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents associated with hunting or casual firearms use; and low probability events such as landslides, flash floods and range fires.

Occupational Hazards

Two types of workers would be employed by the Project: oil and gas workers, who had a 1998 annual accident rate of 4.0 per 100 workers, and special trade contractors, who had a non-fatal accident rate of 8.9 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 1998). These rates compare with an overall private industry average for all occupations of 6.2 per 100 workers.

There has been recent concern among CBM drillers that worker safety standards and training used for conventional oil and gas activities may not be appropriate for the CBM industry (Rock Springs Rocket Miner 2001). During 2000, five workers died and six others were seriously injured in CBM-related accidents in Campbell County, Wyoming. The Wyoming Occupational Safety and Health Administration, Worker's Safety Division (OSHA) is working with CBM company officials to consider changes in worker safety standards and revised training requirements.

Pipeline Hazards

Accident rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 14 per year from 1990 through 1996, fatalities averaged one per year and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 1998).

Other Risks and Hazards

Highway safety impacts are discussed under Transportation. Sanitation and hazardous material hazards would exist during CBM activities.

The potential for firearms-related accidents would occur primarily during hunting season.

Risk of fire in the analysis area would occur under the Project.

NOISE

The Project Area is located in a sparsely-populated rural setting having modest sound disturbances. The principal sound source within the Project Area is the wind. Vehicle traffic on Wyoming State Highway 789, jet aircraft overflights at high altitudes, localized vehicular traffic on county, BLM and two-track roads in the Project Area, and nearby drilling activities also cause sound disturbances within the Project Area. The EPA has established an average 24-hour noise level of 55 dBA as the maximum noise level that does not adversely affect public health and welfare. No definitive data has been established concerning noise levels that affect animals. No regulations concerning quantitative noise levels have been established by the State of Wyoming.

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CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter provides an analysis of the potential environmental consequences that would result from implementation of the Proposed Action (Project) (development of federal land or minerals associated with 23 exploratory well locations, access roads, associated facilities, two injection well locations, access roads, associated facilities) or No Action (denial of further federal land or minerals development in the Blue Sky Project Area (Project Area). Measures that would avoid or reduce impacts under the Project have been included in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter under the Mitigation Summary for each resource discipline.

As discussed in Chapters 1 and 2, the Project Area lies within the proposed Atlantic Rim CBM Project Area (**Figure 1**). Drilling and field development activities associated with the Project would have to conform with the terms of the Interim Drilling Policy (**Appendix A**), the terms of which do not allow approval of activities that may result in significant impacts to resources.

This analysis of environmental consequences addresses those direct and indirect impacts associated with exploration and development of the Blue Sky Project, and cumulative impacts that would result from past, present, and reasonably foreseeable future actions within a cumulative impact assessment area relevant to the resource being analyzed. The description of the environmental consequences includes the following subsections where applicable:

Direct and Indirect Effects

The level and duration of direct and indirect effects that would occur as a result of the Project or the No Action Alternative. The impact evaluation assumes that the applicant-committed and BLM required practices described in Chapter 2 would be implemented

Mitigation

In addition to the Best Management Practices (BMPs) described in Chapter 2, a summary of additional measures that could be applied to avoid or reduce impacts. Mitigation items specified in the Mitigation Summary are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, Pedco would coordinate with private landowners to determine which measures would be applied, to what degree, and where. Mitigation described would apply to the Project only, as no actions requiring mitigation are contemplated under the No Action Alternative. The measures identified under this section would be considered for application to all BLM administered lands where appropriate. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts

A summary of impacts that would remain after the application of additional reasonable mitigation and, therefore, would remain throughout the duration of the Project and to some point beyond.

Cumulative Impacts

A description of impacts likely to occur due to this Project in combination with other ongoing and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable future actions or RFFAs).

This environmental analysis addresses cumulative impacts associated with exploration and development of 200 interim CBM wells and other activities, ongoing or proposed, within the Atlantic Rim Project Area. Cumulative impacts associated with exploration and development of the Blue Sky Project are described later in this chapter, beginning on page 4-26.

GEOLOGY/MINERALS/PALEONTOLOGY

Proposed Action

Use of cut and fill construction techniques to develop well locations, access roads, and facilities would result in the alteration of existing topography. An estimated 78.5 acres would be affected by surface-disturbing activities. Utilization of proper construction techniques described in Chapter 2 would lessen the effects associated with topographic alteration. As discussed in Chapter 3, no major landslides have been mapped within the Project Area. By following prescribed procedures, construction activities would not likely activate landslides, mudslides, debris flows, or slumps. Seismic activity is low in the area, so the potential for damage of Project facilities is minimal.

Drilling of the wells may result in the discovery of CBM resources. This in turn may lead to further exploration to better define the nature of CBM accumulation. If further exploratory information shows an economic accumulation of CBM, then development would likely follow. Recovery of CBM results in the depletion of an in-place resource. If no CBM resources are discovered, then additional exploratory wells may or may not be drilled, depending on the information obtained during drilling of the proposed wells. No other major mineral resources would be affected by implementation of the Project.

As discussed in Chapter 2, Project-Wide Mitigation Measures, the mitigation measures presented in the Soils and Water Resources sections would avoid or reduce potential effects on the surface geologic environment. Implementation of these measures and adherence to federal and state rules and regulations regarding drilling, testing and completion procedures would avoid or reduce potential effects on the subsurface geologic environment.

Under the Project, no effect on any sensitive resource area, such as a high-density paleontological site or stabilized sand dunes, is anticipated. While the surface-disturbing activities associated with the Project could disturb paleontological resources, the potential for recovery of important vertebrate

fossils in the Project Area is considered to be low to moderate. Construction excavation associated with the development of access roads, CBM well pads, gas and water pipelines, and related gas production and water disposal facilities could directly result in the exposure, damage, or destruction of scientifically significant fossil resources. For example, fossils may be subject to damage or destruction by erosion that is accelerated by construction disturbance. In addition, improved access and increased visibility, as the result of construction and ongoing production activity, may lead to fossils being damaged or destroyed by unauthorized collection or vandalism. However, there are no documented occurrences of paleontological resources in the Project Area. The Lewis Shale of Cretaceous age, which underlies the area, has produced scientifically significant fossils elsewhere in Wyoming (and thus meets BLM Condition 2). Mitigation measures discussed in Chapter 2 would protect potential paleontological resources that may be inadvertently uncovered during excavation.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur, although one existing well included in the Project would produce CBM. By not drilling the proposed wells, additional depletion of the CBM resources would not occur. The nation's demand for this resource likely would result in exploration and development elsewhere. Additional information on CBM accumulation in this area of the Washakie Basin would not be obtained and the collective knowledge base would not increase.

AIR QUALITY

Proposed Action

The small number of exploratory wells and Project facilities included in the Project would generate only a small amount of air pollutants. Some temporary effects on air quality would likely occur in the immediate vicinity of Project activities due to particulate matter and exhausts from vehicles and equipment. These effects would be local and would be dispersed by prevailing winds. The effects on air quality would be minimized through the application of dust abatement practices.

No noticeable deterioration in visibility would occur at Class I or sensitive Class II wilderness areas located within 100 miles of Project activities (Mount Zirkel, Rawah, Savage Run, Platte River, Huston Park, or Encampment River). No noticeable deterioration in visibility would occur at the Dinosaur National Monument. Wind dispersion of the small quantity of air pollutants generated by Project activities would likely eliminate the formation of regional haze or acid deposition.

If these wells are deemed economical to produce, Pedco would be required to file an application for an air quality permit from WDEQ for oil and gas production facilities under Section 21 of the Wyoming Air Quality Standards and Regulations.

No violations of applicable state or federal air quality regulations or standards are expected to occur as a result of direct or indirect Project air pollutant emissions from CBM well development (including both construction and operation) in the Project Area.

Under the Project, air emissions would occur from the construction and production of CBM wells within the Project Area. Construction emissions would include PM₁₀, SO₂, NO_x, CO, and VOCs, from ground-clearing, heavy equipment use, drilling, and completion activities, as well as the construction of access roads. Construction emissions are temporary and would occur in isolation, without significantly interacting with adjacent wells.

Production emissions of NO_x, CO, VOC, and HAPs (formaldehyde) would result primarily from operation of compressor engines. Estimated air quality impacts from compressor engines assumed that the compressor engines would have an average potential NO_x emission rate of approximately 2 grams per horsepower-hour (g/hp-hr) of operation. This reflects emission control levels which have already been required in similar applications, although WDEQ-AQD operating permit records have shown existing facility hourly emission levels to be substantially less. The emissions generated from compressor operation would contain negligible amounts of SO₂ and particulate matter due to the composition of coalbed methane gas. Production emissions from the compressor engines would occur over the life of the Project.

Emissions from production wells would be negligible since the produced gas is nearly 100 percent methane and will require no ancillary production facilities at the well site.

Pollutant emissions from the construction and operation of natural gas fields in the vicinity of the Project Area have been analyzed in recent air quality studies performed under NEPA by the BLM. Studies conducted for the Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects (BLM 1999a and 2000) indicated potential near-field increases in CO, NO₂, PM₁₀, and SO₂ concentrations, however, the predicted maximum concentrations would be well below applicable state and National Ambient Air Quality Standards. Similarly predicted HAP (formaldehyde) concentrations would be below various 8-hour maximum Acceptable Ambient Concentration Levels, and the related incremental cancer risks to residences would also be below applicable significance levels.

The emissions resulting from the implementation of this Project would be much the same as those found on similar oil and gas projects such as Continental Divide, but on a much smaller scale. The 23-well exploratory Project described in this EA is within the limit of the 3,000-well air quality analysis prepared for the Continental Divide EIS, considering only 2,130 wells were approved. The analysis for the Continental Divide EIS project included impacts to Class I areas from oil and gas development in southern Wyoming. Based on the relative size of the Project when compared to the magnitude of those projects, no ambient air quality standards would be violated and no adverse air quality conditions would result from the Project.

Mitigation

Emission levels could be further reduced by implementing the following type of control measures including; reduction of compression requirements, electric compression, or the use of nonselective catalytic reduction (NCR), lean combustion, or selective catalytic reduction (SCR) control technologies. Currently, emission levels are below Wyoming Air Quality Standards and the likelihood of requiring these measures is small.

Residual Impacts

Implementation of mitigation, if necessary, would further reduce air quality emissions.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on air quality would be expected to occur beyond the current situation.

SOILS

Proposed Action

Soil stability and productivity may be affected in areas where well sites, facilities, and access roads would be constructed under the Project. An estimated 78.5 acres would be affected by surface-disturbing activities during drilling and testing. Use of BMPs during construction, operation, and reclamation activities would minimize effects on soil resources. Practices that Pedco has committed to in Chapter 2 and existing regulatory requirements would conserve soil resources through timely and effective erosion control and revegetation in disturbed areas, and collectively, would represent BMPs. Topsoil salvaged on sandy sites would be subject to wind erosion until replaced during reclamation or stabilized by a vegetative cover. Uncontrolled runoff from the wells sites could cause accelerated water erosion; however, BMPs for erosion control would be employed as necessary. The application of these BMPs would result in minimal impacts on soil resources.

Should the CBM exploratory wells be productive, the surface areas required for production facilities would not be reclaimed until production ends, which could be as long as 20 years. An estimated 34.8 acres could be affected by production facilities over the long-term.

Approximately 78.5 acres of soils resources would be temporarily disturbed during drilling and field development; after initial reclamation, approximately 34.8 acres would remain disturbed over the life of the Project (**Table 2-3**).

Increased susceptibility to wind and water erosion would be a direct impact in newly-disturbed areas and may cause sedimentation in drainage channels or impoundments. Soil compaction caused by equipment traffic or by increased raindrop impact after loss of surface vegetation cover would decrease infiltration and percolation, increase runoff, and reduce overall water storage capacity. Susceptibility to erosion would occur primarily in the short-term and would decline rapidly over time due to the use of proper construction and reclamation techniques and the implementation of mitigation measures described in Chapter 2.

Due to the high amount of salt or sodium content/high clay material within the Project Area disturbance and/or use of this material is discouraged. Sodium affected soils could contaminate suitable material and cause dispersion of clays and sealing of reclaimed surfaces. Other direct chemical effects on the soil resource could also include reduction of overall fertility based on length

of stockpiling of material and loss of nutrients, and possible oxidation and release of elements such as boron or selenium, although no analyses were conducted.

Stripping of high clay material, surface sandy or gravelly material, as well as channery material in the subsoil, could reduce the physical suitability of the soil resource used for reclamation. If stripped and stockpiled with suitable material, contamination could result in increased droughtiness and decreased fertility, of reclamation material, as well as hamper actual seeding operations. Other physical effects on the soils resource during stripping may include: loss of soil structure and decreased permeability, mixing of various textures, and solution of surface organic matter and subsequently soil biota. Stockpiling soil material could degrade physical properties of the soil resource such as bulk density, in addition to the biological and chemical effects mentioned earlier. In addition, stockpiling of material can increase the potential for soil loss until the soil is revegetated.

Topsoil quality in the Project Area varies based on local topography and source of parent material. Primary limitations overall include: salt or sodium content, high clay content, thin soil development or inaccessibility to stripping operations, channery or high coarse fragment content, or sandy or gravelly soils. Revegetation potentials range from mostly fair to poor, with some areas rated as good. In addition to these limitations, low annual precipitation, susceptibility to wind and water erosion, and short growing season could make reclamation in the Project Area more difficult.

Due to the small area of disturbance and use of proper construction and reclamation techniques and implementation of mitigation described in Chapter 2, impacts to soil resources in the Project Area are anticipated to be minimal.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on soils would be expected to occur beyond the current situation, , where one existing well included in the Project currently affects about one acre.

WATER RESOURCES

Proposed Action

With the use of proper construction techniques, drilling practices, and with the implementation of BMPs, no adverse effect on groundwater aquifers and quality would be anticipated under the Project. Groundwater would be removed from the coal seam aquifers within the Allen Ridge and Almond Formations, members of the Upper Cretaceous Mesaverde Group. CBM testing activities likely would lower the hydraulic pressure head in the affected coal seam aquifer. The reduction of hydraulic pressure head in an aquifer also is referred to as drawdown. Relative to the available drawdown within the aquifer, effect on the coal aquifer during the interim drilling project is expected to be minimal.

The water level in an existing BLM water well completed in the Mesaverde aquifer also may be lowered or drawn down. The potential yield from the nearby water well also may be affected by the removal of groundwater under the Project. Other wells completed in the coal seams could be affected by activities under the Project, however, no other wells permitted by the WSEO are known to occur within a mile of the Project Area. Minimization of potential effects on water wells would be accomplished by the use of a water well agreement and other measures described in Chapter 2 and in the Water Management Plan (**Appendix D**).

These targeted coal seams are classified as confined to semi-confined aquifers because they are bound by aquitards consisting of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the coal seams and any aquifer stratigraphically above or below the coal seams is therefore very limited. The hydrostatic pressure head of the water measured in coal seam test wells completed in the Project Area can be considerably higher (100 to 300 feet higher) than the ground level elevation at any respective well location. Confined, or artesian, aquifer conditions of this type are indicative of an effective seal or aquitard above and below the aquifer. However, lowering of the hydraulic pressure head in the coal seam aquifers by water removal may induce a slight leakage of water through the semi-pervious shale layers into the pumped aquifer. Due to extremely low hydraulic conductivity of the confining layers, enhanced leakage from any aquifer stratigraphically above or below the affected coal seams would be minimal.

CBM exploratory wells would produce water that would be disposed of in two injection wells. The proposed injection targets for each injection well are the Cherokee and Deep Creek Sandstones, located approximately 4,170 and 4,450 feet below the surface, respectively, stratigraphically below the coal zones being explored. Background water quality analyses of the injection horizon currently are not available, but it is anticipated that the CBM produced water that would be injected would be of equal or higher quality in regards to class of use as defined by WDEQ-GWD regulations. Injection of the CBM produced water is not expected to result in any deterioration in groundwater quality within the injection horizon. These sandstones are isolated above and below by competent shale barriers that would prevent the initiation and propagation of fractures through overlying strata to any fresh water zones. The only effect on the injection horizons would consist of an increase in hydraulic head emanating from the injection well, which would dissipate with distance away from the wellbore. In terms of water quantity and quality, the Proposed Action's effect on the injection horizon would be minimal.

The fracture gradient of the shale aquitards that overlie and underlie the injection horizons would not be expected to be exceeded, so all injected water would be contained in the injection horizon and would not migrate vertically. For this reason, the injected water is not expected to degrade water quality of the Mesaverde aquifer.

The groundwater would be removed from a formation that is stratigraphically lower and hydraulically isolated from shallow groundwater sources that typically are developed with water wells. The proposed injection zone is also stratigraphically lower than the shallow groundwater sources. Shallow groundwater sources (stratigraphically above the Mesaverde coal zones) are not likely to be affected by the Project.

Monitoring of the quality of CBM produced water, the volume of water produced over time during testing, and the static water levels in nearby wells before, during, and after completion of Project activities would provide information about the groundwater system in the Project Area. This information also would be used to quantify interim drilling project impacts for use in evaluating future field development.

As all produced water is to be injected under the Project, surface water quality or quantity would not be affected directly by the disposal of produced water. Pedco would implement BMPs to ensure spills of produced water do not occur.

Surface disturbance associated with drilling activities, such as removing vegetation and stockpiling topsoil, road construction, or shallow excavations for drill pads or facilities, would increase the potential for erosion or bringing increased sediment and salt load to the already overburdened Muddy Creek drainage. Pedco would implement the mitigation measures described in Chapter 2 to control wind and water erosion at disturbed sites so that the drainage is not affected by interim drilling activities. Practices that Pedco has committed to in Chapter 2 and existing regulatory requirements would include the design of surface-disturbing activities in a manner that diverts and controls runoff, as needed, and provides for the re-establishment of vegetation on disturbed areas at the earliest opportunity. These measures, collectively, would represent BMPs for erosion control. The application of these BMPs would result in minimal impacts on water and soil resources.

Potential impacts that could occur to the surface water system under the Project include increased surface water runoff and off-site sedimentation due to soil disturbance, water quality impairment of surface waters, and stream channel morphology changes due to road and pipeline crossings. Effects on surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration of time within which construction activities occur, and the timely implementation and success/failure of mitigation measures. Increased sedimentation is not expected to occur as a result of the implementation of the Project due to compliance with measures described in Chapter 2.

Construction activities would occur over a relatively short period of time. Construction impacts would likely be greatest shortly after the start of the Project and would decrease in time due to stabilization, reclamation, and revegetation efforts. The construction disturbance would not be uniformly distributed across the Project Area, but rather, Project construction activities would be concentrated within and around the wells.

Water for use in drilling the initial CBM well in the Project Area would be obtained from a local source and water for drilling the remaining wells would be obtained from the first well drilled. The Project would require approximately 84,000 gallons (0.26 acre-foot) of water per well for completion, well stimulation and dust control. This water requirement is relatively small and would not adversely affect existing surface or groundwater sources or rights.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on water resources would be expected to occur beyond the current situation.

VEGETATION/WETLANDS/NOXIOUS WEEDS

Proposed Action

Implementation of the Project would result in the loss of natural vegetation in terms of cover and species composition in areas where well sites, facilities, and access roads would be constructed. An estimated 78.5 acres would be affected by surface-disturbing activities during drilling and testing. To avoid permanent loss of species diversity and vegetative cover, topsoil would be stockpiled, and reclaimed areas would be seeded with site-specific mixes during appropriate planting periods.

Should the CBM exploratory wells be productive, the surface areas required for production facilities would not be reclaimed until production ends, which could be within five to fifteen years. An estimated 34.8 acres could be affected by production facilities over the long-term.

Indirect effects would include increased potential for weed invasion, exposure of soils to accelerated erosion, loss of habitats and changes in visual aesthetics. Use of BMPs described in Chapter 2 during construction, operation, and reclamation activities would minimize effects on vegetation resources. Weed monitoring would occur during drilling, production, and reclamation activities. Weeds found would be eradicated following county control procedures. Properly reclaimed areas free of weed species would not cause loss of habitat or change visual aesthetics.

The Wyoming big sagebrush, greasewood, and saltbush cover types that would be disturbed under the Project are commonly found across southwest Wyoming. The short-term or long-term loss in acreage described above would not impact the overall abundance and quality of these habitats.

In general, the duration of effects on vegetation in the Project Area would depend on the time required for natural succession to return disturbed areas to pre-disturbance conditions of diversity (species diversity and structural diversity). Reestablishment of pre-disturbance conditions would be influenced by climatic (growing season, temperature, and precipitation patterns) and edaphic (physical, chemical, and biological soil conditions) factors. This would include the amount and quality of topsoil salvaged, stockpiled, and spread over disturbed areas.

Surface disturbance activities could affect vegetation directly and indirectly by destroying individuals or their habitat, and introducing weeds. Weedy species often thrive on disturbed sites such as road ROWs and out-compete more desirable plant species. Increased weed invasion may render a site less productive as a source of forage for wildlife and livestock. However, given the application of mitigation measures summarized in Chapter 2, invasion of weed species is not expected.

No federally listed threatened or endangered plant species are known to occur in the Project Area; therefore, implementation of the proposed development would not adversely impact federally-listed species.

The distribution of plant species of concern is likely limited in the Project Area due to a lack of suitable habitat for most of the species. Due to the low likelihood of the sensitive plant species to occur in the Project Area and the small amount of disturbance associated with the Project, no effects on the plant species of concern would be expected to occur.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on vegetation resources or wetlands would be expected to occur beyond the current situation.

RANGE RESOURCES AND OTHER LAND USES

Proposed Action

Anticipated effects on range resources associated with the Project are limited to a minimal loss of forage, an increased potential for vehicle/livestock collisions and an increased potential for the spread of noxious and invasive weeds (previously discussed above under Vegetation/Wetlands/Noxious Weeds). The Project would not be likely to result in noticeable effects on range resources.

Livestock grazing activities would continue during the drilling, field development and operations phases of the Project. Forage in the Project Area would be reduced slightly during drilling and field development and restored as soon as practical thereafter, except for areas used for roads, production equipment and ancillary facilities, which would remain disturbed throughout the productive life of the field. The increased traffic in the Project Area during the drilling and field development phase could correspondingly increase the potential for vehicle/livestock accidents during that period.

The Project would result in an estimated 78.5 acres of short-term disturbance during drilling and field development; an estimated 34.8 acres of long-term disturbance would remain after the initial reclamation activities described in Chapter 2 are completed (**Table 2-3**). The short-term drill pad and ancillary facility disturbance would be reclaimed as soon as practical after field development, as would all areas disturbed for gas and produced water pipelines. All remaining disturbed areas would be reclaimed at the end of field operations, except those facilities which the BLM may identify as desirable for another use.

The average stocking rate for the Doty Mountain Allotment is 12 acres per AUM and 8 acres per AUM for the Cherokee Allotment. The Project would result in a short-term loss of forage associated with about three AUMs in the Doty Mountain Allotment and five AUMs in the Cherokee Allotment. This would correspond to a very small long-term reduction in available forage within

the Doty Mountain and Cherokee Allotments. These losses would amount to substantially less than one percent of the total grazing capacity in these areas.

There is potential for conflict between activities under the Project and range operations. The increased activity associated with drilling and field development could result in increased vehicle/livestock collisions. The activities under the Project also could benefit range operations. Reclamation may result in increased forage production and availability, since shrubs would be removed in disturbance areas, and shrub species would be slow to recover.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on range resources would be expected to occur beyond the current situation.

WILDLIFE/FISHERIES

Proposed Action

The effects on wildlife would be associated with Project construction and operation, including the displacement of some individuals of some wildlife species, loss of wildlife habitats due to the development of drilling and production operations, an increase in the potential for collisions between wildlife and motor vehicles, and an increase in the potential for illegal kill, harassment, and disturbance of wildlife due to increased human presence and improved vehicle access. The magnitude of impacts to wildlife resources would depend on a number of factors including the type and duration of disturbance, the species of wildlife present, time of year, and successful implementation of avoidance and mitigation measures.

The effect of the Project would be the short-term loss of natural habitats in areas where well sites, facilities, and access roads would be constructed. An estimated 78.5 acres would be affected by surface-disturbing activities during drilling and testing.

Should the CBM exploratory wells be productive, the surface areas required for roads or production facilities would not be reclaimed until production ends, which could be within five to fifteen years. An estimated 34.8 acres could be affected by production facilities over the long-term.

Construction, operation, and maintenance of the proposed CBM wells and associated facilities are expected to have minimal short-term effects on wildlife in the Project Area. Some wildlife species may be temporarily displaced during the construction on pipeline routes, well sites and access road locations, but should return once construction is complete. Extensive suitable habitats for many species exist on lands adjacent to the Project Area and would support any individuals that may be temporarily displaced. Long-term effects on wildlife are expected to be minimal, as most species would become accustomed to routine operation and maintenance activities. Only a very small proportion of the available wildlife habitats in the Project Area would be affected. The capacity of

the Project Area to support various wildlife populations should remain essentially unchanged from current conditions.

During the production phase, the unused portion of well sites and pipelines would be reclaimed. Following completion of production operations (life of the Project is estimated at 10-20 years), the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed and the areas revegetated with seed mixes approved by the BLM, some of which are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to pre-disturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation, however, much more time would be required to achieve reestablishment of shrub communities. Consequently, disturbance of shrub communities would result in a longer-term loss of those habitats.

In addition to the direct loss of habitat due to construction of well pads and associated roads and pipelines, disturbances from human activity and traffic would lower wildlife utilization of habitat immediately adjacent to these areas. Species that are sensitive to indirect human disturbance (noise and visual disturbance) would be affected most. Habitat effectiveness of these areas would be lowest during the construction phase when human activities are more extensive and localized. Disturbance would be reduced during the production phase of operations and many animals may become accustomed to equipment and facilities in the gas field and may once again use habitats adjacent to disturbance areas.

Wildlife

The direct disturbance of wildlife habitat in the Project Area likely would reduce habitat availability and effectiveness for a variety of common small mammals, birds, and their predators. The initial phases of surface disturbance and increased noise levels likely would result in some direct mortality to small mammals and the displacement of songbirds from construction sites. In addition, a slight increase in mortality from increased vehicle use of roads in the Project Area would be expected. Quantification of these losses is not possible; however, the loss is likely to be low over the short-term. During the operations phase of the Project, increased noise levels from compressor engines and other production activities would displace some animals and would affect the production potential of some species. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed, small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation of pipelines, unused portions of roads, well pads, and wells that are no longer productive. No long-term effects on populations of small mammals and songbirds would be expected.

Big Game

In general, effects on big game wildlife species would include direct loss of habitat and forage, and increased disturbance and noise from drilling, construction, operation, and maintenance operations. Disturbance of big game species during the parturition period and on winter range can increase stress and may influence species distribution (Hayden-Wing 1980, Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly

during winter. According to management directives in the RMP (BLM 1990), crucial big game winter ranges will be closed to construction and development activity from November 15 through April 30. This partial closure of crucial big game winter ranges would reduce disturbance to wintering big game. This partial closure would also limit the potential for poaching and/or harassment of big game species wintering in the area. Recreational use of the area and production activities would not be affected by the partial closure.

Effects on big game are expected to be minimal, as the Project Area represents less than one-tenth of a percent of any species winter or year-long range (HWA 2001). No long-term habitat loss is expected once construction is complete, as big game species are expected to return to the area.

A portion of the Project Area has been designated as crucial winter range for pronghorn antelope. Activities associated with the construction phase of the Project would likely temporarily displace antelope, however, once construction is complete antelope would likely habituate and return to pre-disturbance activity patterns. Reeve (1984) found that pronghorn acclimated to increased traffic volumes and machinery as long as the traffic and machines moved in a predictable manner. Overall, no noticeable effects on the antelope population utilizing the Project Area are expected, provided mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

Upland Game Birds

No noticeable effect on the greater sage grouse population is expected provided all applicant-committed and BLM-required mitigation measures described in Chapter 2 are followed. The Project Area is considered a sensitive resource area and mitigation measures described in Chapter 2 and included as Application for Permit to Drill (APD) conditions of approval must be followed to protect this area.

Well site production facilities often act as raptor perches, increasing predation on greater sage grouse and other wildlife. Use of low profile structures should mitigate these potential effects if any wells produce commercial quantities of CBM.

Although no active leks are located in the Project Area, suitable greater sage grouse habitat is abundant. The amount of habitat disturbance would be minimal, considering the amount of habitat available in the Project Area. However, greater sage grouse can be impacted by other activities associated with CBM development, including increased human activity, increased traffic disturbance, and pumping or compressor engine noises. Increased noise levels occurring in sensitive resource areas could affect the ability of greater sage grouse to carry out mating activities. Careful siting of noise sources, addressed in applicant-committed and BLM-required mitigation measures in Chapter 2 and in the Blue Sky Project, would result in minimal effects on greater sage grouse.

The RMP contains mitigating measures that protect the nesting activities of greater sage grouse from February 1 to July 31, including strutting grounds and nesting habitat. Exceptions may be granted if the activity will occur in unsuitable nesting habitat. No surface occupancy stipulations apply within a one-quarter mile buffer around active leks, however there are no NSO areas located in the Project Area associated with greater sage grouse leks. The portion of the Project Area included

within the two-mile buffer of an active greater sage grouse lek is a sensitive resource area according to the Interim Drilling Policy and mitigation measures must be followed to protect this area, especially during time periods when greater sage grouse mating activities could be affected by noise associated with the Project. If all avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are implemented, minimal impacts to greater sage grouse populations or habitats are expected.

Raptors

Above-ground power lines are not included in the Project, and are not considered here. The principal potential effects of the Project on avian species would be nest abandonment and/or reproductive failure caused by Project-related disturbance and increased noise levels, increased public access and subsequent human disturbance resulting from new construction or production activities, and small, temporary reductions in prey populations for raptors. However, no active raptor nests were found within or near the Project Area during a 2001 survey.

No effects on breeding raptors are expected, provided avoidance and mitigation measures are followed. Oil and gas mitigating measures contained in the RMP state that no activity or surface disturbance would be allowed near raptor nesting habitat from February 1 through July 31. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether the nest is within the line of sight of construction activities. No effects on breeding raptors are expected, provided that avoidance and mitigation measures in this document, the RMP and the Interim Drilling Policy are followed.

Threatened and Endangered Species - Wildlife and Fish

Wildlife Species

The following wildlife species are either threatened, endangered, or proposed for listing under the ESA: black-footed ferret; mountain plover; bald eagle; and Canada lynx. These species may have potential to occur on or near the Project Area and therefore potential impacts to these species that could occur under the Project are considered.

In Wyoming, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food, and they depend upon prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980). A large portion of the Project Area consists of prairie dog towns having sufficient size and burrow densities to be considered potentially suitable habitat for black-footed ferrets (HWA 2001). Prairie dog towns must be greater than 200 acres and have a burrow density greater than or equal to 8 burrows/acres in order to be considered suitable for black-footed ferrets (Biggins et al. 1989). However, no ferrets or their sign were found during a nocturnal survey over the entire prairie dog town conducted in August 2001 (HWA 2001). Implementation of the Project would not be expected to impact black-footed ferrets.

Although no mountain plovers were found during 2001 surveys, the presence of prairie dog towns indicates that plovers may use these areas during some times. The potential exists for effects on mountain plovers if nesting habitat were removed or an active nest were disturbed. However, two patches of potential mountain plover habitat were surveyed in 2001 and no mountain plovers were observed (HWA 2001). If mountain plovers are observed on the Project Area in the future, the avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy would be followed to ensure no significant impact to mountain plovers occurs. Implementation of the Project is not expected to affect mountain plovers, provided any required avoidance and mitigation measures are implemented.

The Project is not expected to affect bald eagles provided avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy are implemented. Bald eagles do feed on road-killed carrion in the Project Area and workers should be educated about the danger of striking a bald eagle with a vehicle.

The Canada lynx is not expected to occur within the Project Area because of the lack of potentially suitable habitats. Thus, the implementation of the Project is not expected to affect Canada lynx.

Fish Species

The lack of large river habitat within the Project Area precludes the occurrence of adults of the four species of endangered fish. Additionally, critical habitat has not been established anywhere in Wyoming for any of these species (Upper Colorado River Endangered Fish Recovery Program 1999).

Depletions to the Colorado River resulting from reduced groundwater discharge (base flows) are not expected due to the Project's distance from the Colorado River and the subsurface orientation, or bedding attitude, of the aquifers contained in production formations that would be affected by the Project. Orientation of the Mesaverde aquifer would preclude groundwater contained in the coal zone being produced from discharging as base flow to the Colorado River or its tributaries (Whitehead 1996). Therefore, removal of groundwater from the Mesaverde aquifer during the Project would not be expected to affect base flows of the Colorado River or its tributaries.

Water quality effects on the Colorado River resulting from reduced quality of groundwater discharge (base flows) are not expected due to the Project's distance from the Colorado River and the subsurface orientation, or bedding attitude, of the aquifers contained in injection formations that would be affected by the Project. Orientation of the injection zone formations would preclude groundwater being injected from discharging as base flow to the Colorado River or its tributaries (Whitehead 1996). Therefore, injection of produced water during the Project would not be expected to affect base flows or water quality of the Colorado River or its tributaries.

Confining layers are expected to preclude interaction between the injection and production formations. No major faults are known to occur in the area. Faults, if present, could serve as conduits for water to migrate between formations. Improperly completed wells also could serve as conduits for water to migrate, unless drilling practices specified by the BLM and the WOGCC are strictly followed.

No surface water withdrawals from Colorado River system drainages are included in the Project, and no surface discharge of produced water is planned. The Project would not be expected to affect surface water quantity or quality of the Colorado River or its tributaries. The course of the Colorado River comes no closer than 140 miles to the Project. In order for surface water in drainages in the Project Area to reach the Colorado River, water would have to flow from Muddy Creek to the Little Snake River to the Yampa River to the Green River, finally reaching the Colorado River in southeastern Utah.

Colorado Pikeminnow

Although Muddy Creek and the Little Snake River may potentially support this species of fish at certain times, this species is absent downstream from the Project Area. The Project would have no impact on this species.

Bonytail and Humpback Chub

These species are absent downstream from the Project Area, therefore the Project would have no impact on these species.

Razorback Sucker

Suitable habitat is not available in the Little Snake River drainage, therefore, the Project would have no impact on this species.

Within Muddy Creek, sediment levels may be elevated during construction of well access road crossings and road grade along and across the creek. Implementing reasonable precautions to limit offsite sediment movement from these areas would prevent substantial increases in sediment loadings in the downstream section of Muddy Creek and downstream from its confluence with the Little Snake River, and would avoid violation of Wyoming Surface Water Quality Standards (WDEQ 2001). Because the limited water development and usage for this Project are predicted to only affect subterranean aquifers related to the coal seams, surface flows would not be affected by wells developed for this Project.

The occurrence of these endangered fish species has not been confirmed in the Muddy Creek drainage or immediately downstream in the Little Snake River, and their occurrence is highly unlikely. If any of these species are identified within the downstream portion of Muddy Creek or immediately downstream in the Little Snake River, the BLM should consult with the FWS and develop a protection plan for the fish. Given these precautionary measures, no adverse impacts to any of these species would be expected to result from the implementation of the Project.

Species of Concern - Wildlife and Fish

Wildlife

Effects on BLM wildlife species of concern could occur due to loss of habitat or displacement due to increased noise levels. Due to the relatively small size of the Project Area, the inherent mobility of the species of concern, and abundance of nearby potentially suitable habitats, no noticeable effects are expected under the Project, provided avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy are followed.

Fish

If measures to prevent downstream sedimentation are implemented to prevent offsite movement of fluid spills (if any occur) or disturbed soils caused by construction activities under the Project (WDEQ 1997 and 2000), implementation of the Project is not likely to adversely effect BLM sensitive fish species occurring within or downstream of the Project Area. Implementation of reasonable precautions to limit offsite sediment movement should prevent violations of Wyoming Water Quality Standards (WDEQ 1997 and 2000). Further, to avoid depletion of Muddy Creek and Little Snake River surface flows, and subsequent adverse impacts to these species due to surface or near surface water removals for well site use, water would be drawn from deep aquifer wells. Stream crossings of Muddy Creek, Cow Creek, and Dry Cow Creek will be constructed to provide passage for upstream spawning migrations of these sensitive native fishes. Given these precautionary measures, implementation of the Project is not likely to adversely effect the roundtail chub, bluehead sucker, flannelmouth sucker, or Colorado River cutthroat trout.

Mitigation

The BLM may require that noise levels be limited to no more than 10 dBA above background levels at greater sage grouse leks and other sensitive resource areas. In order to comply with the above noise level limits, the BLM may require compressor engines to be enclosed in a building and located at least 600 feet away from sensitive receptors or sensitive resource areas (BLM 1999b).

Residual Impacts

Where indications are that noise levels are 10 dBA or more above background levels at lek locations or other sensitive areas, the implementation of the above mitigation measure should reduce the impact of noise from production facilities on strutting greater sage grouse or other affected species. Long-term impacts on species affected by increased noise levels could include displacement and decreased production potential, resulting in reduced populations in the Project Area.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on wildlife or fisheries or threatened, endangered, or sensitive species would be expected to occur beyond the current situation.

RECREATION

Proposed Action

Due to the abundance of nearby similar recreational opportunities for hunting, camping, and off-road vehicle use, no noticeable effects on recreational experiences are expected under the Project. Impact to the recreation use of the Project Area would involve a temporary displacement of some hunters, particularly during construction and drilling activities. Some hunters perceive these activities as displacing game species and creating an environment that detracts from the hunting experience. Hunter displacement would be highest during the general deer and elk season when the most users are in the area. The proposed drilling schedule would limit displacement to one season. Hunters could relocate to other hunting areas near the Project Area.

Undisturbed landscapes, isolation and solitude are often important to nonconsumptive users such as photographers and backpackers. Project-related disturbances that adversely impact the characteristic landscape could also contribute to a decline in the recreation experience for these users. There may be some displacement of these users to more pristine landscapes such as the Adobe Town Wilderness study area. The recreation experience for those continuing to use the area would be less satisfying than use under the pre-disturbance conditions described in Chapter 3.

The affects described above would diminish substantially once drilling and construction were completed. However, they would persist at reduced levels. Patterns of game use and population densities would change slightly as a result of implementation of the Project. Some long-term displacement, permanent or relocation, of hunters and nonconsumptive users likely would result under the Project. Further, there may be reduced levels of satisfaction for those recreationists who might continue to use the Project Area. Overall effects on the recreation resource would be minimal due to the short-term nature of drilling and construction activities, and concentrated locations of activities.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on recreation resources would be expected to occur beyond the current situation.

VISUAL RESOURCES

Proposed Action

As noted in Chapter 3, Affected Environment, the Project Area is not pristine. Off-road vehicle tracks exist throughout the area, and are used by ranchers, recreationists and mineral developers. No effects on the existing visual resource management class (Class III) are expected under the Project.

Short-term impacts to the visual resource associated with construction and drilling in the Project Area would include contrasts in line, form, color, and texture. These contrasts would be associated with drilling rigs, construction equipment, service trailers and the general industrial character of drilling activities. Additional impacts may occur from fugitive dust produced by construction activities.

The Project Area would not be visible from Wyoming State Highway 789 or from the community of Baggs. Potential viewers of the contrasts described would be few in number and would include hunters and other recreationists, ranchers, and oil and gas field workers.

In the BLM's VRM rating system, the severity of impact is related to the scenic quality, sensitivity level, and distance zone of the affected environment. In general, short-term impacts would be most severe where the level of contrast is high and is highly visible to potentially large numbers of viewers.

The short-term impacts would exceed the level of contrast permitted in Class III areas; however, because the contrasts would be seen by relatively few viewers and would be short in duration, they would be considered minimal.

Permanent production facilities, as described in Chapter 2, would remain once well drilling activities were completed. The presence of permanent production facilities would have continued impacts over the long-term.

These facilities would create contrasts in line, form, color, texture and overall pattern in the landscape that would remain for the duration of the Project. Fugitive dust impacts as part of ongoing operations would also persist. However, as noted for short-term impacts, these contrasts would not be visible to many viewers. With the application of mitigating measures described in Chapter 2, the level of contrast would not exceed Class III standards. Levels of contrast would, however, detract from the recreation experience of visitors to the Project Area.

Additional fixed facilities such as access roads (improved and unimproved roads and overland routes) would be required to service production facilities. Roads would create additional contrasts in line, color and texture to those described above. With appropriate mitigation, the level of contrast would not exceed Class III standards. However, contrasts could diminish the experience of motorists and recreationists.

Residual Impacts

As a result of siting facilities where they would be least observed, fewer recreationists may be inclined to leave the Project Area.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on visual resources would be expected to occur beyond the current situation.

CULTURAL RESOURCES

Proposed Action

It should be possible to eliminate direct and indirect adverse effects to historic properties through avoidance and/or mitigative measures (i.e., data recovery or recordation) on a case-by-case basis. Potential surface disturbance areas under the Project include portions of three identified sites (48CR7556, 48CR7560, and 48CR5491). The preliminary finding is that site 48CR7556 represents the remains of a prehistoric open camp and is not considered eligible for inclusion in the National Register of Historic Places. The preliminary finding is that site 48CR7560 represents the remains of a prehistoric open camp and is considered eligible for inclusion in the National Register of Historic Places. The preliminary finding is that site 48CR5491 represents the remains of a prehistoric open camp and is considered eligible for inclusion in the National Register of Historic Places.

Direct impacts would primarily result from construction related activities. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities and the construction of roads and pipelines. Sites located outside the Project Area would not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the Project is judged to have no effect. Alteration of the environment abutting eligible historic properties may be considered an adverse effect in the form of a direct impact.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

Contributing segments of historic trails would be avoided by a one-quarter mile buffer zone or outside the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors. An intensive ground search was conducted, however, no physical

evidence of the Rawlins-Baggs Stage Road was found. The Project is not expected to have an impact on this resource.

Block surveys have been completed in the Project Area, as required by the Interim Drilling Policy. Identification of important sites prior to disturbance would minimize impacts to cultural resources. The likelihood exists that buried sites could be disturbed during construction. Implementation of measures described in Chapter 2 would reduce impacts and minimize the loss of information.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on cultural resources would be expected to occur beyond the current situation.

SOCIOECONOMICS

Proposed Action

Socioeconomic impacts of the Project would be largely positive. The Project would enhance regional economic conditions and generate local, state and federal government tax and royalty revenues. The relatively small, short-term drilling and field development workforce would not generate noticeable population effects or demand for temporary housing or local government services.

The Project would involve capital investment in gas wells, produced water injection wells, gathering systems, compression stations and other field infrastructure. The Project would require between 16 and 36 drilling and field development workers over a 30 to 45-day period and one operations worker as much as a 20 year period (**Table 2-2**).

Development and operation of the Project would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry and from other industries. Expenditures by the proponent for these goods and services, coupled with employee and contractor spending, would generate economic effects in Carbon County, southwest Wyoming and the nation as a whole. The Project may create up to three new indirect jobs (defined as jobs which become available in support industries as a result of Project activities).

It is reasonable to assume that the direct and indirect economic benefits of the Project would be positive.

Carbon County Oil and Gas Activity

Successful completion of the Project would increase natural gas production in Carbon County, particularly during the first several years of production. In 1999, a total of 127 APDs were issued for Carbon County. The 23 wells associated with the Project would be about 19 percent of the 1999 APD level for the county. However, the relatively short drilling time and low infrastructure and labor requirements associated with CBM wells would not result in a substantial increase in drilling activity or drilling employment in the county.

Economic effects on grazing activities would include very small losses of forage due to temporary and long-term disturbance, until revegetation of disturbed areas is successful. Temporary disturbance could result in a very small reduction in grazing activity. If grazing activity does not increase accordingly in nearby areas, the associated grazing economic activity in Carbon County could be lost. A recent UW study estimated that each AUM of cattle grazing was worth \$65.07 in total economic impact in the region (UW 2000). Using this estimate, the Project could result in a loss of \$65.00 annually in the Doty Mountain Allotment and \$130.00 annually in the Cherokee Allotment for the life of the Project.

Some hunters and other recreationists may be temporarily displaced from the area associated with the Project during drilling and field development. The effects of the Project on the Carbon County hunting and recreation economy are not expected to be noticeable, given the short-term nature of the drilling and field development period, and the potential that hunters and recreationists may use other areas within Carbon County during this period.

Population Effects

Population effects of the Project would not be noticeable. Some of the skills and services required for the Project are available in the local labor pool, although the recent increase in both conventional oil and gas and CBM drilling activity in southwest Wyoming has absorbed much of the available oil and gas service workforce. Of the short-term demand for 16 to 36 drilling and field development workers, some would likely be contractors from other areas of Wyoming (Rock Springs, Gillette, Casper) and from northern Colorado. The remainder would be hired from the local workforce. Given the short duration of the drilling phase (under two months), most nonlocal workers relocating to Carbon County would be of single status, i.e., without family members.

Nonlocal workers would attempt to obtain temporary housing as close to the work site as possible, most likely in Baggs. Workers not able to secure temporary housing in Baggs might locate in Rawlins or Rock Springs, Wyoming, or in Craig, Colorado. Given the current level of drilling and field development activity occurring in Wamsutter, it is unlikely that Blue Sky project drilling and field development workers would find temporary housing accommodations in that community.

Given the relatively small workforce and short-term nature of the drilling and field development phase of the Project, area businesses could accommodate the increase in economic activity with existing employees.

Temporary Housing Demand

The relatively small demand for temporary housing during drilling and field development under the Project could be accommodated by existing temporary housing resources. Demand may be accommodated in Baggs, Rawlins, Rock Springs and/or Craig, depending on seasonal considerations and other oil and gas industry activity.

Law Enforcement and Emergency Response

The relatively small level of field development and operations activity would be accommodated by existing law enforcement and emergency management resources.

Fiscal Effects

If CBM wells drilled under the Project are productive, the fiscal effects from the facilities developed and the CBM that could be produced from the Blue Sky Project would be considerable. These effects would contribute to the financial well being of Carbon County, including its schools and roads, the State of Wyoming, and the U.S. Treasury.

The production of CBM would generate revenues for the U.S., the State of Wyoming, and Carbon County from the following sources. The distribution of these revenues would vary, but revenues from most sources listed would be shared. Revenue sources consist of the following: federal and state oil and gas royalties, severance taxes, property taxes, sales and use taxes, ad valorem taxes, and federal and state income taxes of those engaged in or supporting CBM development. These increased revenues would be realized for the life of the Project.

To gain an understanding of the potential economic effect of CBM development in the Project Area, estimates can be made based on assumptions regarding methane production rates, sales expectations, and the productive life of a CBM well. Since no reliable data for the Atlantic Rim area will be available until sufficient exploratory drilling evaluates the area, the assumptions presented here for the purpose of this analysis may change.

For the purpose of this analysis, if each successful CBM well in the Blue Sky Project has a productive life of 15 years, and produces on average, nearly 100 mmcf per year of methane, and this methane is sold for \$2.50 per mcf, the sales value of each well would be about \$3,500,000. If 20 federal CBM wells within the Blue Sky Project were productive, the federal royalties would be nearly \$9,000,000. The severance tax collected by the State of Wyoming would exceed \$4,000,000. The ad valorem taxes collected by Carbon County also would exceed \$4,000,000. These values are approximate and are intended to give an idea of the order of magnitude of possible fiscal effects.

Environmental Justice

The Project would not directly effect the social, cultural, or economic well-being and health of minorities or low income groups. The Project Area is relatively distant from population centers, so no populations would be subjected to physical impacts from the Project.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No federal mineral royalties would be gathered. No additional socioeconomic effects would be expected to occur beyond the current situation.

TRANSPORTATION

Proposed Action

Federal and State Highways

The Project would generate increases in traffic volumes on highways providing access to the Project Area and on county and operator-maintained roads within the Project Area. These increases would result from the movement of Project-related workers, equipment and materials to and from the Project Area to perform drilling, field development, well service, field operations and reclamation activities.

Table 2-2 shows the estimated average number of trips associated with various well field activities. According to information provided by the proponent, drill rigs, water trucks and other items of heavy equipment would be transported to the Project Area and remain within the Project Area until drilling is completed. Materials and supplies would be delivered on a weekly basis and stockpiled within the Project Area at a staging area. Drilling and completion crews and other personnel would commute to the Project Area daily, except for drilling engineers who would stay in a trailer at the drill site during the work week. Based on these plans and the estimates contained in the table, the Project would generate between 15 to 20 round trips per day over a 45-day period during drilling and field development. After the drilling and field development phase is completed, Proposed Action-related traffic would average one or two trips per day, with slightly higher peak periods when maintenance activities are performed on wells and facilities.

Based on these assumptions and estimates, the incremental increase in area traffic associated with the Project would not result in a significant deterioration of level of service for I-80 or SH 789 (Rounds 2000).

Given the relatively small increment of traffic and the relatively short duration of the drilling and field development phase, it is unlikely that the Project would result in a measurable increase in accident rates on federal and state highways; during the operations phase, the probability of an increase in accident rates attributable to the Project is negligible.

County Roads

The Project would result in increases in traffic on the county roads that provide access to the Project Area (CCR 605 and CCR 608). The relatively small, short-term increases in traffic are

unlikely to result in significant deterioration of the roads or substantial increases in accidents. The primary effects of Proposed Action-related traffic on county and BLM roads would be to accelerate road maintenance requirements. The cost associated with accelerated road maintenance requirements on county roads may be offset by the Proposed Action-related revenues generated to county government, which are described under Socioeconomics.

Increased traffic would generate an increase in the potential for vehicle/stock accidents, although the slower speeds required by the condition of county roads tend to minimize the frequency of such accidents (Warren 2000). Coordination with livestock operators during sensitive periods (e.g., cattle movements and calving season) could further reduce potential for vehicle/stock accidents.

Internal Roads

The Access Road Construction section in Chapter 2 describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the Project Area. Based on these proposals, an estimated 7.4 miles of new roads would be constructed within the Project Area. The operator would be responsible for constructing and maintaining new and improved roads within the Project Area, therefore, no fiscal impacts are anticipated for the BLM or Carbon County.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional transportation effects would be expected to occur beyond the current situation.

HEALTH AND SAFETY

Proposed Action

Health and safety impacts of the Project would include a relatively low risk to Project workers from industrial accidents, firearm accidents and natural disasters. There would be a slight increase in risk of traffic accidents and range fires for the general public during drilling and field development and a negligible increase during field operations.

Occupational Hazards

During the 45-day drilling and field development phase of the Project when a peak of 36 workers may be employed, the statistical probability of injuries is low. During field development, the annual statistical probability of injuries is minimal, given that only one worker would be employed.

The BLM, WOGCC, WDEQ, OSHA, and USDOT each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the Proponent and

enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the Project Area, and the relatively low use of these lands by others (primarily grazing permittees and hunters), occupational hazards associated with the Project would mainly be limited to employees and contractors rather than the public at large.

Pipeline Hazards

Increasing the miles of gathering line within the analysis area would increase the chance of a pipeline failure. Therefore, the relatively small amount of new pipeline associated with the Project, coupled with the low probability of failure and the remoteness of the Project Area would result in minimal risk to public health and safety. Signing of pipeline rights-of-way would reduce the likelihood of pipeline ruptures caused by excavation equipment, especially in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Other Risks and Hazards

Risks to public health and safety are not expected to increase under the Project. Highway safety impacts are discussed under Transportation. Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Chapter 2.

The potential for firearms-related accidents would occur primarily during hunting season. If drilling and field development would occur during hunting season, the substantial activity in the Project Area would encourage hunters to seek more isolated areas, thus reducing the potential for accidents. The relatively few personnel on site during production operations would result in minimal risk of firearms-related accidents.

The risk of fire in the Project Area would increase under the Project but would remain minimal. Fire is a potential impact associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. This small risk would be reduced further by the placement of facilities on pads and locations that are graded and devoid of vegetation. In the event of a fire, property damage most likely would be limited to construction or production related equipment and range resources. Fire suppression equipment, a no smoking policy, shutdown devices and other safety measures typically incorporated into gas drilling and production activities also would minimize the risk of fire. There would be a heightened risk of wildfire where construction activities place welding and other equipment in close proximity to native vegetation. Given the limited public use and presence in the Project Area, the risk to the public would be minimal. There would be a small increase in risk to area fire suppression personnel associated with the Project.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional effects on public health or safety would be expected to occur beyond the current situation.

NOISE

Proposed Action

Noise associated with construction and natural gas production operations can create a disturbance that affects human safety (at extreme levels) or comfort as well as modify animal behavior. Determining activities that exceed the maximum standards is not a simple issue since perception of sound varies with intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. Noise levels in excess of the 55 dBA maximum standards can occur at construction and production operations. Noise levels around a compressor engine contained in an enclosed building would be below 55 dBA at an estimated 600 feet from the compressor site (BLM 1999b).

Construction-related impacts would be short-term, lasting as long as construction activities were ongoing at well sites, access roads, pipelines, and other ancillary facilities such as compressor sites. Noise would be created over a longer term at the individual well sites as a result of production facilities.

Given the low human population densities in the Project Area, construction and development operations under the Project would be sufficiently distant from residences that none would likely be affected by construction or development operations. Overall noise produced by construction and support services equipment during peak activity periods would be moderate because of its dispersed and short-term nature.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. No additional noise effects would be expected to occur beyond the current situation.

CUMULATIVE IMPACTS

Proposed Action

Cumulative impacts are those that would result from the incremental impacts of the Project when added to non-Project impacts resulting from past, present, and reasonably foreseeable future actions (RFFAs). Reasonably foreseeable development is that any development likely to occur within the Project Area, or cumulative impact assessment area (CIA) within the next five years. CIA areas vary between resources and are generally based on relevant landscapes, resources, projects, and/or jurisdictional boundaries.

The only major resource development currently proposed near the Project Area is the exploration activity planned under the Interim Drilling Policy for the Atlantic Rim CBM Project Area (**Appendix A**). Thus, the effects of the Blue Sky Project (described in this chapter) would not overlap cumulatively with the effects of current or reasonably foreseeable projects or activities other

than the interim drilling program, grazing activities, and existing or planned prescribed burns within the Atlantic Rim CBM Project Area.

The Interim Drilling Policy allows a maximum of 200 coalbed methane wells within the Atlantic Rim CBM Project Area, for research and exploratory purposes, during the interim period while the Atlantic Rim EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated. Surface-disturbing activities for these 200 wells may affect an estimated 650 acres, including an estimated 60 miles of new road access (new roads associated with the interim drilling program will likely be in the form of spur roads from the existing road network) and an estimated 100 miles of water and gas flowlines. If productive, and following reclamation of short-term disturbance, long-term disturbance associated with the 200-well interim drilling program would likely affect an estimated 200 acres. These 200 acres would be reclaimed at the conclusion of the interim drilling program. Total distance between pods 1 and pod 9 is about 40 miles. The distances between the individual pods vary, from 1.5 miles between pods 2 and 3, to over 6 miles between pods 7 and 8. The Blue Sky Project is part of the 200-well interim drilling program, and is also known as pod 7.

Past or existing actions on or in the vicinity of the Project Area that continue today and have major influences on the area include the road network, non-CBM oil and gas wells, ranching/livestock facilities (i.e. fences, stock watering facilities, ranch houses, power lines, and pipeline, etc.), prescribed burns, and previously approved CBM wells and associated facilities. **Table 4-1** provides a summary of the cumulative impacts analysis requirements for each of the resource values in the other eight pods associated with interim development in pod 7.

Resource Value	POD 1	POD 2	POD 3	POD 4	POD 5	POD 6	POD 8	POD 9	Discussion
Geology	X	X	X	X	X	X	X	X	All wells completed in the Almond Formation of the Mesaverde Group
Air Quality	X	X	X	X	X	X	X	X	All in Laramie Air Basin
Soils	O	O	O	O	X	X	X	0	Impact discussion limited to Muddy Creek CIA area
Surface Water	O	O	O	O	X	X	X	O	Pod 7 located in Muddy Creek CIA area; Pod 7 would have no impacts on other watersheds
Groundwater	X	X	X	X	X	X	X	X	Production of groundwater for all Pods from coalbed formations
Vegetation	O	O	O	O	X	X	X	O	Limit impact discussion to the Muddy Creek CIA area
Range Resources	O	O	O	O	X	X	O	O	Pods 5, 6, 7 in the Doty Mountain Allotment

Resource Value	POD 1	POD 2	POD 3	POD 4	POD 5	POD 6	POD 8	POD 9	Discussion
Wildlife	X	X	X	X	X	X	X	X	Greater Sage grouse habitat in all pods, no surface occupancy within ¼ mile of leks & within greater sage grouse crucial wintering areas. No drilling in prairie dog towns without black-footed ferret clearance
Crucial Winter Range (CWR)	O	O	O	O	O	X	O	O	Pod 6, 7 pronghorn CWR
Recreation	X	X	X	X	X	X	X	X	Minimal displacement of hunters & recreationists
Visual	X	X	X	X	X	X	X	X	Minimal displacement of recreationists
Cultural	O	O	O	O	O	O	O	O	Block surveys required in each Pod, with additional mitigation; no cumulative relationship
Socioeconomic	X	X	X	X	X	X	X	X	All pods within the same socioeconomic area
Transportation	X	X	X	X	X	X	X	X	Increased traffic
Health and Safety	X	X	X	X	X	X	X	X	Major related health and safety issues related to travel
Noise	O	O	O	O	O	O	O	O	Localized affect on wildlife

X - Discussed in the CIA;

O - Not discussed in the CIA (no cumulative relationship)

The CIA area for soils, vegetation and wetlands, and water resources is the 219,500-acre portion of the Muddy Creek Watershed, which overlaps the Atlantic Rim Project Area. To date, 109 CBM and non-CBM oil and gas wells have been drilled within this area. Of that total, 59 non-CBM wells have been plugged and abandoned and are within various stages of reclamation; and 37 non-CBM wells are in various stages of completion, resulting in approximately 337 acres of cumulative, long-term disturbance (related facilities disturbance included) from non-CBM oil and gas development. To date, 13 CBM wells and CBM water injection wells, and related facilities, have been drilled, resulting in approximately 13 acres of cumulative, long-term disturbance from CBM development.

Assuming pod 8 contains the maximum number of wells allowed by the interim drilling program (24), the total number of wells in pods 5,6,7 and 8 would be 86. Pods 5, 6, 7, and 8 are located within this CIA area and would account for approximately 221 acres of reasonably foreseeable short-term disturbance and 101 acres of long-term disturbance. Applications for Permits to Drill (APDs) have already been filed for 74 of the CBM wells and CBM injection wells associated with these pods. APDs also have been filed for 25 non-CBM oil and gas wells within the Atlantic Rim Project Area, six of which are in the Muddy Creek Watershed (no estimate of acreage affected is available).

The existing long-term disturbance of 350 acres resulting from past and current CBM and non-CBM oil and gas activities, added to the reasonable foreseeable long-term disturbance associated with the four pods under the 200-CBM well interim drilling program proposed for the Atlantic Rim (approximately 101 acres) area totals 451 acres, or (0.2 percent) of anticipated cumulative oil and gas-related disturbance within the 219,500-acre Muddy Creek CIA area.

Within the larger Atlantic Rim CBM Project Area, a total of 165 CBM and non-CBM oil and gas wells have been drilled. Eighty of these wells have been plugged and abandoned and are in various stages of reclamation. The 165 well total includes the 109 described within the Muddy Creek watershed. This oil and gas activity is summarized in Table 4-2.

Type of Activity	Muddy Creek Watershed	Atlantic Rim Project Area	Total Wells
CBM Well (Spudded)	2	1	3
CBM Well	10	0	10
Oil Well (Spudded)	20	0	20
Oil Well (Completed)	1	19	20
Oil Well (Plugged & Abandoned)	48	16	64
Non-CBM Gas Well (Spudded)	0	7	7
Non-CBM Gas Well (Completed)	16	7	23
Non-CBM Gas Well (Plugged & Abandoned)	11	5	16
Non-CBM Water Injection Well	1	1	2
Total Wells (Existing)	109	56	165

* Data provided by the BLM Reservoir Management Group and the Wyoming Oil and Gas Conservation Commission, 9/2001

Geology/Minerals/Paleontology

Existing, proposed, and reasonably foreseeable actions would not affect landslide deposits and would be unlikely to trigger geologic hazards such as landslides, mudslides, debris flows, or slumps, no incremental increase in cumulative impacts associated with geologic hazards would occur. If the terms of the Interim Drilling Policy are followed and proper well pad and facility siting, construction, and reclamation techniques are used, the cumulative impacts to the surface geologic environment would be minimized. Proposed and RFFAs would require the restoration of disturbed lands to pre-disturbance conditions and as such would minimize topographic alterations. Standard stipulations and Project- and site-specific construction and reclamation procedures would be required for additional development on federal lands and these measures would further minimize cumulative impacts of surface geologic environment.

With the exception of CBM, no major surface mineral resources would be impacted by the implementation of the RFFAs. Protection of subsurface mineral resources is provided by the BLM and WDEQ casing and well bore cementing policy.

Drilling exploratory CBM wells would contribute to the cumulative knowledge of the occurrence or absence of recoverable CBM resources within the area encompassed by the Atlantic Rim CBM Project, which is currently being evaluated by the BLM in an EIS. The Atlantic Rim Project Area encompasses 310,335 acres within portions of T.13-20N. and R.89-92W. If productive, these 200

wells would contribute to the cumulative CBM production from the Atlantic Rim Project Area and Wyoming, while at the same time adding to the overall depletion of CBM resources within the same area.

No cumulative adverse impacts on paleontological resources would occur beyond those discussed earlier in this chapter under the Project, as a result of the Project being implemented in combination with other existing, proposed, and reasonably foreseeable actions. Adoption of mitigation measures prescribed in that section could foster cumulative beneficial effects by discovering new fossil resources or providing paleontologists with evidence of absence of such resources in the area.

Air Quality

Cumulative impacts from emissions resulting from the implementation of past oil and gas projects and the proposed 200-well program would be much the same as those found on similar oil and gas projects such as the Continental Divide project. Emissions from oil and gas facilities approved prior to 1999 were included in the 3,000-well air quality analysis prepared for the Continental Divide EIS, of which only 2,130 wells were approved. The emissions from the 200 well interim drilling program have been accounted for under the air quality model completed for the Continental Divide project.

RFFAs, including the relatively small number of exploratory wells and facilities in the interim drilling program, would generate only a small amount of air pollutants. Some temporary effects on air quality would likely occur in the immediate vicinity of interim drilling activities due to particulate matter and exhausts from vehicles and equipment. These effects would be local and would be dispersed by prevailing winds from the west. The effects on air quality would be minimized through the application of dust abatement practices.

No noticeable deterioration in visibility would occur at Class I or sensitive Class II wilderness areas located within 100 miles of interim drilling activities (Mount Zirkel, Rawah, Savage Run, Platte River, Huston Park, or Encampment River). No noticeable deterioration in visibility would occur at the Dinosaur National Monument. Wind dispersion of the small quantity of air pollutants generated by RFFAs would likely eliminate the formation of regional haze or acid deposition.

Soils

The CIA area for soils includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area (Muddy Creek CIA area). Cumulative impacts include soil impacts from ongoing exploration and development activities, recently constructed projects, and RFFAs. Cumulative long-term disturbance of 451 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek CIA area. This amount of cumulative impacts upon the soil resources would be minimal, provided that all mitigation and avoidance measures are implemented.

With the use of proper construction techniques, drilling practices, and with BMPs described earlier in this Chapter under Soils and Water Resources, no adverse effects on soils would be anticipated under the interim drilling program. Surface disturbance associated with drilling activities, such as removing vegetation and stockpiling topsoil, road construction, or shallow excavations for drill pads or facilities, would increase the potential for increased erosion and sedimentation. Implementation

of BMPs to control erosion would ensure that soil resources would not be affected by interim drilling activities. Use of BMPs during construction, operation, and reclamation activities would minimize effects on soil resources.

Water Resources

The CIA area for water resources includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area (Muddy Creek CIA area). Existing and future disturbance consists of approximately 451 acres, or 0.2 percent of the Muddy Creek CIA area. This cumulative disturbance would minimally impact surface water or groundwater quantity or quality.

The cumulative impacts would be associated with CBM interim drilling activities and would be predicted to occur are based upon the current knowledge of the geology, CBM resources and groundwater hydrology in the area. Both methane and water production rates from future CBM wells, and specifics related to groundwater injection, cannot be accurately predicted. These variables could potentially affect the configuration of field production, gas processing, and gas and water conveyance facilities; however, none of these changes are expected to measurably affect the conclusions presented herein. Federal regulations provide for additional analysis if substantial changes in resource conditions would alter the conclusions reached herein.

Cumulative impacts to surface water resources would be maximized shortly after the start of construction activities, decreasing in time due to reclamation efforts, then stabilizing during the production/operation period when routine maintenance of wells and ancillary facilities takes place. Additionally, all roads, well locations and facility infrastructure would be regularly inspected and maintained to minimize erosion, sedimentation and surface water quality impairment.

Impacts to groundwater within the Atlantic Rim Project Area are not anticipated. The springs in the area are classic “contact” springs which result from permeable rocks overlying rocks of much lower permeability. In the Atlantic Rim Project Area, the permeable Browns Park Formation overlies the less permeable Almond Formation, which is a member of the Mesaverde Group. Water easily percolates through the Browns Park, and is perched on the lower permeability clay and shales of the Almond. Where this contact is exposed by erosion, a line of springs can result. No impact to these springs is foreseen from pumping on the Almond Formation coal seams during the interim drilling program. The source of the springs is infiltrating precipitation, and this source would not be removed by pumpage of the underlying coal seams.

Due to thick confining layers, water wells completed in water-bearing strata above or below the Almond coal seams are not likely to be impacted. Water wells completed in the Almond Formation coal seams in close proximity (less than one mile) to the pod could be impacted, but it is not likely that wells of this type exist. As described in Chapter 2, water analysis is being completed to determine if water from the Almond Formation coal seams contributes to the surface water system in the Colorado River Basin.

Cumulative impacts to the groundwater resources within the Mesaverde Group would be limited to a decline in hydrostatic head in coal seams within the targeted coalbed formations resulting from development wells associated with the interim drilling program. For purposes of this analysis,

existing impacts to groundwater resources within the Mesaverde Group resulting from prior development are so limited as to be nonexistent.

Current and future oil and gas exploration and development activities in the Project Area must comply with federal and state environmental regulations. Therefore, impacts to groundwater quantity or quality on a cumulative scale are not expected. This is particularly true given the fact that wells would be completed in accordance with Onshore Order No. 2 and the recent BLM guidelines that reduce the potential for groundwater contamination.

With the use of proper construction techniques, drilling practices, and with BMPs similar to those described in Chapter 2 as applicant-committed and BLM-required mitigating measures, and earlier in this Chapter under Soils and Water Resources, no adverse effects on groundwater aquifers or groundwater quality would be anticipated under the interim drilling program. Surface disturbance associated with oil and gas drilling activities, such as removing vegetation and stockpiling topsoil, road construction, or shallow excavations for drill pads or facilities and existing burned areas within the CIA would increase the potential for erosion and sedimentation. Due to their effects on vegetation (see following section) burns, prescribed and otherwise, would increase the potential for erosion and sedimentation for the first two years following the burn. Implementation of BMPs to control erosion would ensure that surface water resources of the Colorado River Basin would not be affected by surface-disturbing activities.

Vegetation/Wetlands/Noxious Weeds

The CIA area for vegetation/wetlands/noxious weeds includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area (Muddy Creek CIA area). Cumulative impacts include impacts to vegetation and wetlands from ongoing exploration and development activities, recently constructed projects, prescribed burns where sagebrush cover type has been converted to grass and bare ground, and RFFAs.

Within a 500,000 acre area that includes the CIA, approximately 20,000 acres have been burned as a result of prescribed burns and 4,000 acres have been burned by wildfire over the past fifteen years. In prescribed burns the objective is not to burn all vegetation, but to leave mosaics of burned and unburned vegetation. These burns are in various stages of recovery.

Anticipated cumulative long-term disturbance that can be quantified (451 acres) would be approximately 0.2 percent of the 219,500-acre Muddy Creek CIA area. This amount of vegetation loss would be minimal, and no direct effects on wetlands or aquatic and riparian areas would be expected, because existing and reasonably foreseeable activities would avoid these areas in accordance with RMP provisions. Provided erosion mitigation measures are followed, no indirect aquatic or riparian impacts would be expected. Use of BMPs during construction, operation, and reclamation activities would minimize effects on vegetation resources. Use of BMPs also would minimize the potential for invasive weedy species to increase during reasonably foreseeable activities. Cumulative impacts upon both vegetation and wetland resources would be minimal, provided all mitigation and avoidance measures specified by the RFO are implemented. The cumulative impact of existing and reasonably foreseeable activities and prescribed burns in the CIA would be a reduction in sagebrush cover type and in sagebrush-dependent habitat types. An

estimated 95 percent of BLM prescribed burns occur in mountain big sagebrush and basin big sagebrush. Wyoming big sagebrush, the main forage for big game and main habitat for sage grouse would not be affected.

The distribution of plant species of concern is likely limited within the Atlantic Rim Project Area due to a lack of suitable habitat for most of the species. The required application of existing FWS and BLM monitoring and mitigation measures would be expected to provide adequate protection for threatened, endangered, and special status plant species. Thus, impacts to special status species would be expected to be minimal.

Range Resources and Other Land Uses

The CIA area for range resources and other land uses includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area (Muddy Creek CIA area). Cumulative impacts include those from ongoing exploration and development activities, recently constructed projects, and RFFAs. Cumulative long-term disturbance of 451 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek CIA area. This amount of cumulative impacts upon range resources and other land uses would be minimal, provided that all BMPs are implemented.

RFFAs located within the Doty Mountain Allotment include the Blue Sky Project, the Doty Mountain Project, and the Sun Dog Project. Only the Blue Sky Project is located within the Cherokee Allotment. Based on the anticipated disturbance associated with these RFFAs, the cumulative disturbance would be approximately 65 acres in the Doty Mountain Allotment and 15 acres in the Cherokee Allotment. The estimated 80 acres of cumulative long-term disturbance equates to a very small reduction in available forage within the Doty Mountain and Cherokee Allotments.

Wildlife/Fisheries

Wildlife

RFFAs, including the interim drilling program, are expected to have minimal cumulative, short-term effects on wildlife. Some wildlife species may be temporarily displaced from well sites, access road locations, and pipeline routes by construction activities, but should return once construction is complete. Extensive suitable habitats for many species exist on adjacent lands, and would support any individuals that may be temporarily displaced during RFFAs. Cumulative long-term effects on wildlife also are expected to be minimal, as most species would become accustomed to routine operation and maintenance activities. Only a very small proportion of the amount of available wildlife habitats within the Atlantic Rim Project Area would be affected. The capacity of the area to support various wildlife populations should remain essentially unchanged from current conditions. No cumulative effects on wildlife, including threatened or endangered species, or species of concern, are expected during RFFAs, including the interim drilling program, provided avoidance and mitigation measures, lease stipulations and RMP provisions, are followed.

The CIA area varies with species, as indicated within the respective analyses. The disturbance of wildlife habitat resulting from implementation of RFFAs, including the interim drilling program

would reduce habitat availability and effectiveness for a variety of common mammals, birds, and their predators. Initial phases of surface disturbance would result in some direct mortality to small mammals, displacement of songbirds, along with a slight increase in mortality from increased vehicle use. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed (0.006 percent of the Atlantic Rim Project Area), small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation, and no long-term impacts to these populations are expected.

RFFAs, including activities associated with the construction phase of each of the pods in the interim drilling program, would likely temporarily displace antelope, mule deer, and elk; however, once construction is completed they would likely habituate and return to pre-disturbance activity patterns. Elk winter range does not occur on any of the pods and should not be affected by interim drilling activities. Pronghorn CWR occurs only in the Blue Sky Project Area. The proportion of pronghorn CWR within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.03 and 0.008 percent, respectively. Mule deer CWR occurs in pods 8 and 9. The proportion of mule deer CWR within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.05 and 0.01 percent, respectively. Construction activities on CWR would be limited to May 1 through November 14. Prescribed burns are not expected to impact big game as the burns would not affect dominant forage. Provided that mitigation measures contained in Chapter 2 and the Interim Drilling Policy are implemented, cumulative impacts to big game populations within their respective herd units are expected to be minimal.

Greater sage grouse occupy the area where interim drilling activities are proposed year-round and make seasonal use of the habitats. No exact figures on the amount of sage grouse habitat available within the Atlantic Rim Project Area exist, but the RMP identifies the area as lying within the area for which the Baggs Habitat Management Plan was prepared. In this larger area, 160,500 acres of sage grouse habitat was identified. Prescribed burns are not expected to impact sage grouse, as the height and density of the sagebrush typically treated by burns are outside of the range used by sage grouse for nesting and brooding habitat. One crucial winter habitat unit and two leks occur on pod 1, and a portion of pod 8 lies within the one-quarter mile NSO radius of a lek. Approximately 11,005 acres (56.2 percent of the total surface area of the nine pods) overlaps the 2-mile radius of the historical leks in the area. Approximately 365 (3.3 percent) and 112 (1.0 percent) acres of potential greater sage grouse nesting habitat would be affected cumulatively by short-term and long-term disturbances, respectively, associated with the production activities. Considering the vast amount of potential nesting habitat available, the 112-acre loss would be minimal. Greater sage grouse within Sierra Madre Upland Game Management Unit (Area 25) would only be minimally impacted from the cumulative 200-acre disturbance associated with RFFAs, including interim drilling activities, provided the implementation of RMP provisions, stipulations, interim drilling guidelines, seasonal closures, reclamation, and mitigation measures specified by the RFO are followed.

Although no active raptor nests were located in the interim drilling pods during 2001 aerial surveys, implementation of protection measures identified in Chapter 2 and the Interim Drilling Policy are expected to protect the raptor populations within the interim drilling area (**Appendix A**) during RFFAs. Therefore, only minimal cumulative impacts to raptors within Muddy Creek Watershed are likely to occur.

Acreages and burrow densities that are adequate to support black-footed ferrets (200 or more acres with eight or more burrows per acre) occur in only two of the pods included in the interim drilling program. Black-footed ferret surveys have been conducted on both of these pods and no ferrets or ferret sign were found. The Blue Sky Project was surveyed in October 2000 and September 2001. The Blue Sky Project was surveyed again in August 2001. Because of the lack of evidence that black-footed ferrets occur and the fact that black-footed ferret surveys will be conducted when required (per interim drilling guidelines), no impacts to this species are expected as the result of RFFAs, including the proposed 200-well interim drilling activities.

Fisheries

Currently, four BLM sensitive fish species are known to occur in Muddy Creek and downstream in the Little Snake River (Baxter and Stone 1995). Although unlikely, four endangered fish species have the potential to occur immediately downstream in the Little Snake River. Cumulative impacts from existing, proposed, and reasonably foreseeable development may influence offsite endangered fisheries resources and therefore potential impacts are evaluated within the boundaries of the Muddy Creek watershed. Additionally, direct impacts to the four BLM sensitive species through increased sediment levels or surface water depletions in Muddy Creek may result from the implementation of interim drilling activities.

Perennial surface waters within the analysis area are limited. Additionally, no “contact” between the surface springs and deep water aquifers planned for use during RFFAs are anticipated. Water used in drilling and construction activities associated with the interim drilling program would be obtained from wells drilled into aquifers that are geologically isolated from the Little Snake River and not generally associated with surface water expression in the Muddy Creek watershed. Therefore, no surface water depletions that would affect BLM sensitive, threatened, or endangered fish species would occur. If the existing, proposed, or reasonably foreseeable development leads to surface water depletion in either Muddy Creek or the Little Snake River (both tributary to the Colorado River and falling under the Colorado River Compact), adverse impacts to the BLM sensitive species could occur, and potential impacts to the four downstream endangered species would require the initiation of consultation with the FWS.

RFFAs are not expected to result in reductions in BLM sensitive, threatened, or endangered adult fish numbers, or their exclusion from, or degradation to their spawning areas within the Muddy Creek watershed or in downstream waters of the Little Snake River. Additionally, permitted disturbances associated with the exploratory CBM pod development and other development within the Muddy Creek watershed would employ erosion control measures and construction techniques suitable to limit offsite soil movement and downstream degradation of fisheries habitat due to sediment inputs.

The mitigation and avoidance measures set forth in this EA, and the application of standard wetland and surface water protection and reclamation measures to protect fisheries resources are likely to be adequate to protect surface waters and the threatened, endangered, and BLM fish species of concern. Thus, the cumulative impacts to fish species found within the affected watersheds are expected to be minimal.

The required application of existing FWS and BLM monitoring and mitigation measures to the proposed CBM interim drilling program is expected to provide adequate protection for threatened, endangered, and special status species.

Recreation

BLM does not have statistics on historical use of the interim drilling area (**Appendix A**) by recreation groups which could be used to determine trends in cumulative impacts on recreation use and displacement resulting from past or current activities and RFFAs. Cumulatively, overall impacts to the recreation resource are expected to be minimal with some temporary displacement of hunters and recreationists during the short-term drilling periods. Some long-term displacement of hunters and nonconsumptive users may occur, and there may be reduced levels of satisfaction for those who might continue to use the area.

Visual Resources

Existing visual qualities in the interim drilling area (**Appendix A**) and adjacent lands have already been affected by ongoing natural gas development, including road building and pipeline construction. Existing, proposed, or reasonably foreseeable development would add to the level of impact to visual resources in the immediate area. The composite experience of those traveling through the area, particularly on back roads, is one of a modified landscape. Contrasts in line, form, color and texture from development activities begin to dominate the viewers experience. These conditions would increase the likelihood that viewers, particularly back country recreationists, would be dissatisfied with the visual component of their recreation experience. However, the cumulative impact of existing, proposed, or reasonably foreseeable development on visual resources would still be consistent with the current VRM Class III designation and implementation of mitigation measures proposed similar to those described in Chapter 2.

Cultural Resources

Cultural resources on public lands, including archaeological sites and historic properties, are protected by federal law and regulations. Cultural resources in the interim drilling area (**Appendix A**) and adjacent lands already may have been affected by surface-disturbing activities, including ongoing natural gas development, road building and pipeline construction. Existing, proposed, or reasonably foreseeable development could add to the level of impact on cultural resources in the immediate area, unless BLM specified inventories and protective or mitigation measures are followed. BLM has required the completion of cultural resource inventories prior to surface-disturbing activities. These inventories have been used to identify sites potentially eligible for inclusion on the National Register of Historic Places and to identify sites which BLM has required past exploration and development activities to avoid.

Because Class III cultural resource inventories would be completed, the potential for increased impacts on cultural artifacts would be minimized. It should be possible to eliminate direct and indirect adverse effects to historic properties under the interim drilling program through avoidance and/or mitigative measures (i.e., data recovery or recordation), on a case-by-case basis. By avoiding known cultural and historical sites during the layout of drill sites, access roads, and pipeline corridors, the potential for incremental increases in cumulative impacts would be avoided.

Completion of cultural resource inventories would have a beneficial, cumulative impact on the level of cultural information available about the interim drilling area (**Appendix A**). Some unintentional damage to subsurface resources could occur during grading or excavation activities. However, implementation of resource protection and mitigation measures similar to those described in Chapter 2 would protect such resources upon discovery.

Socioeconomics

Southwest Wyoming is currently experiencing an increase in the pace and level of natural gas development. Drilling and field development is occurring in areas near the interim drilling area (**Appendix A**) including Continental Divide/Wamsutter II, South Baggs, Mulligan Draw, Creston/Blue Gap, Hay Reservoir and potentially, Desolation Flats. While this surge in development will result in increased employment and income and tax revenues in the region, it will also result in increased housing demand and increased demand for local and state government facilities and services. Rawlins is also experiencing some growth associated with the opening of a new prison facility.

Communities such as Rawlins and Rock Springs are still below peak population levels of the early 1980s and have infrastructure and housing to accommodate some population growth. Smaller communities near the Project Area, such as Wamsutter or Baggs, are struggling to accommodate population growth associated with development of the currently approved natural gas fields identified above. Neither the relatively small, short-term drilling and field development workforce nor the minimal operations employment and activity associated with the existing, proposed, or reasonably foreseeable development would add appreciably to cumulative housing and local government service demand in the area. Drilling and field development associated with these activities would be completed some time before the initiation of the proposed Atlantic Rim CBM project.

If the current accelerated pace of drilling and field development in southwest Wyoming continues, the potential for degradation of the quality of recreation resources in the area would increase. If Carbon County residents perceive that degradation of recreation resources has occurred, levels of dissatisfaction among some residents and area visitors would correspondingly increase.

Transportation

Increased oil and gas development in western Carbon County and eastern Sweetwater County will result in increased traffic on affected segments of I-80 and WSH 789. The condition of these highways is adequate to accommodate existing levels of traffic and some increases (Rounds 2000).

Currently known cumulative impacts on CCR 605 and CCR 608 would be limited to grazing and recreation activities, and occasional traffic associated with oil and gas exploration activities. The increased traffic associated with drilling and field development of the interim drilling program would accelerate maintenance requirements; however, associated costs may be offset by revenues generated, which are described under the Socioeconomics section of this chapter.

Health and Safety

Cumulative health and safety impacts would be limited to those associated with the 200-well interim drilling proposal and existing grazing and recreation activities. Cumulative impacts to health and safety conditions are anticipated to be similar to those described for the Project. Occasional traffic and activity associated with oil and gas exploration activities would generate small increases in risks to workers and the public.

Noise

Cumulative noise impacts would be limited to those associated with the 200-well interim drilling proposal and existing grazing and recreation activities. Cumulative noise impacts are likely to be similar to those described for the Project. Noise would result from ongoing construction, drilling, and CBM operations, including an estimated nine compressor stations, one in each pod, during the life of interim drilling activities. Increased traffic would occur on existing transportation system roads within the area where interim drilling activities are planned (**Appendix A**), thus adding to existing traffic noise. Given the current and anticipated low traffic volumes, and dispersed nature of traffic and CBM operations within the interim drilling pods, the additional traffic-related noise would be minimal. Given the dispersed locations of the interim drilling pods, the noise from one compressor station located in each pod would not likely be noticeable throughout the interim drilling area (**Appendix A**). The distance between the pods also would minimize the overall noise impact on visitors to the area, however, the cumulative additional noise from all RFFAs would combine to create an environment that is no longer pristine. Applicant-committed and BLM-required mitigating measures for interim drilling activities, similar to those described in Chapter 2 for the Blue Sky Project, would result in minimal noise impacts.

No Action

Under the No Action Alternative, the development of the Blue Sky Project of the Atlantic Rim Coalbed Methane Interim Drilling Project would not occur. However, interim drilling activities associated with other pods, not including the Blue Sky Project (Pod 7), likely still could occur. Therefore, if interim drilling activities still were to occur (excluding the Blue Sky Project), the cumulative impacts would be very similar to those described under the Project. If interim drilling activities were not to occur, there would be no additional cumulative impacts on resources occurring in the Atlantic Rim CBM Project Area beyond the current situation.

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CHAPTER 5

CONSULTATION AND COORDINATION

CONSULTATION AND COORDINATION

An environmental analysis is prepared when a federal government agency considers approving an action within its jurisdiction that may impact the human environment. An environmental analysis aids federal decision makers by presenting information on the physical, biological, and social environment of a proposed project and its alternatives. The first step in conducting an environmental analysis that meets the requirements of NEPA is to determine the scope of the project, the range of action alternatives, and the impacts to be included in the document.

The Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508) require an early scoping process to determine the issues related to the Proposed Action and alternatives that the analysis should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis. The results of the scoping process are used to focus the analysis on the issues and concerns identified for the proposed project, so that alternatives or mitigation considered can be responsive to the issues and concerns. Alternatives that are not technically or economically feasible or responsive to the issues and concerns are not considered further in the analysis.

The environmental assessment documenting the NEPA analysis conducted for the Blue Sky Project was prepared by a third party contractor working under the direction of and in cooperation with the lead agency for the project, the Bureau of Land Management (BLM), Rawlins Field Office, Rawlins, Wyoming.

PUBLIC PARTICIPATION

A scoping notice was prepared and submitted to the public by the BLM on June 14, 2001, requesting comments on the proposed Atlantic Rim Coalbed Methane Project. Scoping documents were sent out to the public listed on the BLM mailing list, as well as organizations, groups, and individuals requesting a copy of the scoping document.

As a part of the scoping process, the interim drilling programs proposed by Pedco and other operators were included in the scoping notice. The scoping period ended on July 25, 2001. During preparation of the EA, the BLM and the consultant interdisciplinary team have communicated with, and received or solicited input from various federal, state, county, and local agencies, elected representatives, environmental and citizens groups, industries, and individuals potentially concerned with issues regarding the proposed exploratory drilling activities. The contacts made are summarized in the following sections.

The following organizations/individuals either provided comment or were provided the opportunity to comment during the scoping period.

FEDERAL OFFICES

U.S. Bureau of Land Management, Wyoming State Office
U.S. Congresswoman Barbara Cubin
U.S. Senator Mike Enzi
U.S. Senator Craig Thomas
U.S. Army of Corps of Engineers
U.S. Bureau of Reclamation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

STATE AGENCIES

Governor Jim Geringer
State Representatives
State Senators
State Engineer's Office
Wyoming Department of Environmental Quality
Wyoming Department of Transportation
Wyoming Game and Fish Department
Wyoming Oil and Gas Conservation Commission
Wyoming State Planning Coordinator

COUNTY GOVERNMENT

Carbon County Commissioners
Carbon County Planning Commission

MUNICIPALITIES

Mayor-Baggs
Mayor-Rawlins
Mayor-Wamsutter

NATIVE AMERICAN TRIBES

Northern Arapahoe Tribal Council
Shoshone Tribal Council
Ute Mountain Tribe
Ute Tribal Council
Shoshone-Arapahoe Joint Tribal Council
Uinta-Ouray Tribal Council

GRAZING PERMITTEES

Weber Ranch
Montgomery Livestock Company
Salisbury Livestock Company
Stratton Sheep Company
Three Forks Ranch Corporation
Sam Morgan
Mike Sheehan
Robert Orchard
H.B. Lee
Matt Weber
Espy Livestock
Jack Creek Land and Cattle Company
PH Livestock Company

LEASE AND ROW HOLDERS

Benson–Montin-Greer
KCS Mountain Resources, Inc.
Merit Energy Company
North Finn, LLC
P&M Petroleum Management
Stone & Wolf, LLC

LANDOWNERS

This scoping notice has been sent to 111 landowners potentially affected by the proposal.

LOCAL MEDIA

Casper Star-Tribune
Rawlins Daily Times
Rock Springs Rocket Miner
Wyoming State Journal
Wyoming State Tribune/Eagle
Gillette News-Record
Northwest Colorado Daily News
KRAI - Craig, Colorado
KRAL - Rawlins
KRKK - Rock Springs
KSIT - Rock Springs
KTWO - Casper
KTWO TV - Casper
KUWR - University of Wyoming

OTHER AGENCIES, INDUSTRY REPRESENTATIVES, INDIVIDUALS, AND ORGANIZATIONS

Audubon Society
National Wildlife Federation
Wilderness Society
Carbon County Stockgrowers
The Nature Conservancy
Wyoming Association of Professional Archaeologists
Field Museum of Natural History, Department of Geology
Independent Petroleum Association of Mountain States
Montana Oil Journal
Murie Audubon Society
Petroleum Association of Wyoming
Sierra Club
Wyoming Farm Bureau Federation
Wyoming Outdoor Council
Wyoming Public Lands Council
Wyoming Stockgrowers Association
Wyoming Wildlife Federation
Wyoming Woolgrowers Association
Vern Brodsho
Ivan Herold
Little Snake River Conservation District

LIST OF PREPARERS

The following tables identify the core BLM IDT (**Table 5-1**) and the consultant IDT (**Table 5-2**) that were principally involved in preparing this EA.

Table 5-1 BLM Interdisciplinary Reviewers	
Name	Responsibility
BLM Team	
Brenda Vosika-Neuman	BLM IDT Lead
John Spehar	Planning and Environmental Coordinator
Mary Apple	Public Affairs
Krystal Clair	Visual Resources/Recreation
Sarah Crump	Cultural Resources
Kip Purington	Petroleum Engineer
Andy Warren	Vegetation/Range Issues
Mark Newman	Paleontology/Geology
Susan Foley	Soils/Pipeline Construction/Reclamation
John Ahlbrandt	Natural Resource Specialist
Frank Blomquist	Wildlife/T & E Issues
Mike Bower	Fisheries Biologist; Riparian/Wetland
Janelle Wrigley	Realty Specialist
Wyoming State Office	
Susan Caplan	Air Quality

Table 5-2 Consultant Interdisciplinary Team EA Preparers		
Name	Affiliation	Area of Expertise and Responsibility
Principal Interdisciplinary Team		
Kathy Wilkerson	Greystone Environmental Consultants, Inc.	Interdisciplinary Team Leader, Project Manager, Mineral and Energy Resource Specialist
Kyle Davenport	Greystone Environmental Consultants, Inc.	Environmental Scientist
Lee Fyock	Greystone Environmental Consultants, Inc.	Natural Resource Specialist
Dave Cameron	Greystone Environmental Consultants, Inc.	NEPA Specialist, Wildlife Biologist
Technical Support Team		
Larry Hayden-Wing	Hayden-Wing Associates	Wildlife/Fisheries/Special Status Species
Travis Olson	Hayden-Wing Associates	Wildlife Biologist
Jeffrey Winstead	Hayden-Wing Associates	Wildlife Biologist & Cartographer
Scott Mullner	Hayden-Wing Associates	Fisheries Biologist
Carrie Womack	Greystone Environmental Consultants, Inc.	Document Editing & Production
Julie Hatcher	Pronghorn Archaeology	Cultural Resources
Gary Holsan	Gary Holsan & Associates	Atlantic Rim Coalbed Methane Project - ongoing environmental analysis for EIS

CHAPTER 6 REFERENCES

- Baxter, G.T. and M.D. Stone. 1995. Fishes of Wyoming. Wyoming Game and Fish Department, 290 pages.
- Biggins, D., B. Miller, B. Oakleaf, A. Farmer, R. Crete, and A. Dood. 1989. A System for Evaluating Black-footed Ferret Habitat. Report prepared for The Interstate Coordinating Committee by The Reintroduction Site Group. 25 pages.
- Breithaupt, B.H. 1985. Non-mammalian Vertebrate Faunas from the Late Cretaceous of Wyoming. Wyoming Geological Association 36th Annual Field Conference Guidebook. 159-175 pages.
- Bower, P.W., J.C. Miller, M.W. Bergstrom, L.L. Harrell, and A.D. Gardner. 1984. The Sheehan Site. Cultural Resource Management Report No. 20. Archaeological Services of Western Wyoming College, Rock Springs, Wyoming.
- Bureau of Land Management. 1972. Divide Grazing: Draft Environmental Impact Statement. Rawlins District Office, Rawlins, Wyoming.
- Bureau of Land Management. 1987. Draft Resource Management Plan/Environmental Impact Statement for the Medicine Bow-Divide Resource Area, Rawlins District, Wyoming, BLM-WY-ES-87-008-4410. Rawlins District Office, Rawlins, Wyoming. 500 pages.
- Bureau of Land Management. 1988a. Proposed Resource Management Plan/Final Environmental Impact Statement for the Great Divide Resource Area (formerly Medicine Bow and Divide Resource areas) Rawlins District, Wyoming. U.S. Department of the Interior, Bureau of Land Management, Great Divide Resource Area, Rawlins District Office, Rawlins, Wyoming. 249 pages.
- Bureau of Land Management. 1988b. National Environmental Policy Act Handbook (H-1790-1). U.S. Department of the Interior, Washington, D.C. 67 pages, 9 apps.
- Bureau of Land Management. 1990. Great Divide Resource Area Record of Decision and Approved Resource Management Plan. Rawlins District Office, Rawlins, Wyoming. 74 pages.
- Bureau of Land Management. 1999a. Draft Environmental Impact Statement South Baggs Area Natural Gas Development Project, Carbon County, Wyoming. Rawlins District Office, Rawlins, Wyoming.
- Bureau of Land Management. 1999b. Wyodak Coal Bed Methane Project Draft and Final Environmental Impact Statement, Bureau of Land Management. Buffalo District Office, Buffalo, Wyoming.

Bureau of Land Management. 2000. Record of Decision Environmental Impact Statement Continental Divide/Wamsutter II natural gas project, Sweetwater and Carbon Counties, Wyoming. Rawlins District Office, Rawlins, Wyoming. Rock Springs District Office, Rock Springs, Wyoming.

Bureau of Land Management. 2001. BLM Wyoming Sensitive Species Policy and List. Instruction Memorandum Number WY-2001-040. Issued by A. Pierson, Cheyenne, Wyoming.

Carnes, S. 2000. [Jun 7 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Clerk, Town of Wamsutter, Wamsutter, Colorado.

Case, J.C., L.L. Larson, L.A. Coombs, D.R. Gilmer, T.C. Nissen, J.A. Ford, J.C. Cannia, and W.B. Murray. 1991. Landslide Map of Wyoming. The Geological Survey of Wyoming, Open File Report, 91-1, scale 1:1,000,000.

Clair, K. 2000. [Jun 27 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Outdoor Recreation Planner, Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming.

Collentine, M., R. Libra, K.R. Feathers, and L. Hamden. 1981. Occurrence and Characteristics of Groundwater in the Great Divide and Washakie Basins, Wyoming. Water Resources Research Institute, University of Wyoming, Laramie, Wyoming.

Colorado Department of Public Health and Environment, Air Pollution Control Division. 1996. Background pollutant concentration information on file at the Colorado Department of Public Health and Environment, Air Pollution Control Division, Denver, Colorado.

Craig Chamber of Commerce. 2000. Website Listing for Motels. Craig, Colorado.

Driver, N.E., J.M. Norris, and G. Kuhn. 1984. Hydrology of Area 53, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado, Wyoming, and Utah. United States Geological Survey WRI Open File Report 83-765.

Druse, S.A., W.R. Glass, G.F. Ritz, and M.L. Smalley. 1994. Water Resource Data, Wyoming Water Year 1993. United States Geological Survey Water-Data Report WY-93-1.

Evans, B. 2000. [Jun 8, Jul 12 personal communication with George Blankenship, Blankenship Consulting LLC]. Foreman, Carbon County Road and Bridge Department, Rawlins, Wyoming.

Fish and Wildlife Service. 1993. Colorado River Endangered Fishes Critical Habitat. Draft Biological Support Document. Salt Lake City, Utah.

Fish and Wildlife Service. 2000. [Feb 8 letter from Michael M. Long, Field Supervisor for Wyoming Field Office, Cheyenne, Wyoming. RE: Listed endangered, threatened and candidate species potentially impacted by coal bed methane development in Carbon County, Wyoming].

- Freethey, G.W. 1987. Upper Colorado River Basin Regional Aquifer Systems Analysis-Mesozoic Rock in Colorado, Utah, Wyoming, Arizona, and New Mexico. Pages 57-70. *in* J.S. McLean and A.I. Johnson, editor. Regional Aquifer Systems of the United States: Aquifers of the Western Mountain Area. Amer. Water Res. Assoc. Mono. Ser. No. 14. 23rd Annual AWRA Conference and Symposium, Nov. 1-6, 11987, Salt Lake City, Utah. 229 pages.
- Gill, J.R., E.A. Merewether, and W.A. Cobban. 1970. Stratigraphy and Nomenclature of Some Upper Cretaceous and Lower Tertiary Rocks in South-central Wyoming. U.S. Geological Survey Professional Paper 667, 50 pages.
- Grieve, P. 2000. [Jun 26 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Western United Realty, Baggs, Wyoming
- Hall, D.H. 1987. Archaeological Investigations Within the Little Snake River Basin Colorado and Wyoming. Master's Thesis. Department of Anthropology, Colorado State University, Fort Collins, Colorado.
- Hamilton, D.S. 1993. Stratigraphy and Coal Occurrence of the Upper Cretaceous Mesaverde Group, Sand Wash Basin, Gas Research Institute, Pages 23-49. *in* Topical Report: Geologic and Hydrologic Controls on Coalbed Methane: Sand Wash Basin, Colorado and Wyoming.
- Hatcher J. and S.L. Davis. 2001. Class III Cultural Resource Inventory for the Blue Sky POD Block Survey Located in Sections 4, 5, 8, 9, & 16, T15N, R91W, and in Sections 32 & 33, T16N, R91W Carbon County, Wyoming. Pronghorn Archaeology, Mills, Wyoming. 99 pages.
- Hawkins, M. 2000. [Jun 26 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Drifter's Inn Motel, Baggs, Wyoming.
- Hayden-Wing, L.D. 1980. Distribution of Deer, Elk, and Moose on a Winter Range in Southeastern Idaho. Pages 122-131 *in* M.S. Boyce, and L.D. Hayden-Wing editors. North American elk: Ecology, Behavior, and Management. University of Wyoming, Laramie, Wyoming, 294 pages.
- Hayden-Wing Associates. 2001. Biological Survey Report, Blue Sky Pod of the Atlantic Rim Coalbed Methane Project Area. Laramie, Wyoming. 14 pages.
- Heath, R.C. 1984. Groundwater Regions of the United States. U.S. Geological Survey Water-Supply Paper 2242. U.S. Government Printing Office, Washington, D.C. 78 pages.
- Hewitt, H. 2000. [Jun 20 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Chairman, Carbon County Planning Commission.
- Hiatt, K. 2000. [Jun 22 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Rawlins - Carbon County Chamber of Commerce.

- Higley, S.T. 1996. Numerical Simulation and Groundwater Storage Relationships within the Muddy Creek Aquifer System. M.S. Thesis, Department of Civil and Architectural Engineering, University of Wyoming, Laramie, Wyoming.
- Hillman, C.N. and T.W. Clark. 1980. *Mustela nigripes*. Mamm. Species No. 126. 3 pages.
- Hoffman, D.S., and J.F. Nunley III. 2000. Wyoming Mineral and Energy Yearbook 1999. The Wyoming Business Council, Community Programs Division, Energy Section, Cheyenne, Wyoming.
- Latham, M. A. 1999. Class III Cultural Resource Inventory and Evaluation of Eleven Prehistoric Sites: Little Snake Supplemental Irrigation Water Supply Project, High Savery Dam and Reservoir Alternative, Carbon County, Wyoming. Burns and McDonnell.
- Massey, R. 1989. Wyoming Comprehensive Historic Preservation Plan. Report Prepared for Archive, Museums, and Historic Department. Wyoming State Historic Preservation Office, Cheyenne, Wyoming.
- Metcalf, M.D. 1987. Contributions to the Prehistoric Chronology of the Wyoming Basin Pages 233-261. in A. J. Osborn and R. C. Hassler, editors. Perspectives on Archaeological Resources Management in the Great Plains. I & O Publishing Company, Omaha, Nebraska.
- Metcalf, M.D. and K. Black. 1991. Archaeological Excavations at the Yarmony Pit House Site, Eagle County, Colorado. Colorado Cultural Resource Series No. 31, Denver, Colorado.
- Miller, M. 1997. Hollow Victory: The White River Expedition of 1879 and the Battle of Milk Creek. University Press of Colorado, Niwot, Colorado.
- Minckley, W.L. and J.E. Deacon. 1991. Battle Against Extinction - Native Fish Management in the American West. The University of Arizona Press, Phoenix, Arizona.
- Oakleaf, B., H. Downing, B. Raynes, M. Raynes, and O.K. Scott. 1982. Wyoming Avian Atlas. Wyoming Game and Fish Department and Bighorn Audubon Society. 87 pages.
- Morgantini, L.E., and R.J. Hudson. 1980. Human Disturbance and Habitat Selection in Elk. Pages 132-139 in M.S. Boyce and L.D. Hayden-Wing, editors. North American Elk: Ecology, Behavior, and Management. University of Wyoming, Laramie, Wyoming, 294 pages.
- Pederson Planning Consultants. 1997. Carbon County Draft Land Use Plan: A Report to the Carbon County Board of Commissioners from the Carbon County Planning Commission. Carbon County Land Use Plan. Rawlins, Wyoming. 400 pages.
- Pederson Planning Consultants. 1998. Carbon County Land Use Plan. Rawlins, Wyoming.

- Porter, M.A. 1999. Spatial Relationships of Sympatric Mule Deer and Elk in South-central Wyoming. M.S. Thesis, University of Wyoming, Laramie, Wyoming.
- Powder River CBM Information Council. 2001. Methane Gas Industry Taxes [Web Page]. Located at http://www.cbmwyo.org/economics_taxes.htm. Accessed: October 3, 2001.
- Rawlins Daily Times. 2000a. Rag Shoshone coal mine closes Thursday. August 30, 2000.
- Rawlins Daily Times. 2000b. Realtors believe market can handle housing needs. August 5, 2000.
- Reeve, A.F. 1984. Environmental Influences on Male Pronghorn Home Range and Pronghorn Behavior. Ph.D. Dissertation, University of Wyoming, Laramie, Wyoming. 172 pages.
- Rock Springs Rocket Miner. 2001. Wamsutter officials asking for assistance. February 8, 2001.
- Roehler, H.W. 1990. Stratigraphy of the Mesaverde Group in the Central and Eastern Greater Green River Basin, Wyoming, Colorado, and Utah. U.S. Geological Survey Professional Paper 1508. U.S. Government Printing Office, Washington, D.C.
- Rounds, K. 2000. [Aug 23, Dec 1 personal communications with George Blankenship, Blankenship Consulting LLC]. Wyoming Department of Transportation. Cheyenne, Wyoming.
- Schnal, J. 2000. [Jun 19 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Director, Carbon County Economic Development Corporation.
- Scott, A.R., R. Tyler, D.S. Hamilton, and N. Zhou. 1995. Summary of Coal and Coal Gas Resources for the Mesaverde Group and Fort Union Formation. Pages 185-190 in Greater Green River Basin, Wyoming Geological Association Guidebook 46th Annual Field Conference.
- Sisler, J.F. 1996. Spatial and Seasonal Patterns and Long-term Variability of the Composition of the Haze in the United States: An Analysis of Data from the IMPROVE Network. Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, Colorado.
- Thompson, K.W. and J.V. Pastor. 1995. People of the Sage: 10,000 Years of Occupation in Southwest Wyoming. Cultural Resource Management Report No. 67. Archaeological Services of Western Wyoming College, Rock Springs, Wyoming.
- Tyler, R., W.R. Kaiser, A.R. Scott, D.S. Hamilton, and W.A. Ambrose. 1995. Geologic and Hydrologic Assessment of Natural Gas from Coal; Greater Green River, Piceance, Powder River, and Raton Basins, Western United States. Report of Investigations, Bureau of Economic Geology, University of Texas at Austin, 219 pages.

Tyus, H.M., D. Burdick, R.A. Valdez, C.M. Haynes, T.A. Lytle, and C.R. Berry. 1982. Fishes of the Upper Colorado River Basin: Distribution, Abundance, and Status. Pages 12-70 in W.H. Miller, H.M. Tyus, and C.A. Carlson, editors. Fishes of the Upper Colorado River System: Present and Future. Western Division of the American Fisheries Society. 131 pages.

Upper Colorado River Endangered Fish Recovery Program. 1999. Upper Colorado River Endangered Fish Recovery Program [Web Page]. Located at <http://www.r6.fws.gov/coloradoriver>.

U.S. Department of Commerce. 1979. Climatic Atlas of the United States: Mean Pan and Lake Evaporation (map). U.S. Government Printing Office: 1968 O-311-220, Washington, D.C. 80 pages.

U.S. Department of Labor, Bureau of Labor Statistics. 1998. Incidence Rates of Nonfatal Occupational Injuries and Illnesses by Selected Industries and Case Types. Washington, D.C. December 12, 2000.

U.S. Department of Transportation. 1998. Hazardous Liquid and Natural Gas Pipeline Safety Data and Property Damage. National Transportation Statistics, Washington, D.C.

U.S. Geological Survey. 1980. Water Resources Data for Wyoming, Water Year 1978. v. 2. USGS Water-Data Report WY-78-2.

University of Wyoming, College of Agriculture, Cooperative Extension Service, Agricultural Economics Department. 1997. Southwest Wyoming Resource Evaluation; Socioeconomic Evaluation Part 1 - Historical Context, Final Report. Prepared for the Bureau of Land Management, Wyoming State Office, Laramie, Wyoming.

University of Wyoming, College of Agriculture, Cooperative Extension Service, Agricultural Economics Department. 2000. Jack Morrow Hills Coordinated Activity Plan: Economic Analysis.

Vosika Neuman, B. 2000. [May 5 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Bureau of Land Management National Environmental Policy Act, Coordinator, Rawlins District Office, Rawlins, Wyoming.

Warren, A. 2000. [Jun 14 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Bureau of Land Management, Range Management Specialist, Rawlins District Office, Rawlins, Wyoming.

Weigel, J.F. 1987. Sources of Hydrologic Data on Mesozoic Formations in the Upper Colorado River Basin and Comparison of Data Analysis Methods. Pages 71-80 in J.S. McLean and A.I. Johnson, editors. Regional Aquifer Systems of the United States: Aquifers of the Western Mountain Area. American Water Res. Association. Mono. Ser. No. 14. 23rd Annual AWRA Conference and Symposium, No. 1-6, 1987, Salt Lake City, Utah. 229 pages.

Welder, G.E. and L.J. McGreevy. 1966. Groundwater Reconnaissance of the Great Divide and Washakie Basins and Some Adjacent Areas, Southwestern Wyoming. USGS Hydrologic Investigation Atlas HA-219.

Western Regional Climate Center. 2001. Historical Climate Data for Baggs, Wyoming [WebPage]. Located at <http://www.wrcc.sage.dri.edu>.

Whitehead, R.L. 1996. Ground Water Atlas of the United States Montana, North Dakota, South Dakota, Wyoming. U.S. Geological Survey. HA 730-I.

Willis, J. 2000. [Jun 7 personal communication with George Blankenship, Blankenship Consulting LLC, Denver, Colorado]. Country Inn Motel, Baggs, Wyoming.

Winn, R.D., Hjr., M.G. Bishop, and P.S. Gardner. 1985a. Delta front and deep water basin floor deposition in north Atlantic interior seaway; Lewis Shale, south-central Wyoming. Earth Science Bulletin, v. 18:65-66.

Winn, R.D., Hjr., M.G. Bishop, and P.S. Gardner. 1985b. Shallow water and sub storm base deposition of Lewis Shale in Cretaceous western interior seaway, south-central Wyoming. AAPG Bulletin, v. 71:859-881.

Winn, R.D., Hjr., M.G. Bishop, and P.S. Gardner. 1985c. Lewis Shale, South Central Wyoming; Shelf, Delta front, and Turbidite Sedimentation *in* Wyoming Geological Association Guidebook, 36th Annual Field Conference:113-130.

Wyoming Department of Administration and Information. 2000a. Employment by Industry for the United States, Wyoming and Wyoming Counties.

Wyoming Department of Administration and Information. 2000b. Division of Economic Analysis. Sales Tax for Wyoming and Counties by Major Industrial Sector and Use Tax for Wyoming and Counties by Major Industrial Sector. Cheyenne, Wyoming.

Wyoming Department of Administration and Information. 2000c. CREG Severance Taxes.

Wyoming Department of Administration and Information. 2000d. Federal Mineral Royalties (Including Coal Leases).

Wyoming Department of Administration and Information. 2001. Population for Counties and Incorporated Places: 1990 and 2000.

Wyoming Department of Employment. 2000. Labor Force, Employment and Unemployment Statistics.

Wyoming Department of Environmental Quality. 1997. Background pollutant information on file at the Wyoming Department of Environmental Quality – Air Quality Division, Cheyenne, Wyoming.

Wyoming Department of Environmental Quality. 2001. Water Quality Rules and Regulations. Cheyenne, Wyoming.

Wyoming Game and Fish Department. 2000a. Annual Big Game Herd Unit Reports 1999. Wyoming Game and Fish Department, Green River Region, Cheyenne, Wyoming. 501 pages.

Wyoming Natural Diversity Database, Rebekah Smith. 2000. [Feb 16 search request results for T12-18N:R89-92W addressed to Dawn Martin, Hayden-Wing Associates, Laramie, Wyoming]. Data and Biological Assistant, Cheyenne, Wyoming.

Wyoming Oil and Gas Conservation Commission. 1995 - 1999. Annual Statistical Summaries 1995, 1996, 1997, 1998. Casper, Wyoming.

Wyoming State Land Use Commission. 1979. Wyoming State Land Use Plan: A Program for Land Use Planning in the State of Wyoming. The Wyoming State Land Use Commission, Cheyenne, Wyoming. 180 pages and maps.

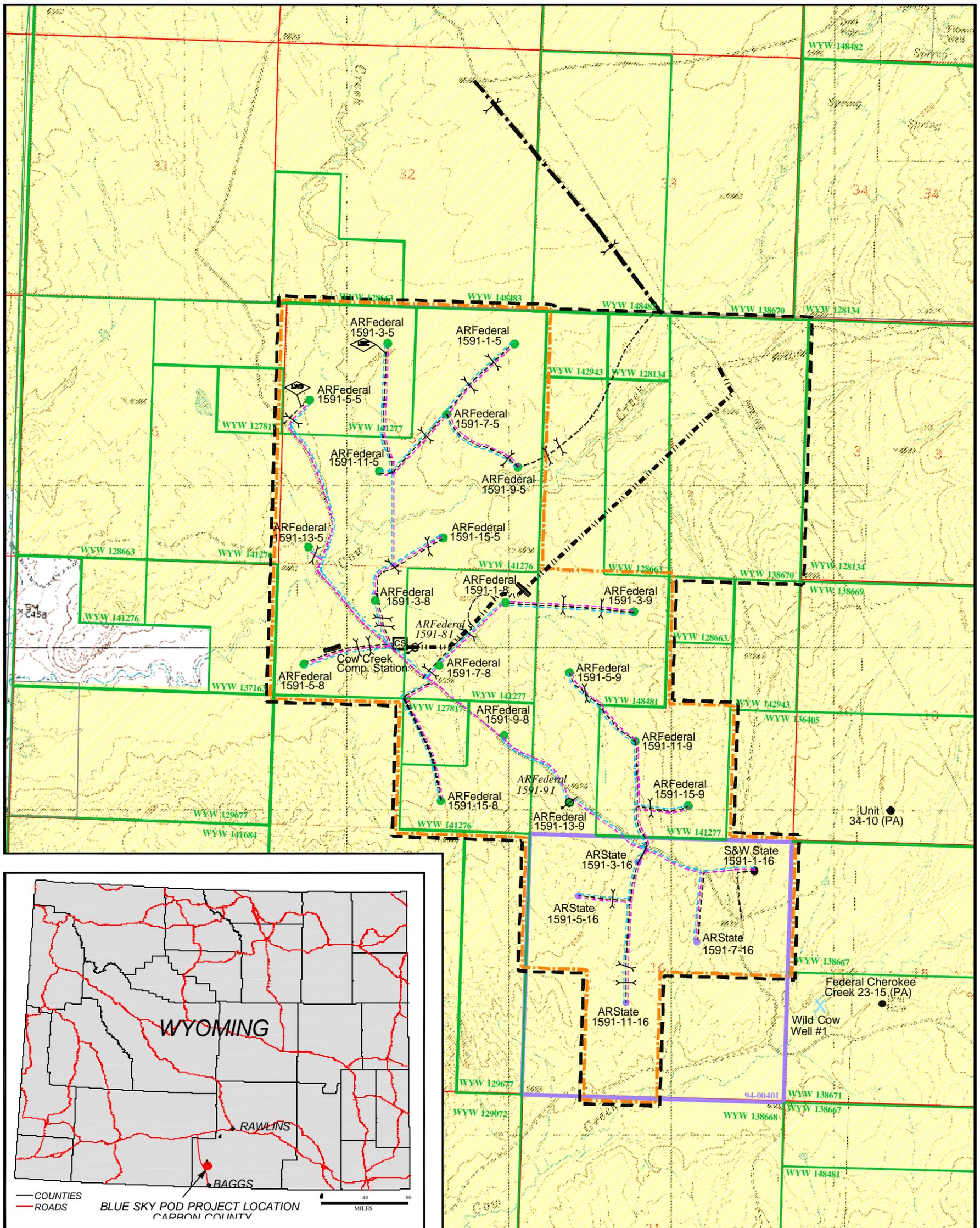
Wyoming Taxpayers Association. 2000. Wyoming Property Taxation 2000. Cheyenne, Wyoming.

CHAPTER 7 ACRONYMS

ACEC	Area of Critical Environmental Concern
ADT	Average Daily Traffic
APCD	Air Pollution Control Division (Colorado Department of Public Health and Environment)
APD	Application for Permit to Drill
AQD	Air Quality Division (Wyoming Department of Environmental Quality)
AUM	Animal Unit Months
BLM	United States Bureau of Land Management
BMPs	Best Management Practices
CBM	Coalbed Methane
CCR	Carbon County Road
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
cfs	Cubic feet per second (equivalent to 448.83 gallons per minute)
CIA	Cumulative Impact Assessment
CO	Carbon monoxide
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
CWR	Crucial Winter Range
Dad Road	Carbon County Road 608
dba	A-weighted scale, decibels
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
°F	Degrees in Fahrenheit
FEIS	Final Environmental Impact Statement
FWS	United States Fish and Wildlife Service
FY	Fiscal Year
IDT	Interdisciplinary Team
g/hp-hr	grams per horsepower-hour

gpd/ft	Gallons per day per foot
gpd/ft ²	Gallons per day per square foot
gpm	Gallons per minute
GWD	Ground Water Division, Wyoming Department of Environmental Quality
HAP	Hazardous Air Pollutants
HWA	Hayden-Wing Associates
MDP	Master Drilling Plan
meq/l	Milliequivalents per liter.
mg/l	Milligrams per liter
mmhos/cm	Soluble salts (salinity) in a soil expressed in millihos per centimeter.
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MSUP	Master Surface Use Plan
NCR	Nonselective Catalytic Reduction
NEPA	National Environmental Policy Act
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
OSHA	Occupational Safety and Health Administration (federal & state)
pCi/l	Picocurie per liter, used to measure Radium 226.
Pedco	Petroleum Development Corporation
PM ₁₀	Particulate matter less than 10 microns in effective diameter
Pod	Grouping of CBM wells into a well pod, i.e., Pod 7
PPP	Pollution Prevention Plan
PSD	Prevention of Significant Deterioration
psi	Pounds per square inch
RCRA	Resource Conservation and Recovery Act
RFFA	Reasonably Foreseeable Future Action
RFO	Rawlins Field Office, Bureau of Land Management
RMP	Resource Management Plan
ROD	Record of Decision

ROW	Right-of-Way
RV	Recreational Vehicle
R_W	Range <u>number</u> West
SAR	Sodium Adsorption Ratio
SARA	Superfund Amendments and Reauthorization Acts
SCR	Selective Catalytic Reduction
SH	State Highway
SHPO	State Historic Preservation Office
SO ₂	Sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
s.u.	Standard Units
TDS	Total Dissolved Solids
T_N	Township <u>number</u> North
TPQ	Threshold Planning Quantity
µg/m ³	Micrograms per cubic meter (1 µg=0.001 mg or 1 part per billion)
USDI	United States Department of the Interior
USDOT	United States Department of Transportation
USFS	United States Forest Service
UW	University of Wyoming, Laramie
VOC	Volatile Organic Compounds
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WMP	Water Management Plan
WOGCC	Wyoming Oil and Gas Conservation Commission
WOS	Wildlife Observation System
WSEO	Wyoming State Engineer's Office
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database



Source: USGS 7.5' Quadrangles Blue Gap, Garden Gulch WY.

LEGEND

- | | | |
|-------------------------|----------------------------|------------------------------|
| Permitted Water Well | Project Area Boundary | Existing Road to be Improved |
| Proposed Federal Wells | POD Boundary | |
| Proposed State Wells | Federal Lease Boundary | |
| Proposed Fee Wells | State Lease Boundary | |
| Existing Wells | Proposed Gas Flowline | |
| Compressor Station | Proposed Water Flowline | |
| Proposed Injection Well | Proposed Road | |
| Culvert | Proposed 8" Gathering Line | |
| Low Water Crossing | BLM Surface Ownership | |
| Cattleguard/Gate | Private Surface Ownership | |

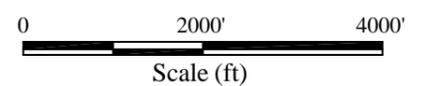
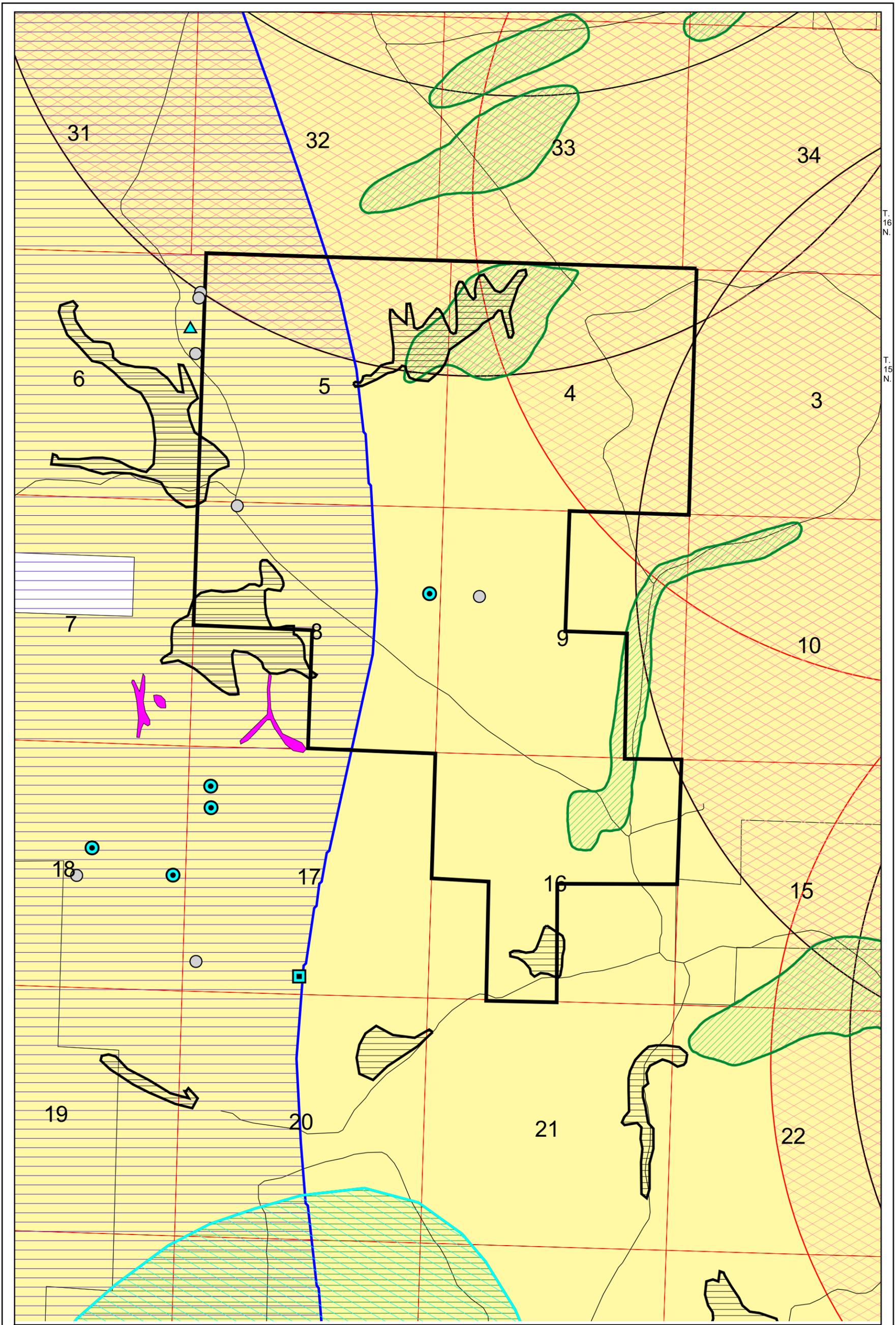


Figure 1- Blue Sky POD Project Map			
Prepared by Greystone Environmental Consultants			
DATE PLOTTED	DATE CHECKED	DRAWN BY	SCALE



LEGEND

R. 1 W.

Prepared by Greystone Environmental Consultants
Data Courtesy of Hayden-Wing Associates



- Project Area Boundary
- Land Ownership**
- BLM
- PRIVATE
- Sage Grouse Lek (2 mi Buffer, pre-2001)
- Sage Grouse Lek (2 mile Buffer, 2001)
- Existing Road
- Historic Raptor Nests
- Golden Eagle
- Unknown Raptor
- Ferruginous Hawk
- Critical Sage Grouse Winter Use
- Prairie Dog Towns
- Pronghorn Crucial Winter Range
- Potential Mountain Plover Habitat
- Mule Deer Crucial Winter Range

PETROLEUM DEVELOPMENT CORP.
801 E. 4th Ste. 23 Gillette, WY 82716
Office (307) 682-1088 Fax (307) 682-2767

Figure 2 - Blue Sky Project Map
Wildlife Sightings, Habitat Locations and Buffer Zones
2000 and up to May 1, 2001 Data.

Date: 12.20.01

ArcView File: C:\PROJECTS\ATL\ARC\ALTAN_APR

PLOT SCALE: 1" = 1000'

Prepared By: PBE

APPENDIX A

Interim Drilling Policy - Conditions and Criteria Under Which Development Activities May Occur Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project

During the preparation of the Atlantic Rim Coalbed Methane EIS, the Bureau of Land Management's (BLM) authority to allow drilling on the federal mineral estate is limited. The Council on Environmental Quality (CEQ) Regulations and 40 CFR 1506.1, *limitations on actions during NEPA process* to comply with the National Environmental Policy Act (NEPA) provide the following regarding limitation on concurrent authorizations:

Section 1506.1

(a) Until an agency issues a record of decision as provided in para. 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

- (1) Have an adverse environmental impact; or*
- (2) Limit the choice of reasonable alternatives.*

(b) If any agency is considering an application from a non-federal entity, and is aware that the applicant is about to take an action within the agency's jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.

(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

- (1) Is justified independently of the program;*
- (2) Is itself accompanied by an adequate environmental impact statement; and*
- (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.*

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance....

The above regulations and the following criteria and conditions will be used by the BLM to determine new exploratory activities allowed on Federal surface and/or minerals during preparation of the EIS. They also establish conditions under which these activities will be approved. The intent of these criteria and conditions are to keep all activity within the scope of existing analysis and at a reasonable level, to allow limited drilling activity for acquisition of additional data necessary for completion of the EIS, and to prevent unnecessary hardship to leaseholders. These criteria may be modified by the BLM authorized officer (AO) if any of the allowed activities are viewed as having a potentially significant effect on the environment or prejudice the ultimate decision on the drilling program for the EIS as outlined in the CEQ regulations quoted above.

APPENDIX A: INTERIM DRILLING POLICY

Activities Allowed on Federal Lands and Minerals During EIS Preparation

1. A maximum of 200 coalbed methane wells will be allowed within the project area, for research and exploratory purposes, during the interim period in which the EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated (see map).
2. Activities within individual pods will be authorized by BLM. For any pod location which overlaps the boundary of a sensitive resource area for sage grouse, mountain plover, raptors, big game migration corridors, and sensitive plants, appropriate stipulations and mitigation will be applied to protect any sensitive resources present (see Term Definitions below). Some sensitive resources such as high density paleontological or cultural resources sites, are not mapped and will also be handled on a pod basis.
3. Existing coalbed methane wells (two wells re-completed as coalbed methane producers in the Cow Creek Unit by Double Eagle and one new well completed by Petroleum Development Corporation, to the east of this unit) will count toward the above well limits. As Federal 1691 #10-8 has been plugged and abandoned, it will not count toward the above well limit. In addition, the six coalbed methane wells originally permitted by North Finn LLC and drilled in Section 5, T17N, R90W, and the well located in Section 36, T15 N, R91W, will not count toward the allowed well number, as long as they are not included as part of any proposed pod. In addition, required injection wells and monitoring wells will not count toward the well limit.
4. Any modifications proposed to the approved pods (i.e. changing pod locations, drilling wells outside of the current pod locations, or increasing the total number of wells allowed during interim drilling), will only be approved if geologic, hydrologic, or reservoir characteristics support a change. These changes will be allowed after review by, and concurrence of, the Reservoir Management Group and authorization by the BLM, Rawlins Field Office. Additional federal drainage protection wells may be required.
5. During preparation of the EIS, coalbed methane wells and associated roads and pipelines on any private surface/private mineral where the operator has, or has obtained legal access (i.e., county roads, approved BLM ROW grant or private access road) prior to approval of the interim drilling plan, may be developed as deemed appropriate by the operator/lessee. However, these wells will count toward the total number of wells allowed to be drilled under this interim drilling policy.

Criteria and Conditions that Apply to Interim Drilling Operations

1. A detailed Plan of Development/Surface Use Plan (POD/SUP) and Master Drilling Plan for each individual pod, using guidance provided by the BLM Rawlins Field Office, will be submitted and approved prior to surface disturbing activities.
2. The operator(s) agree to supply the geologic, coal, and water data information discussed in Appendix C of this document.
3. Prior to initiating interim drilling, an environmental assessment (EA), including a detailed Water Management Plan will be prepared and approved for each individual pod. Because

APPENDIX A: INTERIM DRILLING POLICY

of the current BLM workload, and in order to expedite the completion of the EAs, it is recommended that these documents be prepared by a third-party contractor.

4. All pod EA's will be submitted to the BLM in pdf format and each document will be placed on the BLM Wyoming web page. A 30-day public review of each document will occur from the date the document is placed on the site. BLM will be responsible for writing the Decision Record for each EA.
5. A 1/4 mile buffer is required between surface disturbing activities and the Overland Trail.
6. Block surveys for cultural resources will be required for each pod.
7. No interim drilling will be allowed in the Sand Hills Area of Critical Environmental Concern as described in the Great Divide Resource Management Plan Record of Decision (RMP-1990).
8. The Great Divide RMP states the BLM will include intensive land-use practices to mitigate salt and sediment loading caused by surface disturbing activities within the Muddy Creek watershed. The Muddy Creek Coordinated Resource Management (CRM) group was established as an advisory group to address this issue. Because this area overlaps with the Muddy Creek CRM effort, and since road use contributes the most in increasing the amount of sediment in the Muddy Creek drainage, the POD/SUP will be reviewed by the Muddy Creek CRM Road Committee and recommendations of the group will be considered by BLM. Changes to the POD/SUP will be made prior to initiating work on the pod EA.
9. Surface discharge as a method of disposal for produced coalbed methane waters will be considered for each individual pod during interim drilling activities within the Great Divide Basin. This is subject to the approval of the Water Management Plan and upon obtaining all required federal, state and local permits.
10. Prior to completion of the EIS, water produced from coalbed methane wells located in the Colorado River Basin will be disposed of by re-injection. The only exception to this would be waters produced from the Double Eagle's coalbed methane existing and proposed wells located in the Cow Creek POD. Double Eagle has applied to the Wyoming Department of Environmental Quality (WDEQ) for a National Pollutant Discharge Elimination System (NPDES) permit for their two existing wells and four wells permitted recently by BLM. Should Double Eagle receive their state permit, they will be allowed to surface discharge from these six wells. Prior to any additional drilling of CBM wells by Double Eagle in the Cow Creek Pod, an environmental assessment, including a Water Management Plan, will be prepared and submitted to BLM which will examine the environmental impacts from these wells. Double Eagle will be allowed to dispose of produced CBM waters to the surface only after completion of the environmental analysis and a determination is made that the additional surface discharge will cause no significant impact to the environment.
11. No drilling activities will be allowed in prairie dog towns during interim operations. However, drilling will be allowed in each individual pod containing prairie dog towns upon the completion of black-footed ferrets survey using methods approved by the United States Fish and Wildlife Service. These surveys will clear the pod for a one year period. The operators also have the option of completing surveys in the whole EIS area which would clear the area for the life of the project.

APPENDIX A: INTERIM DRILLING POLICY

In the event a black-footed ferret or its sign is found, the BLM Authorized Officer shall stop all action on the application in hand, and/or action on any application that may directly, indirectly, or cumulatively affect the colony/complex, and initiate Section 7 review with the USFWS. No project related activities will be allowed to proceed until the USFWS issues their biological opinion. The USFWS biological opinion will specify when and under what conditions and/or prudent measures the action could proceed or whether the action will be allowed to proceed at all.

12. No drilling or disturbance will be allowed in those areas determined to be critical winter habitat for sage grouse.
13. No drilling or disturbance will be allowed in areas where any two or more big game (elk, deer, or antelope) crucial winter ranges overlap.
14. The operators will be required to submit a drilling schedule as part of the Master Drilling Plan. This schedule will be reviewed, and approved by BLM, to ensure that activities are limited within proven big game migration corridors at critical use times during the year.
15. Pipelines, power lines, waterlines, fiber optic lines will be buried and, where possible, will follow the road rights-of-way.
16. Fish passage structures will be installed for roads which cross drainages with fisheries concerns as identified by BLM.

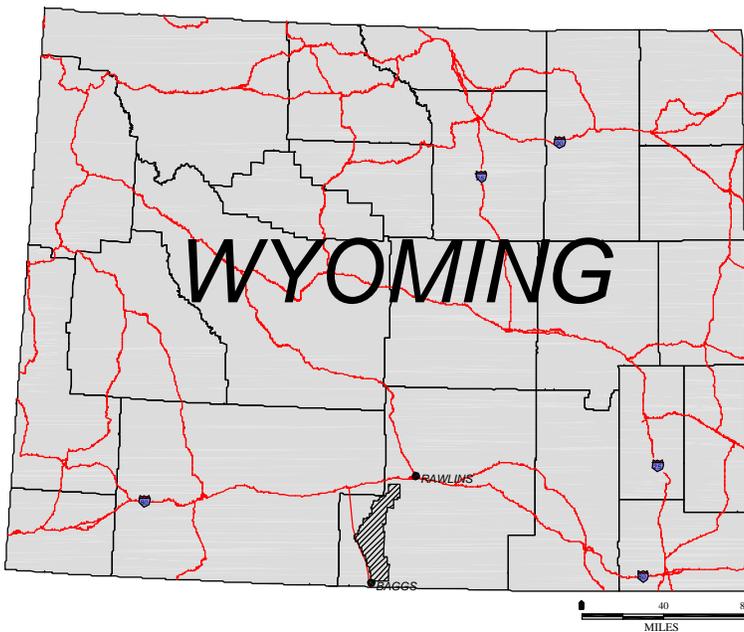
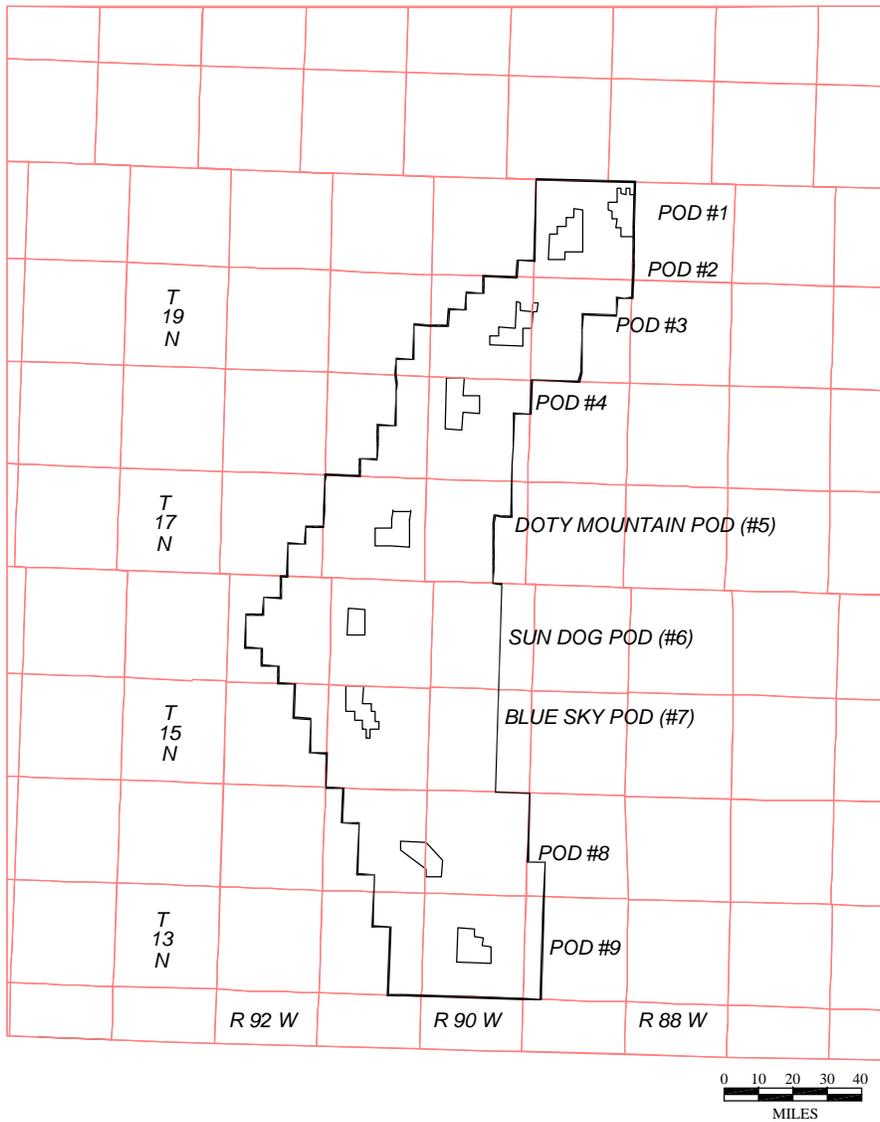
Term/Definitions

SENSITIVE RESOURCE AREAS are defined as those areas containing stabilized sand dunes, sensitive plant areas, raptor nesting concentration areas, prairie dog towns, two-mile buffer around sage grouse leks, mountain plover aggregation areas or potential habitat, big game migration corridors and crucial big game winter ranges, and areas with high density cultural or paleontological resource sites. Field inspections by the BLM will be conducted to verify presence of these resource values and potential impacts prior to considering authorization of any proposed development activity on Federal surface and/or minerals.

WILL BE AUTHORIZED means BLM will authorize the action if, following the environmental review of the APD or ROW application, sensitive resource areas are protected with appropriate stipulations or mitigation and the criteria established under CEQ regulation 40 CFR 1506.1 have been met. An environmental assessment (EA) will be completed for each individual pod prior to authorizing the proposal. Consultation and Coordination with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service will occur when applicable for proposed activity within sensitive resource areas. The pod EA will identify the most environmentally acceptable access route, well site, and pipeline location. Mitigation measures developed from nearby project EISs and EAs for protection of resource values may be considered in the assessment. Any action proposed must be in conformance with the Great Divide Resource Management Plan (RMP) and mineral lease terms and conditions.

A coalbed methane pod may consist of two or more production wells, injection wells, access roads, product pipelines, water pipelines, power lines and other ancillary facilities designed specifically to assess the development potential of the play.

Project Areas- Interim Drilling PODs



ATLANTIC RIM COALBED METHANE EIS INTERIM DRILLING PROJECT AREAS

SCALE: AS NOTED

DATE: 10.25.01

DRAWN BY: MTM

FIGURE: 1

APPENDIX B

Petroleum Development Corporation

Blue Sky CBM Project
Carbon County, Wyoming

Master Surface Use Program
for
Applications for Permit to Drill (APDs)

Land Involved: Sec. 32 & 33
T16N R91W, 6th P.M.

Sec. 4,5,8,9 &16
T15N R91W, 6th P.M.

BLM Leases (Wells):

WYW 141276

ARFederal 1591-1-5
ARFederal 1591-7-5
ARFederal 1591-9-5
ARFederal 1591-11-5
ARFederal 1591-13-5
ARFederal 1591-15-5
ARFederal 1591-3-8
ARFederal 1591-5-8
ARFederal 1591-9-8
ARFederal 1591-15-8

WYW 141277

ARFederal 1591-3-5
ARFederal 1591-5-5
ARFederal 1591-1-8
ARFederal 1591-7-8
ARFederal 1591-11-9
ARFederal 1591-15-9

WYW 148481

ARFederal 1591-3-9
ARFederal 1591-5-9
ARFederal 1591-13-9

PROJECT DESCRIPTION

The Petroleum Development Corporation (Pedco) Blue Sky Coalbed Methane (CBM) Project is located approximately 18 miles north-northeast of Baggs, Wyoming near the intersection of SH 789 and Carbon County Road 608 (Dad Road). Blue Sky is one of nine pods that comprise the Atlantic Rim Interim Drilling CBM Project. All 23 of the proposed CBM well sites and one existing CBM well site in the Blue Sky Project Area are located on surface ownership lands administered by the Bureau of Land Management (BLM) Rawlins Field Office. A total of 19 of the proposed wells would develop Federal minerals. The remaining four proposed wells would develop State minerals. The existing Blue Sky Project well, S&W State 1-16, is located on State of Wyoming mineral ownership lands. Plans for two injection wells were submitted separately.

Name, number, location, and lease information for the proposed wells are listed in **Table 1 - Blue Sky CBM Project Well Information** accompanying this Master Surface Use Program (MSUP). Refer to the enclosed **BLM Application for Permit to Drill (APD) Form 3160-3** for each federal well, and **Well Survey Plats**.

CBM wells are currently planned on WYW141276, WYW141277, WYW148481, and State Lease 94-00401. The federal leases contain special timing stipulations that protect big game crucial winter range (November 15 through April 30), and sage grouse and raptor nesting (February 1 through July 31).

Only access roads cross other leases in the project area. Leases WYW148482 and WYW148483 contain all three stipulations listed above. Only the big game crucial winter range and the sage grouse and raptor nesting stipulations apply to WYW127817 and WYW128663. Lease WYW128134 contains one stipulation, the sage grouse and raptor nesting timing limitation. Refer to the attached **Project Map** for all lease boundaries.

The primary targeted reservoir in the Blue Sky Project is coal seams within the Mesaverde Group. Drill site locations will be on approved 80-acre spacing. All unproductive wells will be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for gas pipeline connections and/or Sundry Notices under review by the BLM for production activities and facilities.

Blue Sky Project contains a total of approximately 1,921 acres. Of that total area, an estimated 28.8 acres or 1.5 percent will be temporarily disturbed during drilling at the CBM well sites (1.25 acres per well), while 5.8 acres will be disturbed for the completed well sites (0.25 acres per well). The compressor site will disturb 1.5 acres. Each injection well will add 1.0 acre and each water transfer facility will add 1.0 acre to this figure. Refer to the attached diagrams for all pad dimensions.

Approximately 34.9 acres will be disturbed by the construction of the proposed access routes and water/gas gathering lines. This figure is based on a 20-foot wide disturbance area for roadways and a 15-foot wide disturbance area for gas and water flowlines and electric lines. A proposed sales pipeline would disturb an estimated 3.1 acres during construction. Refer to the attached **Project Map** for the location of all access routes and gatherings lines. This Master Surface Use Plan (MSUP) is intended to serve as the Right-of-Way (ROW) application for the gas lines, water lines, access roads to well locations, access road to the compressor station, and electric lines in the Project.

Gas lines will require a 30-foot right-of-way, water lines a 20-foot right-of-way, electric lines a 10-foot right-of-way, and the sales pipeline a 50-foot right-of-way.

Coal bed methane (CBM) is naturally adsorbed to the surfaces of the coal matrix and typically is not free to migrate in the subsurface until pressure is relieved. Generally speaking, hydrostatic head provides the pressure that keeps the majority of the CBM adsorbed to the coal. CBM is liberated from the coal matrix by the withdrawal of water, which in turn reduces the hydrostatic head present in the coal formation. Once a “critical” subsurface coal formation pressure is reached as water is pumped from the coal formation, CBM is free to migrate. CBM will then flow or can be pumped to the surface through the wellbore.

Pedco plans to spud the wells when the project is approved. Drilling and testing activities are expected to occur over several months. Wet gas from the productive wells will be routed to a compressor station. Produced water will be gathered from the well sites and routed to two approved injection wells for disposal. The wells will be drilled through the coal seam formations. The coal seams will be exposed to the wellbore through perforation of casing.

The wells may be tested for a period of several months. Well testing involves pumping and testing water from each well and determining its capacity to produce natural gas. It is anticipated that well testing will be completed within six to twelve months. If unproductive, the drill holes will be plugged and abandoned in accordance with WOGCC rules and regulations and BLM guidance, as soon as practicable after the conclusion of well testing. If productive, natural gas will be collected and transported via buried pipelines to a compressor station, where flow will be measured.

For about half of the Project wells, this measurement location will be off-lease and will require a variance from Onshore Order #5. This request for variance, along with a description of the measurement equipment, will be submitted in a Sundry Notice if the wells are deemed producible by Pedco. **Table 1** contains measurement location information for each well.

During well testing associated with this Project, natural gas (e.g. CBM), to the extent it is produced, will be vented or flared on-location in accordance with the applicable BLM Onshore Orders and Notices To Lessees, and Wyoming Oil & Gas Conservation Commission (WOGCC) regulations, and authorized by the WOGCC and the BLM in Sundry Notices. During drilling and testing, produced water from the proposed wells will be transported to one of two approved injection wells for disposal.

Oil and gas activities in Wyoming are managed by the WOGCC. All Pedco’s operations, and those of its contractors, will be conducted in accordance with all BLM and WOGCC rules and regulations.

1. EXISTING ROADS

The Project area is accessible from Baggs, Wyoming, by traveling approximately 20 miles north on SH 789 to the intersection with Carbon County Road 608 (Dad Road), or south on SH 789 from Interstate 80 (I-80) to Dad Road. Turn east onto County Road 608 and travel approximately 6 miles to the Project area.

Local roads are shown on the attached map of the Project area. Existing roads and gates will be used when practical. All existing and proposed BLM roads shall be brought up to minimum standards for a Resource Road as found in BLM Manual 9113.

The existing roads will be maintained in the same or better condition as existed prior to the start of operations. Maintenance of the roads used to access the well locations will continue until final abandonment and reclamation of the well locations occur. A regular maintenance program will include, but is not limited to, blading, ditching, culvert installation, and gravel surfacing where excessive rutting or erosion may occur. Limiting or temporarily suspending vehicle access during adverse conditions will reduce excessive rutting or other resource damage that may be caused by vehicle traffic on access roads that are wet, soft, or partially frozen. If vehicles create ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support vehicles and construction or routine maintenance activities shall be temporarily suspended.

Culverts will be placed in the existing BLM roads as the need arises or as directed by BLM's Authorized Officer. Gates and cattleguards will be installed where appropriate (refer to **Project Map**).

Pedco shall share maintenance costs in dollars, equipment, materials, or labor proportionate to Pedco's use with other authorized users. Upon request, the Authorized Office shall be provided with copies of any maintenance agreement entered into.

2. ACCESS ROADS TO BE CONSTRUCTED

Well Access

Access to the individual well sites will be provided by crowned and ditched roads surfaced with an appropriate grade of gravel. Surfacing of the access roads will be completed prior to moving the drilling equipment/rig onto the pad. The access roads will follow existing terrain and the travelway will be approximately 14 feet wide.

Certain access roads, or portions thereof, may not need to be surfaced prior to moving the drilling equipment/rig onto the well pad. Factors to be considered here are soil types, grade and the weather conditions that suggest excessive rutting or erosion may occur without gravel. These access roads, or portions thereof, will be identified during the on-site inspection.

The access roads will be constructed to minimum standards for a BLM Resource Road as outlined in BLM Manual 9113. The minimum travelway width of the road will be 14 feet with turnouts. No structure will be allowed to narrow the road top. The inside slope will be 4:1. The bottom of the ditch will be a smooth V with no vertical cut in the bottom. The outside slope will be 2:1 or shallower. Turnouts will be spaced at a maximum distance of 1,000 feet and will be intervisible.

Topsoil and vegetation will be windrowed to the side of the newly constructed access roads. After the roads are crowned and ditched with a 0.03 to 0.05 ft. crown, the topsoil will be pulled back onto the cut slopes of the road right-of-way so there is no berm left at the top of the cut slope.

Drainage crossings on the access routes within the Project area would either be low water crossings or crossings using culverts. Low water crossings would be utilized in shallow channel crossings and at crossings of the main channel. Culverts would be installed on smaller, steeper channel crossings. Topsoil would be saved before channel crossing construction occurs. The additional culverts would be placed as the need arises or as directed by the BLM's Authorized Officer. The total area to be disturbed would be flagged on the ground before construction begins.

Culverts will require a minimum of 12" of fill or ½ the pipe diameter whichever is greater. The inlet and outlet will be set flush with existing ground and lined up in the center of the draw. The bottom of the pipe will be bedded on good material before backfilling. Backfill with unfrozen material and no rocks larger than two inches in diameter. Care shall be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill shall be brought up evenly in 6" layers on both sides of the conduit and thoroughly compacted. A permanent marker will be installed at both ends of the culvert to help keep traffic from running over the ends. Culverts will be installed in a manner which minimizes erosion or head-cutting. This may include rip rapping or other measures as required.

Where low water crossings are required, a 30" deep rock fill over geotextile through the drainage will be required. The rock fill will consist of 75 percent 3" to 10" diameter rough rock and 25 percent Wyoming Grading "W" Material to fill the voids. The geotextile shall be overlapping at all joints and extend beyond the rock fill. The top of the rock fill in the drainage bottom shall match the elevation of the natural drainage to allow for smooth flow with no unnatural scouring or water backup. Four inches of course gravel over the rock will be used for the surface.

The access roads will be winterized by providing a well-drained travelway to minimize erosion and other damage to the roadway or the surrounding public land.

Wing ditches will be constructed as deemed necessary to divert water from the road ditches. Wing ditches will be constructed at a slope of ½ percent to 1 percent.

A "plans-in-hand" review will be conducted with the drilling contractor prior to construction to review the access routes to the well sites. Directional markers will be set where needed and will be removed as soon as they are no longer needed.

No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment and construction/maintenance will be temporarily suspended.

Construction activity or routine maintenance will not be conducted using frozen or saturated soil material or during periods when watershed damage is likely to occur.

If snow removal outside the new and existing roadways is undertaken, equipment used for snow removal operations will be equipped with shoes to keep the blade off the ground surface. Special precautions will be taken where the surface of the ground is uneven to ensure that equipment blades do not destroy the vegetation.

Unless otherwise exempted, free and unrestricted public access will be maintained on the access road. All construction work will be accomplished as specified by the landowner and the BLM. If no specific BLM field survey requirements are provided, the design, field survey and construction requirement for BLM Resource Roads that are described in BLM Manual 9113 will be followed. Design drawings and templates will be submitted only if specifically required by the BLM.

New access routes will be sited to avoid areas susceptible to increased resource damage from the proposed action, such as areas of steep terrain or poor vegetative cover. Every effort will be made to minimize the amount of cut-and-fill construction needed to maintain safe, environmentally sound, year-round access to the well sites. The special Conditions of Approval specified for this Project by the BLM will be implemented.

Compressor Site Access

An all weather road currently exists to the compressor site and has a travel width of approximately 14 feet. All equipment and vehicles will be confined to this travel corridor and other areas specified in the Project. All disturbances related to this access road will be confined within the travel corridor.

3. LOCATION OF EXISTING WELLS

One permitted water well is located within one mile of the Project area (**Table 2 Permitted Water Wells Within One Mile of the Blue Sky Project Area**). Note that this well is not located within the inferred circle of influence (within a half-mile radius) of any individual proposed CBM well. This information, including the well site and other pertinent information, was obtained from the Wyoming State Engineer's Office (WSEO).

The enclosed **Project Map** depicts locations of disposal, drilling, producing, injection, and abandoned oil and gas wells within one mile of the Project wells. The well locations were obtained by a search of the WOGCC website.

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES, IF WELLS ARE PRODUCTIVE

On Well Pad

Should drilling result in established commercial production, the wellhead will require an area of approximately 15 feet by 15 feet. The surface equipment at each CBM well will consist of the wellhead and an insulated wellhead cover. Depending on site specific conditions, the housing will be painted either "Carlsbad Canyon" tan, color 2.5Y 6/2 or Desert Brown, color 10YR 6/3 of the "Standard Environmental Colors", unless otherwise specified by the BLM. Each productive well is expected to require the installation of an electric submersible pump below ground level that will be used to produce water necessary to lower pressure with the coal seams. A schematic of the **Typical CBM Well Site** is attached to the MSUP.

During drilling and testing of each well a temporary generator may be used at the well site. If the well were productive it would be shut-in until production facilities are constructed. After construction of the production facilities a temporary generator would be centrally located and used until permanent electrical services were installed.

In order to minimize surface disturbance, where possible, the operator shall utilize wheel trenchers or ditch witches to construct all pipeline trenches associated with this Project. Track hoes or other equipment will be used where topographic or other factors require their use.

The operator shall submit a Sundry Notice for approval prior to construction of any new surface disturbing activities on-lease that are not specifically addressed in the Master Surface Use Plan or individual APDs.

Off Well Pad/Compressor Station/Water Transfer Facilities

The compressor site facility is expected to be constructed within an approximate area of 200 feet by 200 feet (see attached **Typical Compressor Station & Meter Facility**). About one-half of the compressor site will be affected by the construction, maintenance, and operation of the facility. The compressor site facility will be of all-weather construction, having a thick layer of gravel over the pad site. Topsoil will be removed and conserved for later reclamation activities. The compressor site will consist of an insulated header building containing allocation meters for each well. The header building will also contain a dehydrator that will remove water from the wet gas stream. The water will be pumped from the header building to an approved injection well. If different production facilities are required, plans will be submitted in a Sundry Notice. In addition to the facilities on the pad, Pedco will construct drainage ditches to divert stormwater away from the compressor station pad.

Approval of this APD includes approval for Onshore Order #7 to dispose of produced water. All produced water will be injected into the Federal 1591-8I injection well or Federal 1591-9I injection well unless otherwise authorized. Any changes in the produced water disposal method or location must have written approval from BLM's authorized officer before the changes take place.

Water produced at the well sites will be gathered and transported to the injection wells for disposal. The injection wells will be drilled, cased, and cemented from TD to surface (see attached schematic of the **Injection Well**). The primary injection objectives are the Cherokee Sandstone (approximately 3,900 to 4,400 feet below the surface) and the Deep Creek Sandstone (approximately 4,200 to 4,700 feet below the surface). The Cherokee and Deep Creek are isolated above and below by competent shale barriers that will prevent the initiation and propagation of fractures through overlying strata to any fresh water zones.

The source of the water to be disposed is from the coals in the Mesaverde Group. Coalbed formation water (CBM produced water) will be collected in a buried 2-inch polyethylene flowline (pipeline) for transport to the water disposal facility location approved by the WOGCC and the BLM.

A typical water disposal facility consists of four 400 bbl water tanks, pump house, piping, and well house (see attached schematic of **Typical Water Disposal Facility**). Four transfer pumping stations, consisting of a 400 bbl water tank with associated pump and piping, will be needed (see attached **Typical Water Transfer Facility**). These transfer stations will be located near proposed disturbance areas, outside cultural sites, and, where possible, away from any known sensitive wildlife or resource areas. Final location of the water transfer facilities will be submitted in a Sundry Notice. CBM produced water and gas gathering lines will be co-located with well access roads as much as possible to reduce potential surface disturbance.

The water tanks will be constructed, maintained, and operated to prevent unauthorized surface or subsurface discharges of water. The tanks will be located away from the established drainage patterns in the area and be constructed to prevent the entrance of surface water.

The water tanks will be fenced or capped to prevent livestock or wildlife entry.

The water tanks will be kept reasonably free from surface accumulations of liquid hydrocarbons and are not to be used for disposal of water from other sources without the prior approval of the BLM. Any discharge from the tanks will be reported to the BLM as required by NTL-3A.

All storage tanks and compressor facilities, designed to contain oil, glycol, produced water, or other fluid which may constitute a hazard to public health or safety, shall be surrounded by a secondary means of containment for the entire contents of the largest single tank in use, plus 1 foot of freeboard. The containment or diversionary structure shall be impervious to any oil, glycol, produced water, or other toxic fluid for 72 hours and would be constructed so that any discharge from a primary containment system would not drain, infiltrate, or otherwise escape to groundwater, surface water, or navigable waters before cleanup is completed.

Within 90 days of initial production start-up, the operator will submit to the BLM authorized officer an analysis of the produced water.

5. LOCATION AND TYPE OF WATER SUPPLY FOR DRILLING

Water produced from nearby CBM wells may be transported to the drilling locations and used to drill these wells. Alternately, water for drilling the initial well may be purchased from a private source and transported by truck to the drilling location.

Any changes in the water source or method of transportation must have written approval from BLM's authorized officer before the changes take place.

6. CONSTRUCTION MATERIALS

Construction materials (mineral material aggregate suitable for surfacing material) will be purchased from a nearby private source or a local supplier having a permitted source of materials in the area. No construction materials will be removed from Federal and/or Indian lands without prior approval from the BLM.

7. METHODS FOR HANDLING WASTE DISPOSAL

Drill cuttings (rock fragments generated during drilling) will be produced during the drilling of the borehole. Cuttings will be buried in the reserve pit upon closure of the reserve pit.

No oil or other oil-based drilling additives, chromium/metals-based muds, or saline muds will be used during drilling of these wells. Only freshwater, biodegradable polymer soap, bentonite clay, and non-toxic additives will be used in the mud system. Details regarding the mud program are incorporated within the accompanying **Master Drilling Program**. These wells will not produce oil or saltwater typical of oil production. Furthermore, other liquid hydrocarbons are not anticipated. Should unexpected liquid petroleum hydrocarbons (e.g., crude oil or condensate) be encountered during drilling or well testing, all liquid petroleum hydrocarbons will be contained in test tanks on the well site.

A portable, self-contained chemical toilet will be provided on location during drilling and completion operations. Upon completion of operations, or as required, the contents of toilet holding tanks will be disposed of at an authorized sewage treatment and disposal facility. Disposal will be in accordance with State of Wyoming, Carbon County, and BLM requirements regarding sewage treatment and disposal. Pedco will comply with all state and local laws and regulations pertaining to disposal of human and solid wastes.

No trash will be placed in the reserve pit. All refuse (trash and other solid waste including cans, paper, cable, etc.) generated during construction, drilling, and well testing activities will be contained in an enclosed receptacle, removed from the drill locations promptly, and hauled to an authorized disposal site.

Immediately after removal of the drilling rig, all debris and other waste materials not contained within trash barrels will be cleaned up and removed from the well location. No potentially adverse materials or substances will be left on the drill location.

Hazardous Materials Management

All Project-related activities involving hazardous materials will be conducted in a manner that minimizes potential environmental impacts. An on-site file will be maintained containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds, and/or substances that are used in the course of construction, drilling, completion, production, and reclamation operations. Open pits that may contain hazardous materials will be netted.

No hazardous substance will be used in the construction or drilling operations associated with these wells. The term "hazardous materials" as used here means: 1) any substance, pollutant, or containment (regardless of quantity) listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended 42 U.S.C. 9601 et seq., and the regulations issued under CERCLA; 2) any hazardous waste as defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended; and 3) any nuclear or nuclear byproduct as defined by the Atomic Energy Act of 1954, as amended, 42 U.D.C. 2001 et seq. The operator will be required to provide a referenced list of hazardous

materials that could potentially be used, produced, or transported, disposed of, or stored on the well location including a discussion on the management of the hazardous materials.

Any spills of oil, gas, or any other potentially hazardous substance will be reported immediately to the BLM, landowner, local authorities, and other responsible parties and will be mitigated immediately, as appropriate, through cleanup or removal to an approved disposal site.

8. ANCILLARY FACILITIES

Self-contained travel-type trailers may be used on-site during drilling operations. No facilities other than those described in this MSUP will be constructed to support the operations associated with the wells.

9. WELL SITE LAYOUT

Schematic drawings of the **Well Site Layout** for each well are attached to this MSUP. Each schematic shows the orientation of the drill pad with respect to the topographic features (i.e., cut and fill), facilities, and access to the pad. **Location Survey Plats** and **Drill Pad Cross Sections** are also attached to this MSUP.

At each drill location, surface disturbance will be kept to a minimum. The areal extent of each drill pad is approximately 200 feet by 200 feet. Each drill pad will be leveled using cut and fill construction techniques where needed. Prior to constructing the drill pad the top 6-8 inches (more if available) of soil and associated vegetative material will be removed and stockpiled. Drainage ditches will be constructed to divert stormwater away from each pad. All surface disturbance related to drilling will be confined to each drill site.

Pedco plans to use a reserve pit at each drilling location. A reserve pit is used during drilling to circulate the drilling mud (mostly bentonite clay and freshwater) and rock cuttings out of the borehole and for holding drilling fluids. This pit will be designed and constructed according to WOGCC regulations and BLM requirements.

Each reserve pit will be approximately twenty feet deep (including two feet of freeboard), and will be forty feet wide and forty feet long (at the surface). Each pit will be excavated within the “cut area” of the drill site to minimize any potential for slope failure (geotechnical hazard). Each pit will be closely monitored to ensure no pit overflows occur. The reserve pit will be open for an estimated two to eight weeks to allow for evaporation of pit fluids. During this time the pit will be closed off from wildlife and livestock by two strands of barbed wire above a woven wire fence.

Each reserve pit shall be constructed in a manner which minimizes the accumulation of surface precipitation runoff into the pit. This can be accomplished by appropriate placement of subsoil/topsoil storage areas and/or construction of berms or ditches.

For the protection of livestock and wildlife, all pits and open cellars shall be fenced. Fencing shall be in accordance with BLM specifications. Netting will be placed over any pits that have been identified as containing oil or toxic substances as determined by visual observation or testing. The mesh diameter shall be no larger than one inch.

10. PLANS FOR RECLAMATION OF THE SURFACE

As soon as practical after the conclusion of drilling and testing operations, unproductive drill holes will be plugged and abandoned and site restoration will commence. The BLM will be notified prior to commencing reclamation operations. A Notice of Intent to Abandon will be filed for final recommendations regarding surface reclamation.

Upon completion of drilling, the reserve pit will be dewatered and reclaimed in accordance with BLM guidance. Typically this procedure involves allowing the contents to dry naturally, and then backfilling, re-contouring and reclaiming the reserve pit area to approximate pre-drilling site conditions. After abandonment of productive wells, all wellhead equipment that is no longer needed will be removed and the well sites will be restored.

Any areas, including the drilling locations, reserve pits or access routes, that are disturbed by earthwork will be recontoured to a natural appearance as near to the original contour as possible as soon as practical after the conclusion of operations. Recontoured areas will be outsloped and waterbreaks will be constructed where needed, to avoid concentrating surface waters and producing gullies.

Any flowline trenches that may be constructed will be backfilled completely. The land surface will be left "rough" after recontouring to ensure that the maximum surface area will be available to support the reestablishment of vegetative cover.

All topsoil conserved during earthwork will be distributed evenly and left "rough" over these recontoured areas. BLM goals for vegetative cover will guide revegetation efforts. Common goals are erosion control, palatable and nutritious forage for livestock and wildlife, and visual aesthetics.

Revegetation efforts will comply with BLM specifications on all BLM surface ownership lands. If no specifications are provided, the following specifications will be used. Seeding is expected to occur in the fall after September, prior to ground frost, or in the spring after frost has left the ground. The seed mixture, including fertilizer and mulching requirements, seeding depth, and seed drilling specifications will be developed in consultation with the BLM. Seed will be drilled on the contour using a seed drill equipped with a depth regulator in order to ensure even depths of planting. Seed will be planted between one-quarter to one-half inch deep. The anticipated seed mix and rates of application to be applied are listed below. Soil material that will be stockpiled for ten months or longer will be seeded according to BLM specifications, to the extent practicable.

Species (Pure Live Seed)	Rate of Application*
Grasses	
Slender wheatgrass (<i>Agropyron techycaulum</i>)	2 lbs./Acre
Thickspike wheatgrass (<i>Agropyron dasystachyum</i>)	4 lbs./Acre
Western wheatgrass (<i>Agropyron smithii</i>)	2 lbs./Acre
Indian Ricegrass (<i>Oryzopsis hymenoides</i>)	2 lbs./Acre
Sandberg bluegrass (<i>Poa sandbergii</i>)	0.5 lb./Acre
Bottlebrush squirreltail (<i>Sitanion hystrix</i>)	1 lb./Acre
Shrubs	
Gardner's saltbush (<i>Atriplex gardnerii</i>)	1 lb./Acre

*These seed rates are for drilling. If broadcast seeding, double the rates provided.

11. SURFACE OWNERSHIP

U.S. Bureau of Land Management
Rawlins Field Office
1300 North Third
Rawlins, Wyoming 82301-2407
(307) 328-4200

12. OTHER INFORMATION

Pedco is the lessee or operator for the federal CBM leases associated with this MSUP and these APDs.

The operator will have a qualified individual to serve as a compliance coordinator. This individual will be responsible for assuring that all requirements of the Surface Use Plan and appropriate Conditions of Approval are followed.

No slopes in excess of 25 percent would be affected by this proposal. No activities are planned near existing highways, railroads, pipelines, or powerlines. There are no occupied buildings or residences within one-quarter mile of the proposed drill sites.

Any road crossings of dry drainages, riparian, or other wetland areas will utilize appropriate Best Management Practices (BMP) to minimize impacts to these areas.

The Water Management Plan for this Project is enclosed with this MSUP.

The operator will be responsible for the prevention and suppression of fires on public lands caused by its employees, contractors, or subcontractors. During conditions of extreme fire danger, surface use operations may be either limited or suspended in specific areas, or additional measures may be required by the Authorized Officer.

The presence, distribution, and density of noxious weeds in the Project area will be controlled on disturbed areas within the exterior limits of the access road ROW and well pads. The well access roads and well pads will be inspected regularly to ensure that noxious weeds do not become established in newly disturbed areas. The control methods will be in accordance with guidelines established by the EPA, BLM, and state/local agencies.

The Project area encompasses public lands that consist of undulating grassland and sagebrush uplands, terraces, and riparian areas along and above creeks. The existing stream channels are intermittent or ephemeral and are partially vegetated with grasses. The nearest live water is located in Cow Creek.

Local flora consists primarily of needlegrass, western wheatgrass, prairie junegrass, blue grama grass, Indian rice grass, prickly pear cactus, and salt sage. Local fauna consists primarily of mule deer, antelope, coyotes, rabbits, raptors, and various smaller vertebrate and invertebrate species. Livestock graze on some of these lands. Oil and gas production activities have occurred in the general area.

Soils have good reclamation potential provided the hydrologic hazard of water erosion is mitigated through the use of adequate water breaks and drainage structures in recontoured areas. Rooting depths are adequate to ensure the reestablishment of vegetation at the conclusion of Project activities.

A cultural/historical resource inventory has been conducted by a qualified archaeologist permitted in Wyoming by the BLM. A block survey for cultural resources was required by the BLM for this Project. The findings have been submitted under separate cover. Any additional areas of potential effect identified subsequent to the completion of the report will be inventoried as specified by the BLM, and a supplemental report will be prepared.

Landowner Notification

Landowners will be contacted prior to any activities being conducted on privately owned lands.

13. SITE-SPECIFIC CONDITIONS

- ARFederal 1591-1-5: Two 18” culverts required in access road.
- ARFederal 1591-3-5: Low water crossing required.
- ARFederal 1591-5-5: One 18” culvert and one low water crossing required in access road.
- ARFederal 1591-7-5: One 18” culvert required in access road. Wing ditches to be constructed on access road leading down the hill.
- ARFederal 1591-9-5: Four 18” culverts required to be installed in access road leading to well location.

- ARFederal 1591-11-5: One 18” culvert required to be installed in access road.
- ARFederal 1591-13-5: One 18” culvert required in access road. Use existing two-track for access and locate water, gas and electrical lines on the south side of two-track road.
- ARFederal 1591-15-5: Two 18” culverts required in access road.
- ARFederal 1591-1-8: One 24” culvert required in access road. Access should come onto the pad from the north. Bring access road north around the knob.
- ARFederal 1591-3-8: One 24” culvert and one 18” culvert required in access road.
- ARFederal 1591-5-8: Two 18” culverts required in access road. One gate or cattleguard to be installed through the fence.
- ARFederal 1591-7-8: One 18” culvert required in access road. Access should come onto the pad from the west side.
- ARFederal 1591-15-8: Topsoil should be placed on south side of pad.
- ARFederal 1591-3-9: Two 18” culverts required in access road. Install gate or cattleguard through the fence.
- ARFederal 1591-5-9: One 36” culvert required in access road. Construct wing ditches.
- ARFederal 1591-13-9: Access should come onto the pad from the south.
- ARFederal 1591-15-9: One 18” culvert required in access road.
- ARState 1591-5-16: Access should come onto the pad from the southeast. One 18” culvert required in access road.
- ARState 1591-7-16: Move topsoil to southeast corner of pad.
- ARState 1591-11-16: Access should come onto the pad from the northeast. Two 18” culverts will be required.

14. LESSEE’S REPRESENTATIVE AND CERTIFICATIONS

Representatives for Petroleum Development Corporation

Name and Title: Mr. Scott Hedlund, Compliance Technician
 Address: 801 East 4th Street, Suite 23
 City/State/Zip: Gillette, Wyoming 82716
 Phone: (307) 682-4088

Bonding

Blanket Bond No. RL80001697; BLM Bond No. WY3280; \$25,000 Surety

Certification

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drill sites and access routes; that I am familiar with the conditions which currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed by Pedco and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved. This statement is subject to the provisions of 18 U.S.C 1001 for the filing of a false statement.

I also certify that Pedco will comply with the provisions of the law or the regulations governing the Federal or Indian right of reentry to the surface under 43 CFR 3814.

I also certify that Pedco shall use its best efforts to conduct its approved operations in a manner that avoids adverse effects on any properties which are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). If historic or archaeological materials are uncovered during construction, the operator will immediately stop work that might further disturb such materials, and contact the authorized officer (or his/her representative) at the BLM Rawlins Field Office. Any paleontological resources or fossils discovered as a result of operations associated with these wells will be brought to the attention of the authorized officer or his/her representative immediately. All activities in the vicinity of such discoveries will be suspended until notified to proceed by the authorized officer.

Pedco has applied for Permits to Appropriate Groundwater from the Wyoming State Engineers Office, concurrently with these APDs.

Name: Scott Hedlund

Title: Compliance Technician, Petroleum Development Corporation

Signature: _____

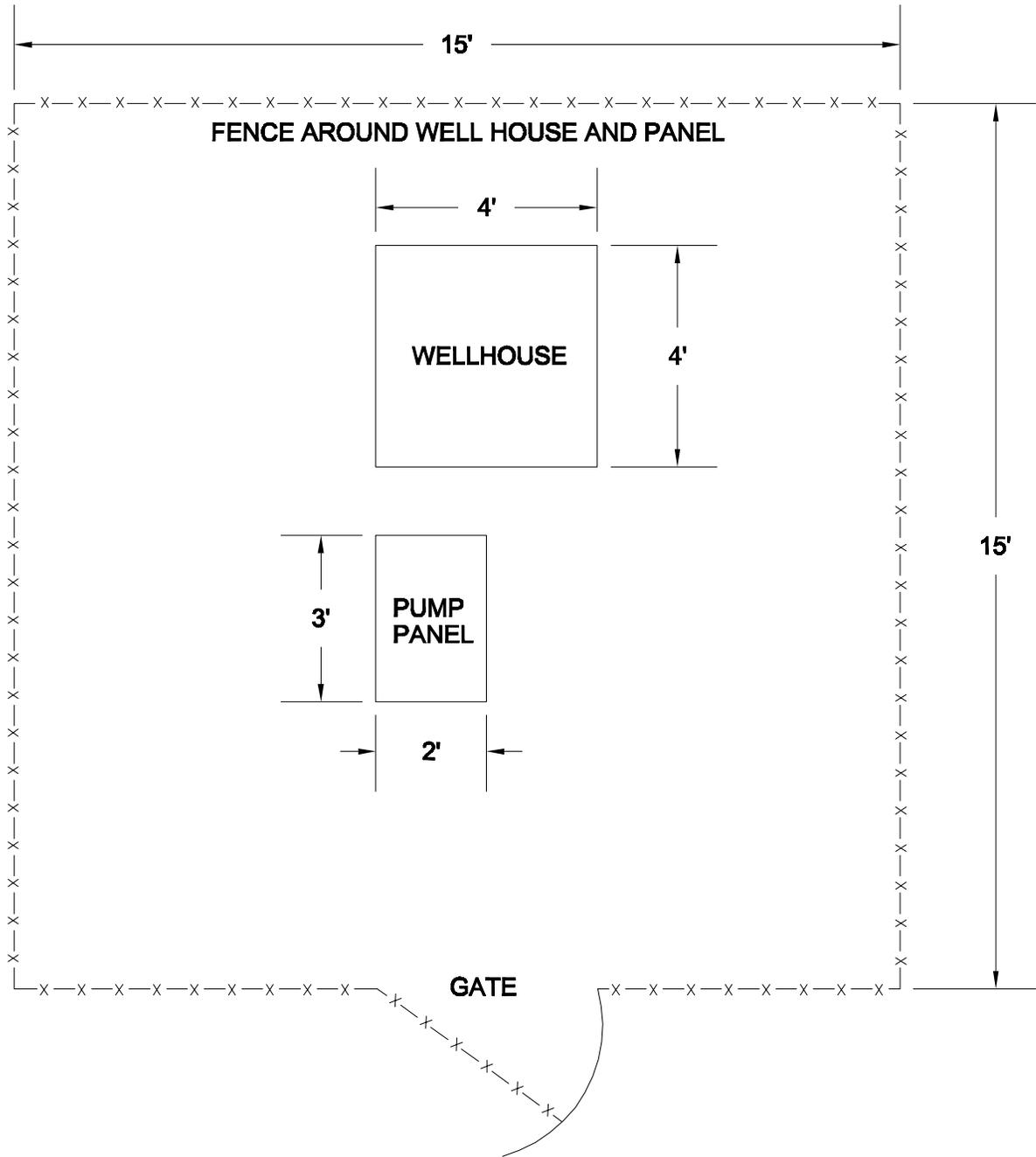
Date: _____

**Table 1
Blue Sky CBM Project Well Information**

Table 1 Blue Sky CBM Project Well Information											
Well Name, Number, and Legal Description							Lease Information	Surface Ownership Information			
No	Name	Number	Qtr/Qtr	Sec	TwN	Rng	Lease No.	Name & Address		Flow Measurement	Location Off Lease Measurement
1	ARFederal	1591-1-5	NENE	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
2	ARFederal	1591-3-5	NENW	5	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
3	ARFederal	151-5-5	SWNW	5	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
4	ARFederal	1591-7-5	SWNE	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
5	ARFederal	1591-9-5	NESE	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
6	ARFederal	1591-11-5	NESW	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
7	ARFederal	1591-13-5	SWSW	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
8	ARFederal	1591-15-5	SWSE	5	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
9	ARFederal	1591-1-8	NENE	8	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
10	ARFederal	1591-3-8	NENW	8	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
11	ARFederal	1591-5-8	SWNW	8	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
12	ARFederal	1591-7-8	SWNE	8	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
13	ARFederal	1591-9-8	NESE	8	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
14	ARFederal	1591-15-8	SWSE	8	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	
15	ARFederal	1591-3-9	NENW	9	15N	91W	WYW 148481	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
16	ARFederal	1591-5-9	SWNW	9	15N	91W	WYW 148481	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
17	ARFederal	1591-11-9	NESW	9	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
18	ARFederal	1591-13-9	SWSW	9	15N	91W	WYW 148481	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
19	ARState	1591-15-9	SWSE	9	15N	91W	WYW 141277	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
20	ARState	1591-3-16	NENW	16	15N	91W	94-00401	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
21	ARState	1591-5-16	SWNW	16	15N	91W	94-00401	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
22	ARState	1591-7-16	SWNE	16	15N	91W	94-00401	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
23	ARState	1591-11-16	NESW	16	15N	91W	94-00401	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
24	S&W State	1591-1-16	NENE	16	15N	91W	94-00401	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	Yes
25	Cow Creek	Comp. Station	SENE	8	15N	91W	WYW 141276	BLM - 1300 North Third, Rawlins WY 82301		Cow Creek Compressor Station	

**Table 2
Permitted Water Wells Within One Mile of the Blue Sky Project Area**

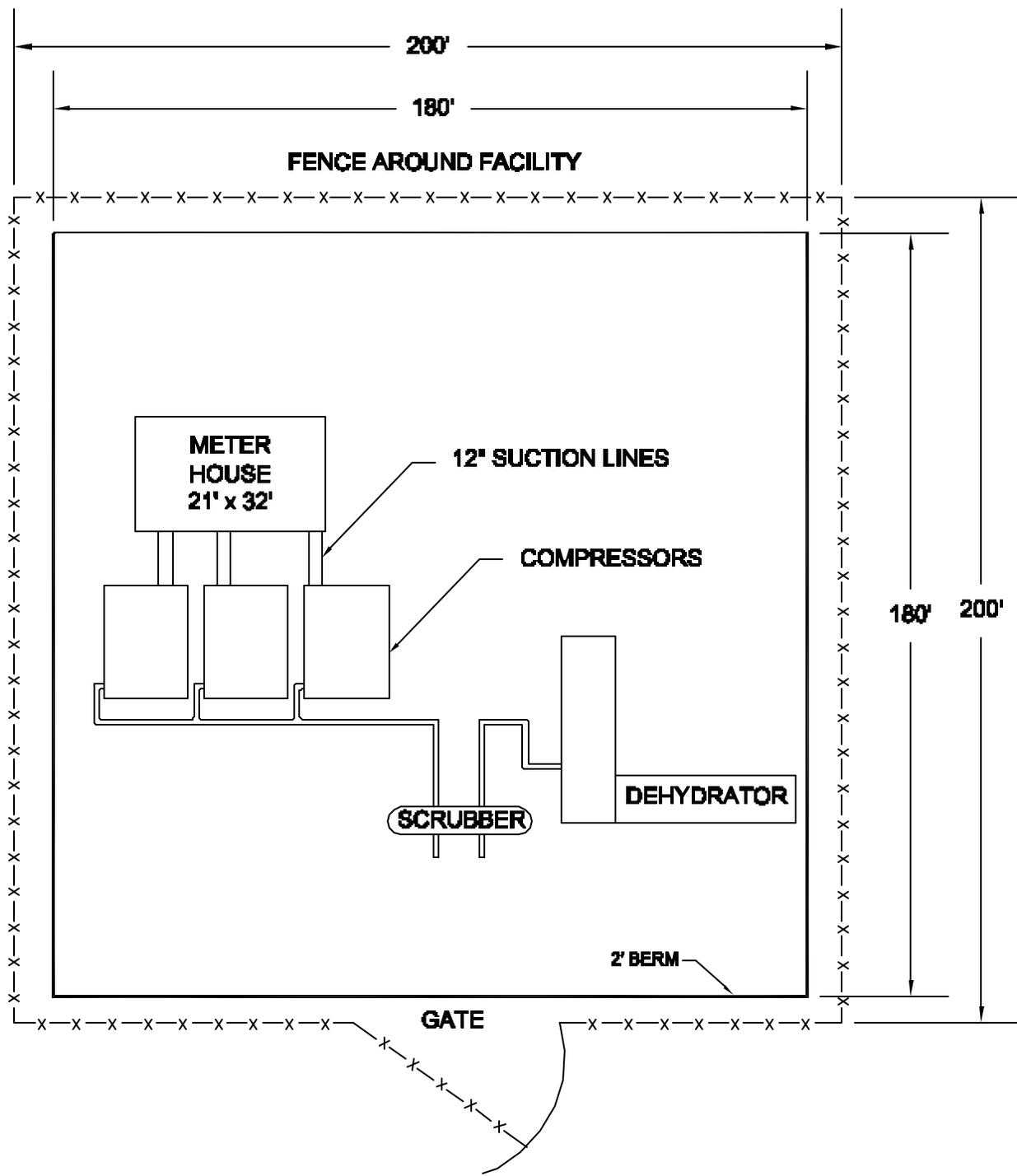
Permit No.	Twn	Rng	Sec	Qtr/Qtr	Applicant	Facility Name	Use	YldAct	Well Depth	Stat Depth
P6142P	15	91	15	NWSW	BLM	Wild Cow Well #1	STO	20	Unkwn	Unkwn



PETROLUEM DEVELOPMENT CORP.



TYPICAL CBM WELL SITE

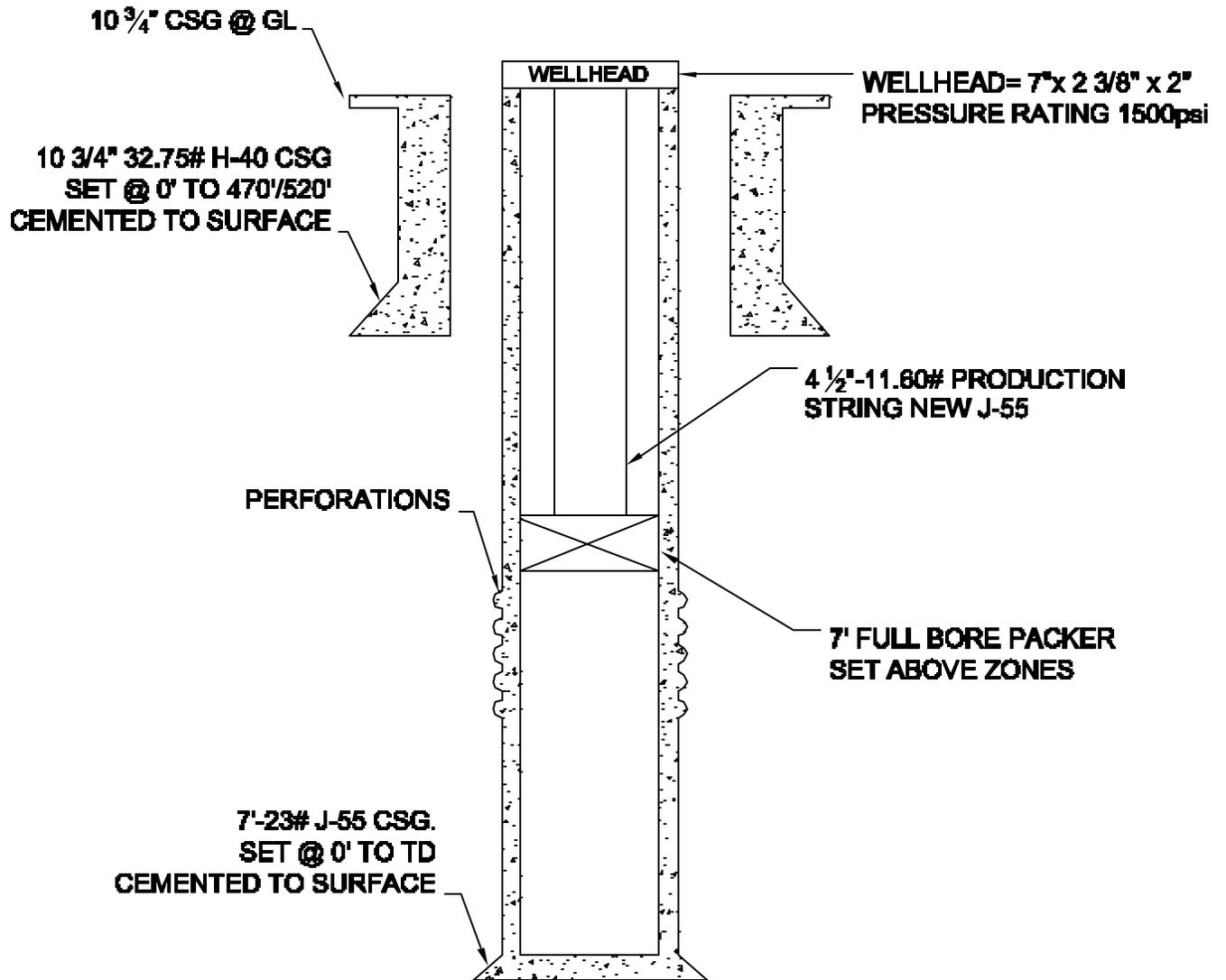


PETROLEUM DEVELOPMENT CORP.



TYPICAL COMPRESSOR STATION & METER FACILITY

SCALE: NTS	DATE: 11.04.01	DRAWN BY: RLZ	FIGURE: 10
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PETROLEUM DEVELOPMENT CORP.



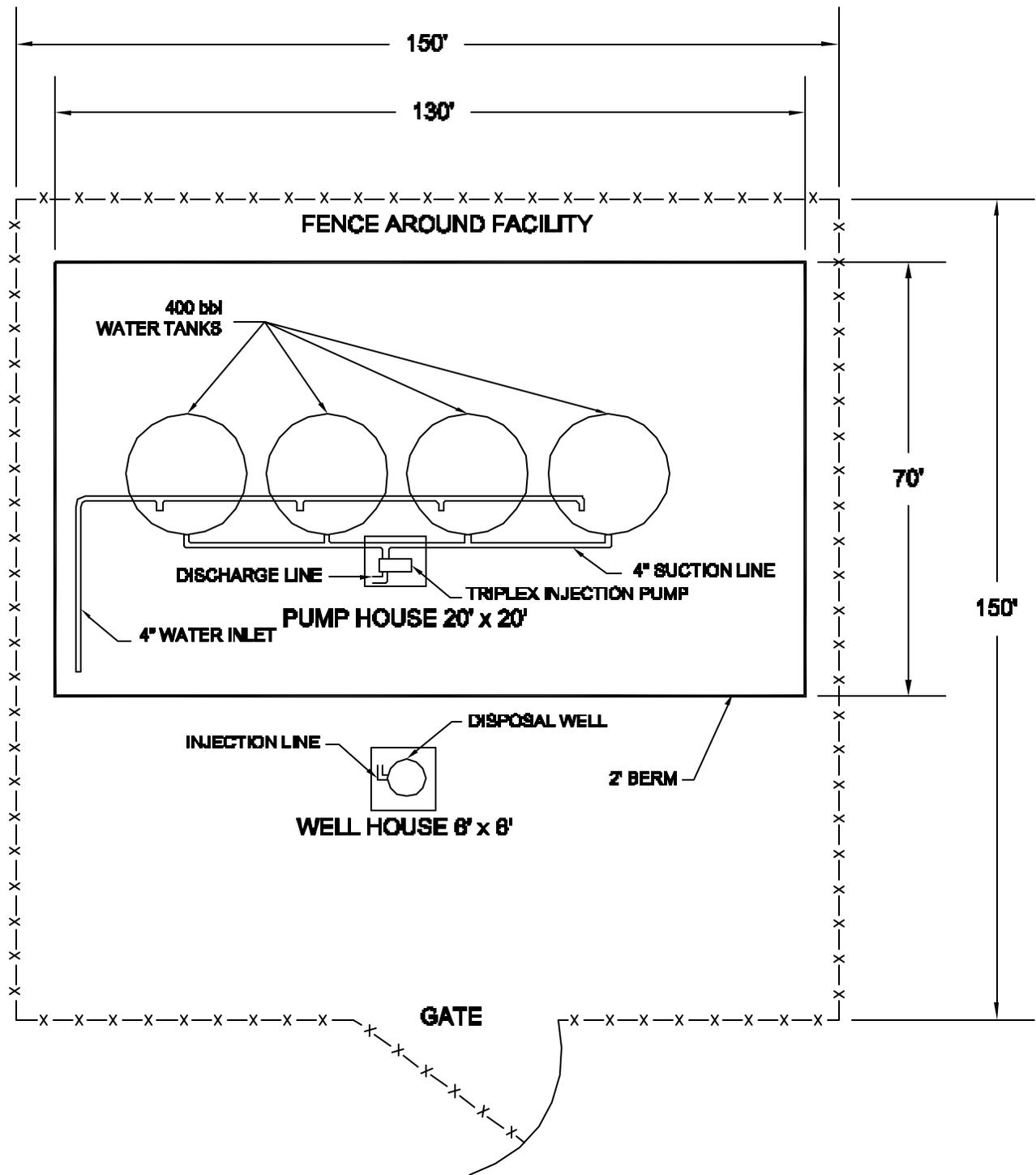
TYPICAL INJECTION WELL

SCALE: NTS

DATE: 01.10.02

DRAWN BY: RLZ

FIGURE: 7



PETROLEUM DEVELOPMENT CORP.



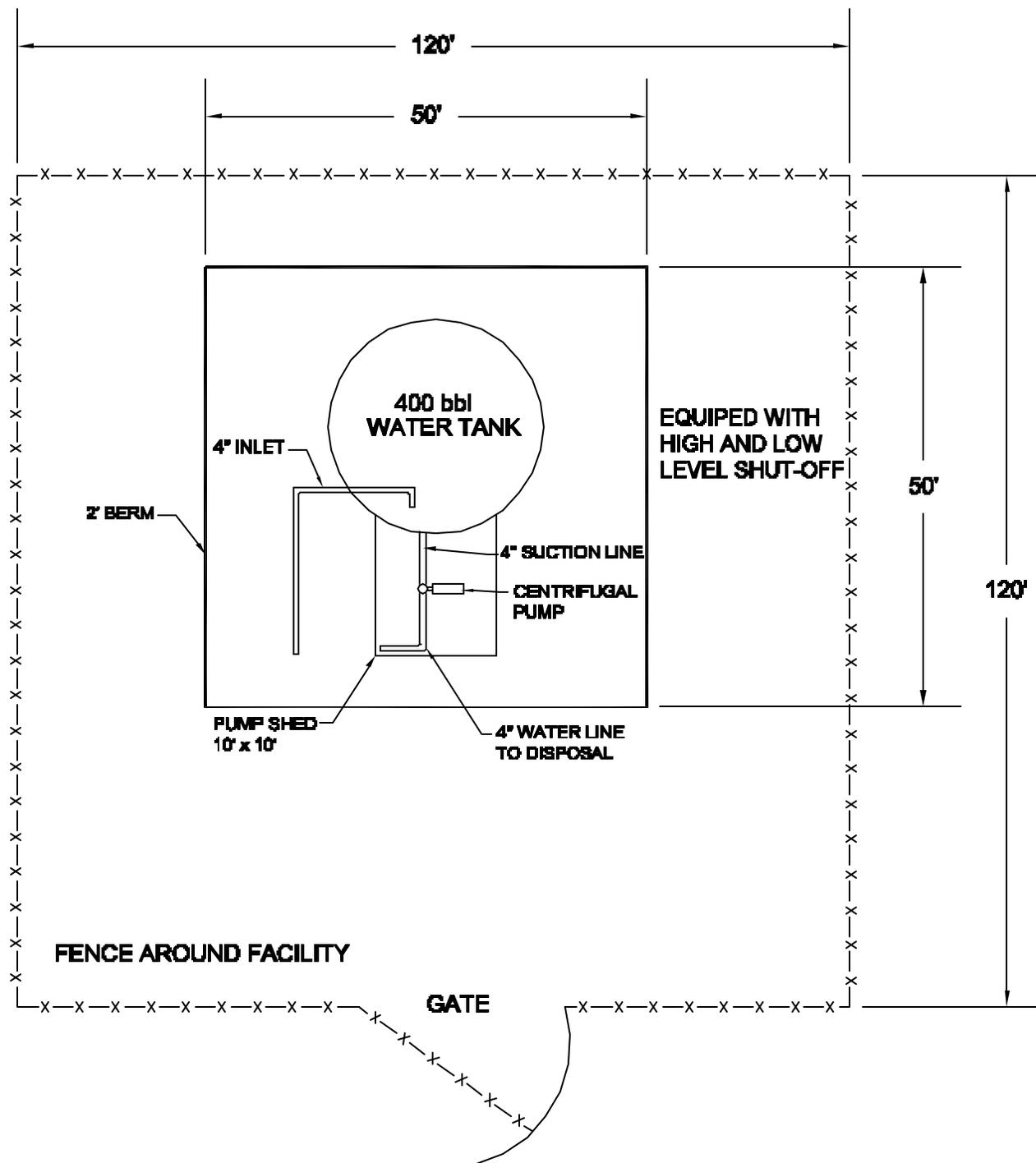
TYPICAL WATER DISPOSAL FACILITY

SCALE: NTS

DATE: 11.02.01

DRAWN BY: RLZ

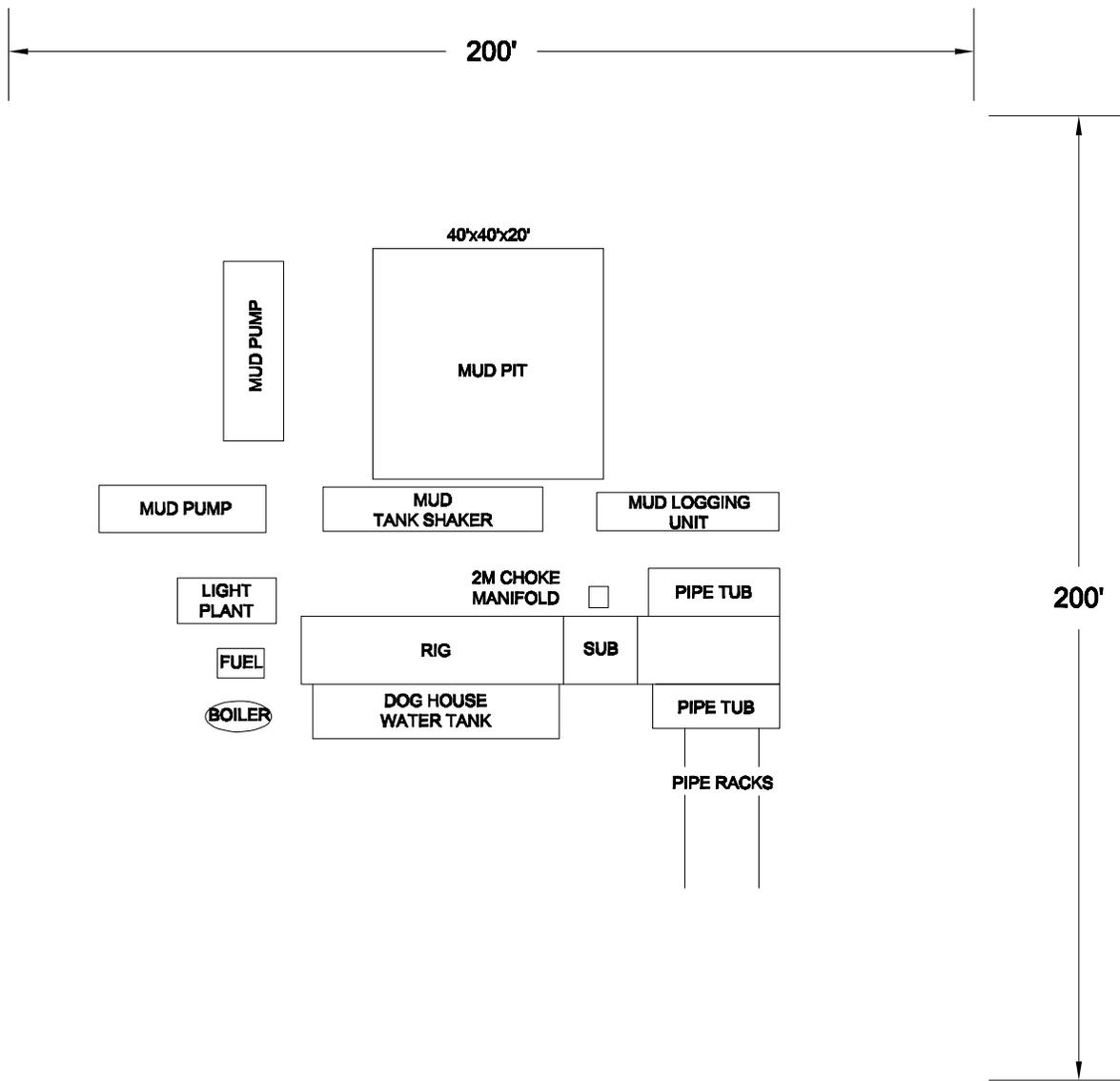
FIGURE: 8



PETROLEUM DEVELOPMENT CORP.



TYPICAL WATER TRANSFER FACILITY



PETROLIUM DEVELOPMENT CORP.



TYPICAL DRILLSITE LAYOUT

SCALE: NTS	DATE: 5.18.01	DRAWN BY: ML	FIGURE: -
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APPENDIX C

MASTER DRILLING PROGRAM OPERATOR: Petroleum Development Corporation (Pedco) Carbon County, Wyoming

Drilling Program for the CBM Wells Listed Below:
Sections 5,8 & 9, T15N, R91W, 6th PM

<u>WYW 141276</u>	<u>WYW 141277</u>	<u>WYW 148481</u>
ARFederal 1591-1-5	ARFederal 1591-3-5	ARFederal 1591-3-9
ARFederal 1591-7-5	ARFederal 1591-5-5	ARFederal 1591-5-9
ARFederal 1591-9-5	ARFederal 1591-1-8	ARFederal 1591-13-9
ARFederal 1591-11-5	ARFederal 1591-7-8	
ARFederal 1591-13-5	ARFederal 1591-11-9	
ARFederal 1591-15-5	ARFederal 1591-15-9	
ARFederal 1591-3-8		
ARFederal 1591-5-8		
ARFederal 1591-9-8		
ARFederal 1591-15-8		

Table 1 contains formation tops and total well depths.

1. Estimated Tops of Important Geologic Markers:

Formation	Depth (2455)	Depth (3600)
Lewis Shale	Surface	Surface
Almond	1325'	2480'
Pine Ridge	1785'	2940'
Allen Ridge	1905'	3060'
TD	2455'	3600'

** these depths would be the shallowest and deepest

**Table 1
Blue Sky POD CBM Project Well Information**

Well Information							Lease Information				Cementing Program			
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)
1	ARFederal	1591-1-5	NENE	5	15N	91W	WYW141276	6520' GL	Lewis	0'	Surface	13 ½"	246	124
									Almond	1330'	Production	9 7/8"	2460	610
									Pine Ridge	1790'				
									Allen Ridge	1910'				
									Total Depth	2460'				
2	ARFederal	1591-3-5	NENW	5	15N	91W	WYW141277	6504' GL	Lewis	0'	Surface	13 ½"	284	143
									Almond	1710'	Production	9 7/8"	2840	704
									Pine Ridge	2170'				
									Allen Ridge	2290'				
									Total Depth	2840'				
3	ARFederal	1591-5-5	SWNW	5	15N	91W	WYW141277	6491' GL	Lewis	0'	Surface	13 ½"	312	158
									Almond	1990'	Production	9 7/8"	3120	774
									Pine Ridge	2450'				
									Allen Ridge	2570'				
									Total Depth	3120'				
4	ARFederal	1591-7-5	SWNE	5	15N	91W	WYW141276	6510' GL	Lewis	0'	Surface	13 ½"	274	138
									Almond	1610'	Production	9 7/8"	2740	680
									Pine Ridge	2070'				
									Allen Ridge	2190'				
									Total Depth	2740'				
5	ARFederal	1591-9-5	NESE	5	15N	91W	WYW141276	6497' GL	Lewis	0'	Surface	13 ½"	263	133
									Almond	1500'	Production	9 7/8"	2630	652
									Pine Ridge	1960'				
									Allen Ridge	2080'				
									Total Depth	2630'				
6	ARFederal	1591-11-5	NESW	5	15N	91W	WYW141276	6484' GL	Lewis	0'	Surface	13 ½"	300	152
									Almond	1840'	Production	9 7/8"	3000	744
									Pine Ridge	2300'				
									Allen Ridge	2420'				
									Total Depth	2970'				
7	ARFederal	1591-13-5	SWSW	5	15N	91W	WYW141276	6481' GL	Lewis	0'	Surface	13 ½"	340	172
									Almond	2090'	Production	9 7/8"	3400	843
									Pine Ridge	2550'				
									Allen Ridge	2670'				
									Total Depth	3220'				
8	ARFederal	1591-15-5	SWSE	5	15N	91W	WYW141276	6489' GL	Lewis	0'	Surface	13 ½"	290	146
									Almond	1740'	Production	9 7/8"	2900	719
									Pine Ridge	2200'				

**Table 1
Blue Sky POD CBM Project Well Information**

Well Information							Lease Information				Cementing Program			
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)
									Allen Ridge	2320'				
									Total Depth	2870'				
9	ARFederal	1591-1-8	NENE	8	15N	91W	WYW141277	6500' GL	Lewis	0'	Surface	13 1/2"	289	146
									Almond	1760'	Production	9 7/8"	2890	717
									Pine Ridge	2220'				
									Allen Ridge	2340'				
									Total Depth	2890'				
10	ARFederal	1591-3-8	NENW	8	15N	91W	WYW141276	6480' GL	Lewis	0'	Surface	13 1/2"	329	166
									Almond	2160'	Production	9 7/8"	3290	816
									Pine Ridge	2620'				
									Allen Ridge	2740'				
									Total Depth	3290'				
11	ARFederal	1591-5-8	SWNW	8	15N	91W	WYW141276	6476' GL	Lewis	0'	Surface	13 1/2"	360	182
									Almond	2480'	Production	9 7/8"	3600	893
									Pine Ridge	2940'				
									Allen Ridge	3060'				
									Total Depth	3610'				
12	ARFederal	1591-7-8	SWNE	8	15N	91W	WYW141277	6500' GL	Lewis	0'	Surface	13 1/2"	314	159
									Almond	2010'	Production	9 7/8"	3140	779
									Pine Ridge	2470'				
									Allen Ridge	2590'				
									Total Depth	3140'				
13	ARFederal	1591-9-8	NESE	8	15N	91W	WYW141276	6565' GL	Lewis	0'	Surface	13 1/2"	319	161
									Almond	2060'	Production	9 7/8"	3190	791
									Pine Ridge	2520'				
									Allen Ridge	2640'				
									Total Depth	3190'				
14	ARFederal	1591-15-8	SWSE	8	15N	91W	WYW141276	6607' GL	Lewis	0'	Surface	13 1/2"	353	178
									Almond	2400'	Production	9 7/8"	3530	876
									Pine Ridge	2860'				
									Allen Ridge	2980'				
									Total Depth	3530'				
15	ARFederal	1591-3-9	NENW	9	15N	91W	WYW148481	6572' GL	Lewis	0'	Surface	13 1/2"	246	124
									Almond	1330'	Production	9 7/8"	2460	610
									Pine Ridge	1790'				
									Allen Ridge	1910'				
									Total Depth	2460'				
16	ARFederal	1591-5-9	SWNW	9	15N	91W	WYW148481	6539' GL	Lewis	0'	Surface	13 1/2"	268	135
									Almond	1550'	Production	9 7/8"	2680	665

**Table 1
Blue Sky POD CBM Project Well Information**

Well Information							Lease Information				Cementing Program			
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)
									Pine Ridge	2010'				
									Allen Ridge	2130'				
									Total Depth	2680'				
17	ARFederal	1591-11-9	NESW	9	15N	91W	WYW141277	6572' GL	Lewis	0'	Surface	13 ½"	251	127
									Almond	1380'	Production	9 7/8"	2510	623
									Pine Ridge	1840'				
									Allen Ridge	1960'				
									Total Depth	2510'				
18	ARFederal	1591-13-9	SWSW	9	15N	91W	WYW148481	6571' GL	Lewis	0'	Surface	13 ½"	290	146
									Almond	1775'	Production	9 7/8"	2905	721
									Pine Ridge	2235'				
									Allen Ridge	2355'				
									Total Depth	2905'				
19	ARFederal	1591-15-9	SWSE	9	15N	91W	WYW141277	6627' GL	Lewis	0'	Surface	13 ½"	245	124
									Almond	1325'	Production	9 7/8"	2455	609
									Pine Ridge	1785'				
									Allen Ridge	1905'				
									Total Depth	2455'				

2. Estimated Depth of Anticipated Water, Oil, Gas or Mineral Formations:

Allen Ridge	Methane gas
Almond	Methane gas

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde Group capable of producing fresh water, including the coal seams. Several coal seams may be tested for gas producing formations to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought to surface to isolate all formations within the Mesaverde Group.

Planned Objective: Mesaverde Group

3. Minimum BOP Requirements: - refer to attached BOP schematics

1. The BOPE shall be closed whenever the well is unattended.
2. The BOPE shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. Pedco shall notify the Rawlins BLM office 24 hours prior to the BOPE test.

4. Supplementary Information:

The primary objective of this project is to drill, stimulate, and produce coalbed methane gas from the coal seams of the Mesaverde Group Formations.

Pedco proposes to test the coal zones between 1,910' and 3,090'. Stimulation of the perforated coal seams will be done by hydraulic fracturing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

Please see the attached schematics for **Typical Drillsite Layout, Typical CBM Completed Well, Typical CBM Well Site, Typical Blow-Out Prevention Stack and Bottom Flange & Choke Manifold Schematic.**

5. Casing Program:

<u>Hole Size</u>	<u>Casing Size</u>	<u>Casing Weight</u>	<u>Grade</u>	<u>Joint</u>	<u>Depth Set</u>	<u>New/Used</u>	<u>Range</u>
13 1/2"	10 3/4"	32.75#	H-40	ST&C	0-245/360	New	3
9 7/8"	7"	23#	MC-50	LT&C	0-TD	New	3
Surface Casing:	10 3/4"	32.75 ppf.	H-40	STC	Collapse Ratings: 880	Burst 1820	Tension 205M

$$\begin{aligned} \text{A. Burst} &= 0.052 * \text{MW} * \text{TVD}(\text{shoe}) \\ &= 0.052 * 9.3\text{ppg} * 360' \\ &= 174.1\text{psi} \end{aligned}$$

$$\begin{aligned} \text{Safety Factor} &= \text{Rating/Burst} \\ &= 1820/174.1 \\ &= 10.45 \end{aligned}$$

$$\begin{aligned} \text{B. Collapse} &= [0.052 * \text{MW} * \text{TVD}(\text{shoe})] - [\text{Gas Gradient} * \text{TVD}] \\ &= [0.052 * 9.3\text{ppg} * 360'] - [0.1\text{psi/ft} * 360'] \\ &= 138.1 \end{aligned}$$

$$\begin{aligned} \text{Safety Factor} &= \text{Rating/Collapse} \\ &= 880/138.1 \\ &= 6.37 \end{aligned}$$

$$\begin{aligned} \text{C. Tension} &= \text{Weight} * \text{D} * [1 - (\text{MW}/65.5\text{ppg})] \\ &= 32.75\text{ppf} * 360' * [1 - (9.3\text{ppg}/65.5\text{ppg})] \\ &= 10139.4 \text{ lbs.} \end{aligned}$$

$$\begin{aligned} \text{Safety Factor} &= \text{Rating/Tension} \\ &= 205,000/10139.4 \\ &= 20.22 \end{aligned}$$

Surface casing shall have centralizers on the bottom three joints of the casing, starting with the shoe joint.

Production Casing:	7"	23 ppf.	MC-50	STC	Collapse	Burst	Tension
				Ratings:	3110	3960	273M

$$\begin{aligned} \text{A. Burst} &= 0.052 * 13\text{ppg} * 3600' \\ &= 2433.6\text{psi} \\ \text{Safety Factor} &= \text{Rating/Burst} \\ &= 3960/2433.6 \\ &= 1.63 \end{aligned}$$

$$\begin{aligned} \text{B. Collapse} &= [0.052 * 13\text{ppg} * 3600'] - [0.1\text{psi/ft} * 3600'] \\ &= 2073.6\text{psi} \\ \text{Safety Factor} &= \text{Rating/Collapse} \\ &= 3110/2073.6 \\ &= 1.5 \end{aligned}$$

$$\begin{aligned} \text{C. Tension weight} &= 23\text{lbs./ft} * 3600' * [1 - (13\text{ppg}/65.5\text{ppg})] \\ &= 23\text{lbs./ft} * 3600' * .8015 \\ &= 66364.2 \text{ lbs.} \\ \text{Safety Factor} &= \text{Rating/Tension} \\ &= 273,000/66364.2 \\ &= 4.11 \end{aligned}$$

6. Mud Program:

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5 – 13 ppg. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

7. Cementing Program:

The following is the proposed procedure for cementing the 10 ¾” surface pipe and 7” long string:

Surface Casing:

Lead: Class “C” Type III, 14.4 ppg., yield 1.44ft³/sk @ 101% excess. Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

Long String:

Lead: Class “C” Type III, 14.4 ppg., yield 1.44ft³/sk @ 35% excess. Compressive strength in 24 hours at 95°F 3200psi.

Estimated top of cement back to surface.

8. Logging Program:

Cores: Rotary Cores will be taken as needed to evaluate the coal seams.

DSTs: None Planned

Logs: Induction, GR, SP, Density, Neutron and Caliper – From surface to TD
Cement Bond Log – From 10 ¾” casing shoe TD
Mud Logger – As Needed.

9. Pressure Data, Potential Hazards:

Bottom hole pressures anticipated @ 1000 – 1100 psi.
There is no history of hydrogen sulfide gas in the area and none is anticipated.

10. Anticipated Starting Dates and Notification of Operations:

A. Anticipated Starting Dates:

Anticipated Commencement Date	- Spring 2002, or upon approval
Drilling Days	- Approximately 7 Days Per Well
Completion Days	- Approximately 2 Days Per Well
Testing Days	- Approximately 7-14 Days Per Well

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the APDs.

B. Notification of Operations:

Rawlins Field Office, BLM
1300 North Third
Rawlins, Wyoming 82301
(307) 328-4200

Drilling Program for the Injection Wells Listed Below:

BLM Lease: WYW141276
Federal 1591-8I
1423' FNL & 2305' FWL of Sec. 8: SENW T15N,R91W

BLM Lease: WYW148481
Federal 1591-9I
500' FSL & 895' FWL of Sec. 9: SWSW T15N,R91W

1. Estimated Tops of Important Geological Markers:

Formation	Depth (1591-9I)	Depth (1591-8I)
Lewis Shale	surface	surface
Almond	+/- 1775'	+/- 2250'
Pine Ridge	+/- 2235'	+/- 2710'
Allen Ridge	+/- 2355'	+/- 2930'
Hatfield	+/- 3675'	+/- 4150'
Cherokee Creek	+/- 3935'	+/- 4410'
Deep Creek	+/- 4263'	+/- 4738'
TD	+/- 4700'	+/- 5200'

2. Estimated Depth of Anticipated Water, Oil, Gas or Mineral Formations:

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde capable of producing fresh water including the coal seams. The Steele Shale is not anticipated to contain any zones capable of producing water. All shallow water zones will be protected with casing and cement. Cement will be brought to surface to isolate all formations within the Mesaverde Group.

Planned Objective: Deep Creek/Cherokee Creek sands

3. Minimum BOP Requirements: - refer to exhibit "A" schematic

1. The BOPE shall be closed whenever the well is unattended.
2. The BOPE shall be pressure tested when initially installed to 1000 psi, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. Notify BLM office in Rawlins 24 hours prior to BOPE test.

4. Supplementary Information:

The primary objective of this project is to test the Cherokee Creek and Deep Creek sands for their suitability for water disposal.

Please see the attached schematics for **Typical Drill Site Layout, Configuration Options, Typical Completed Disposal Well and Typical Water Disposal Facility.**

5. Casing Program:

<u>Hole Size</u>	<u>Casing Size</u>	<u>Casing Wt.</u>	<u>Grade</u>	<u>Joint</u>	<u>Depth Set</u>	<u>New/Used</u>	<u>Rng.</u>	
13 1/2"	10 3/4"	32.75#	H-40	ST&C	0-470/520	New	3	
9 7/8"	7"	23#	J-55	LT&C	0-4700/5200	New	3	
Prod string	4 1/2"	11.6#	J-55	Buttress	0-4700/5200	New	3	
Surface Casing :		10 3/4"	32.75ppf.	H-40	STC	Collapse	Burst	Tension
					Ratings:	880	1820	205M

A. Burst = 0.052 * MW * TVD(shoe)
 = 0.052 * 9.3ppg * 520
 = 251.47psi
 Safety Factor = Rating/Burst 1820/251.47 = 7.24

B. Collapse = 0.052 * MW * TVD(shoe)
 = 0.052 * 8.8ppg * 520
 = 237.95psi.
 Safety Factor = Rating/Burst 880/237.95 = 3.7

C. Tension = Weight * D * [1 - (MW/65.5ppg)]
 = 32.75ppf * 520' * [1 - (8.8ppg/65.5ppg)]
 = 14816.1 lbs.
 Safety Factor = Rating/Tension 205,000/14816.1 = 13.84

Surface casing shall have centralizers on the bottom three joints of the casing, starting with the shoe joint.

Production Casing:	7"	23ppf	J-55	LTC	Collapse	Burst	Tension	
					Ratings:	3270	4360	313M

- A. Burst = $0.052 * MW * TVD(td)$
 $= 0.052 * 12.5ppg * 5200'$
 $= 3380 \text{ psi}$
Safety Factor = Rating/Burst $4360/3380 = 1.29$
- B. Collapse = $[0.052 * MW * TVD(shoe)] - [Gas Gradient * TVD]$
 $= [0.052 * 12.5ppg * 5200'] - 0.1 * 5200'$
 $= 2860 \text{ psi}$
Safety Factor = Rating/Collapse $3270/2860 = 1.143$
- C. Tension weight * D * $[1 - (MW/65.5)]$
 $= 23\#/ft * 5200 * [1 - (12.5ppg/65.5ppg)]$
 $= 23\#/ft * 5200 * .8092$
 $= 96780.32$
Safety Factor = Rating/Tension $313,000/96780.32 = 3.23$

6. Mud Program:

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5 - 13ppg.. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

7. Cementing Program:

The following is the proposed procedure for cementing the 10 3/4" surface pipe and 7" long string:

Surface casing:

Lead: Class "C" Type III, 14.4ppg., yield 1.44ft³/sk @ 101% excess.

Compressive strength in 24 hours at 80⁰F 3100psi.

#1591-8I 263 sacks of cement

#1591-9I 237 sacks of cement

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

Long string:

Lead: Class "C" Type III, 14.4ppg., yield 1.44ft³/sk @ 35% excess.

Compressive strength in 24 hours at 137⁰F 3480psi.

#1591-8I 1290 sacks of cement

#1591-9I 1166 sacks of cement

Estimated top of cement back to surface.

8. Logging Program:

Logs: Induction, GR, SP, Density - Neutron and Caliper – From surface to TD

Cement Bond Log – From 10 ¾" casing shoe to TD

Mud Logger – From 10 ¾" casing shoe to TD

9. Pressure Data, Potential Hazards:

Bottom hole pressures anticipated to be 1000 – 1150psi.

There is no history of hydrogen sulfide gas in the area and none is anticipated.

10. Anticipated Starting Dates and Notification of Operations:

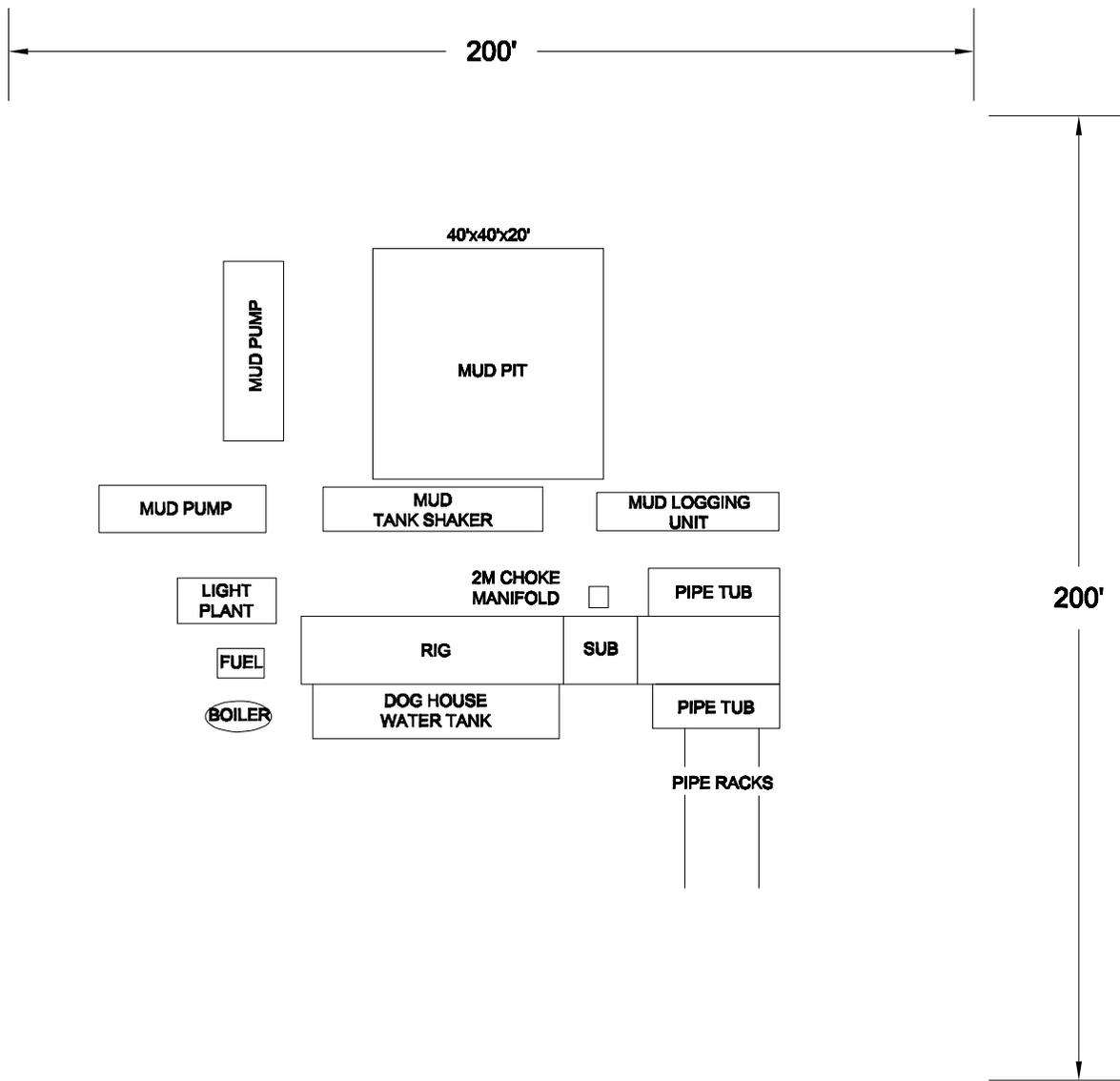
A. Anticipated Starting Dates:

Anticipated Commencement Date	-Spring 2002, or upon approval
Drilling Days	-Approximately 7 Days Per Well
Completion Days	-Approximately 2 Days Per Well
Testing Days	-Approximately 7 – 14 Days Per Well

Note: Drilling operations will commence as soon a practical after approval of all necessary permits including the APD's.

B. Notification of Operations:

Rawlins Field Office, BLM
1300 North Third
Rawlins, WY 82301
(307) 328-4200



PETROLIUM DEVELOPMENT CORP.



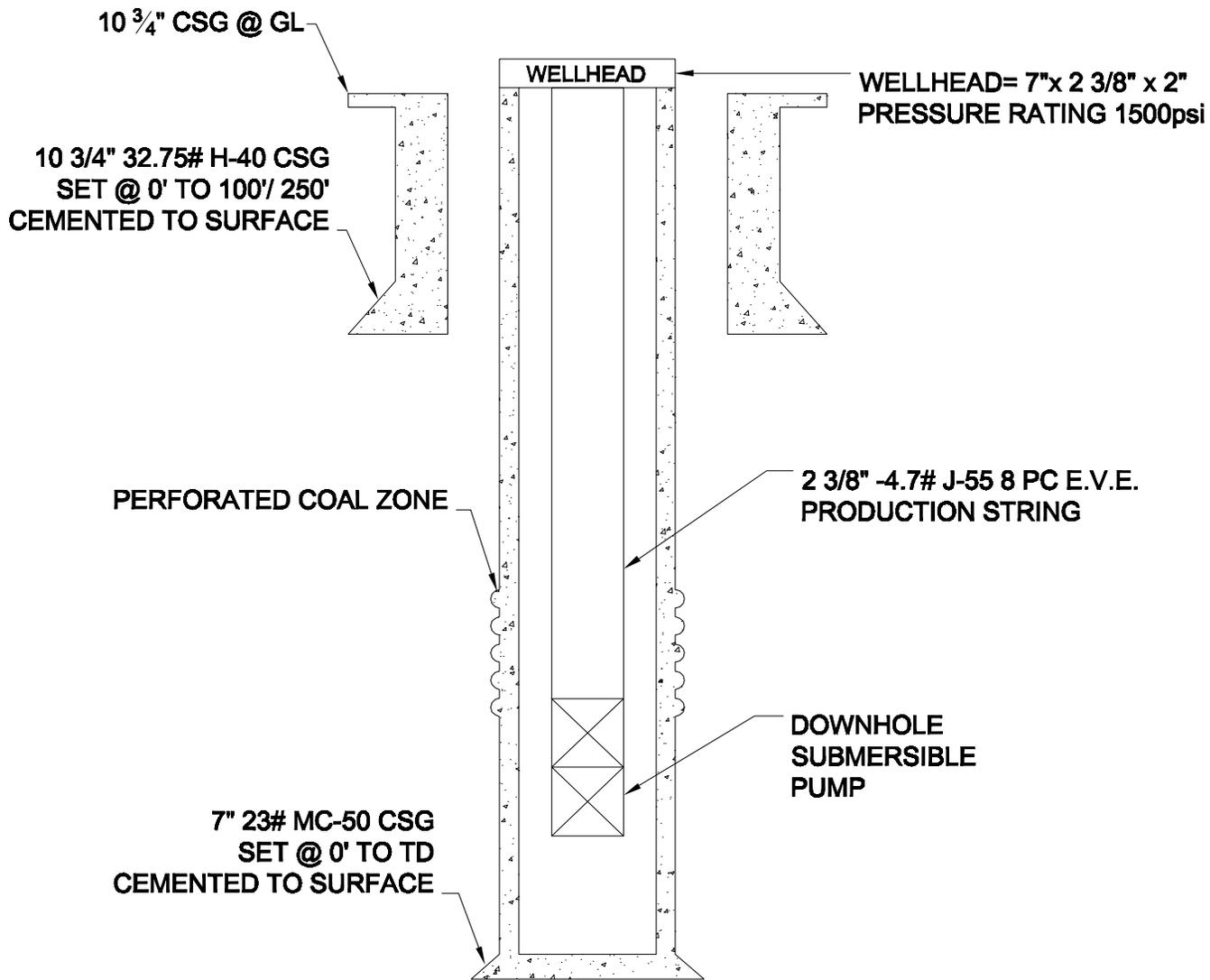
TYPICAL DRILLSITE LAYOUT

SCALE: NTS

DATE: 5.18.01

DRAWN BY: ML

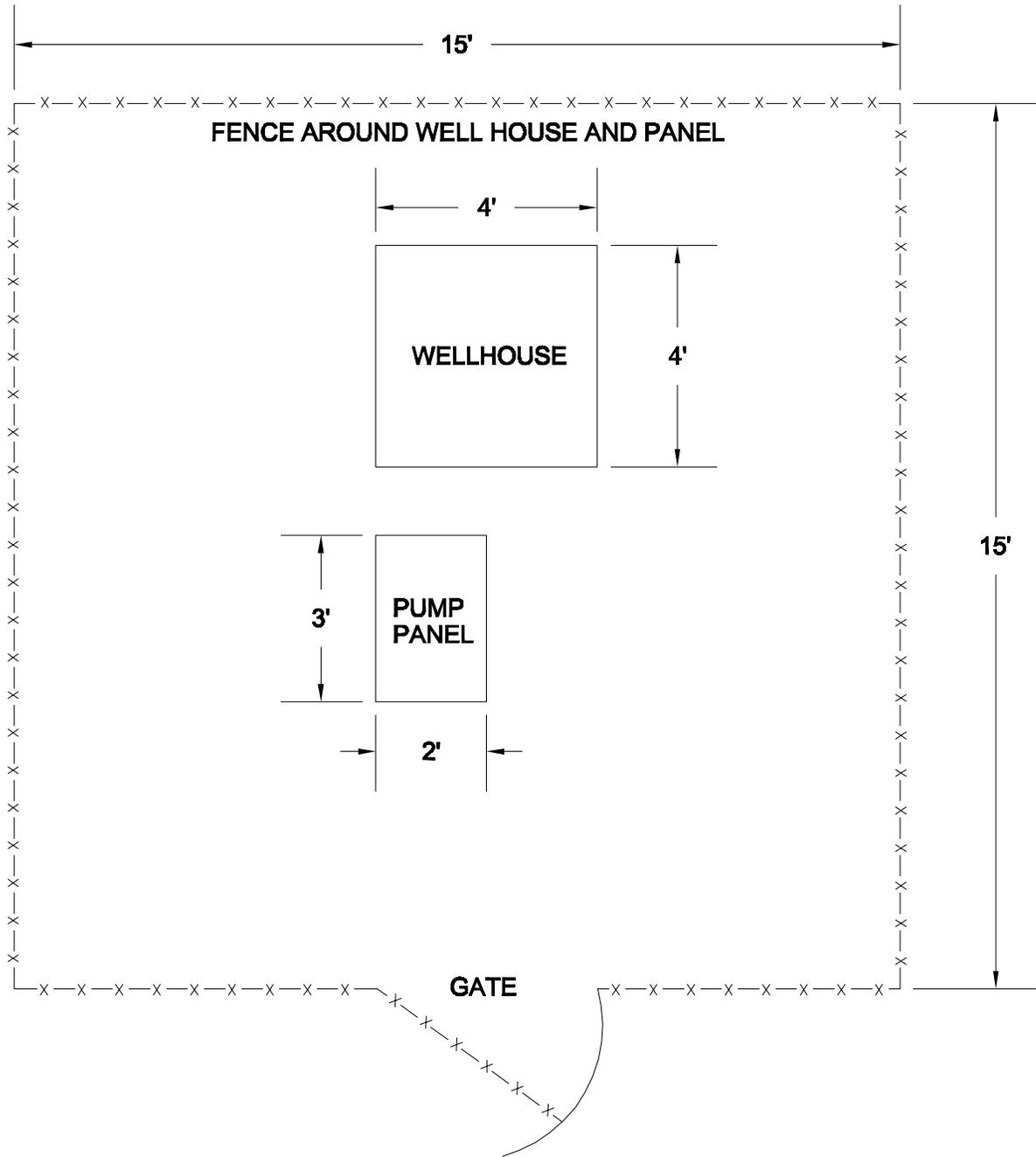
FIGURE: -



PETROLUUM DEVELOPMENT CORP.



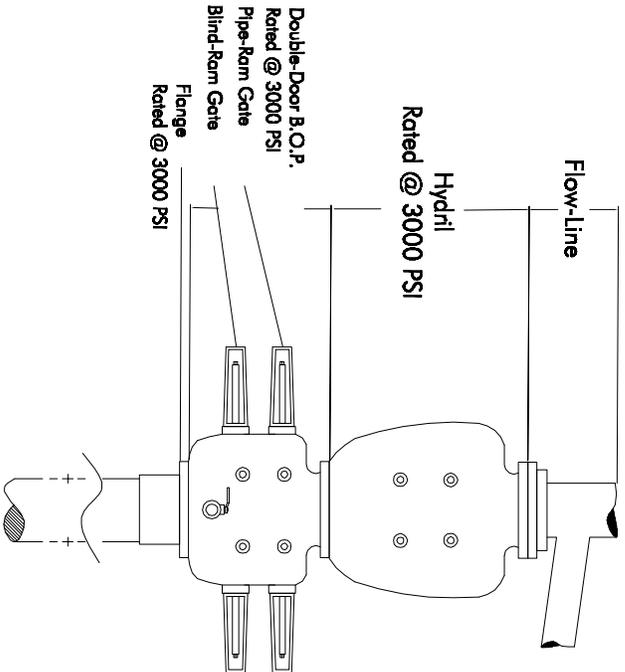
TYPICAL CBM COMPLETED WELL



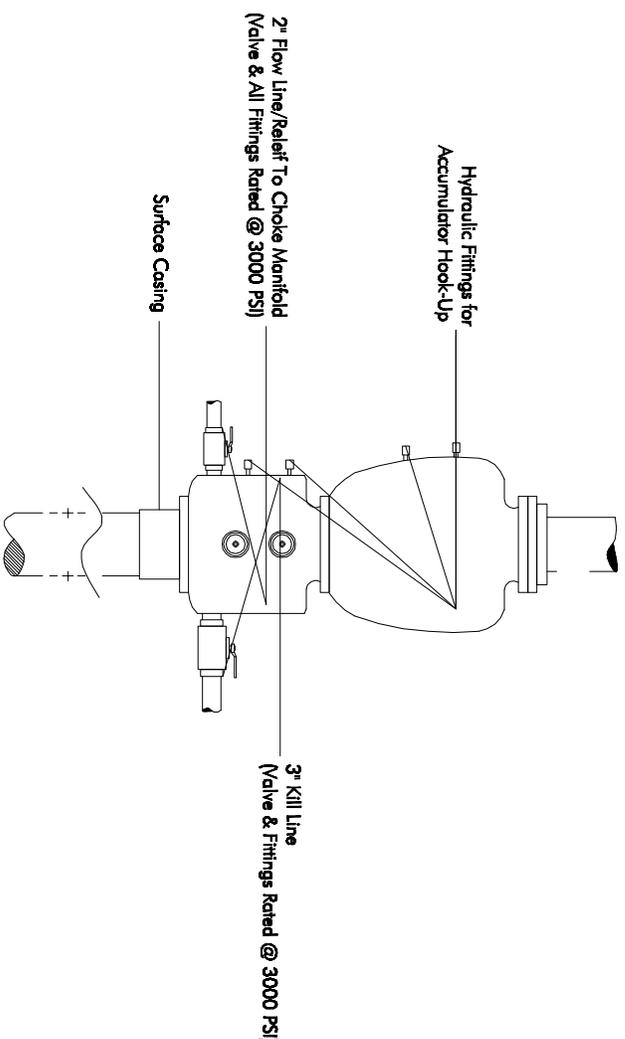
TYPICAL CBM WELL SITE

SCALE: NTS	DATE: 05.04.01	DRAWN BY: MTM	FIGURE: 5
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Front View



Side View



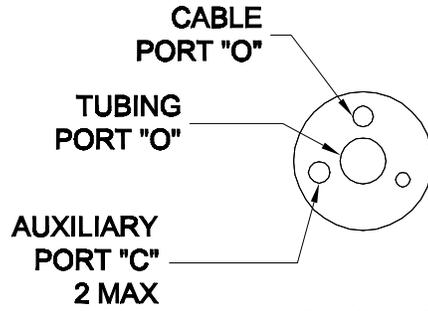
*Note: All Valves, Fittings, Unions and Hoses Associated with the Stack will be rated @ 3000 PSI and Tested @ 1000 PSI



TYPICAL BLOW-OUT PREVENTION STACK

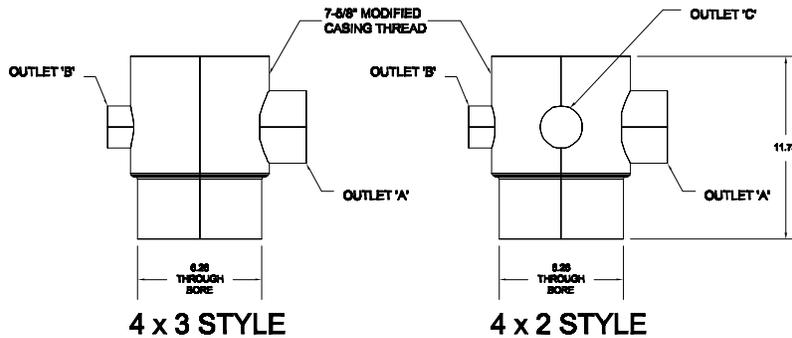
SCALE: NTS	DATE: 11.13.01	DRAWN BY: PBE	FIGURE: ???
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MANDREL STYLE



**GS-3 / GS-4
CENTERED HANGER
WITH CABLE PORT &
UP TO 2 AUX PORTS**

BODY STYLES



Standard Body Configurations				
Body Style	Bottom Connection	Outlet "A"	Outlet "B"	Outlet "C"
4 x 2	7" Short Casing (Male or Female)	4" LP Female	2" LP Female	NA
4 x 3	7" Short Casing (Male or Female)	4" LP Female	3" LP Female	NA
4 x 2 x 2	7" Short Casing (Male or Female)	4" LP Female	2" LP Female	2" LP Female

Standard Mandrel Configurations				
Mandrel Style	Port "C"	Port "D"	Port "E"	Approx Wt - LBS
GS-3	2-3/8" UPTBG Box Down X	1" LP	(1) 1/2" LP Box Up	26
GS-4	2-3/8" UPTBG Box Up	Box Up	(2) 1/2" LP Box Up	26



PETROLIUM DEVELOPMENT CORP.



CONFIGURATION OPTIONS

APPENDIX D

BLUE SKY PROJECT WATER MANAGEMENT PLAN

CBM Produced Water (Injection)

Pedco plans to inject produced water (coalbed formation water) from the Blue Sky Project exploratory CBM wells into two injection wells, ARFederal 1591-8I, located in the SENW of Section 8, R15N T91W, and ARFederal 1591-9I, located in the SWSW of Section 9, R15N T91W. No surface discharge would occur. As Pedco would inject all produced water, no surface waters would be affected by Pedco's management of CBM produced water. Likewise, existing reservoirs or stock ponds would not be affected.

Before the injection wells are drilled and completed, water produced from CBM wells may be transported to nearby drilling locations and used to drill additional wells. Any produced water would be contained in the drilling reserve pit constructed on each well pad until the injection wells are completed. Once all wells have been drilled, water produced at the exploratory well sites would be gathered and transported to the injection wells for disposal, which would be permitted by all necessary agencies.

Produced water would be collected in a buried two-inch polyethylene flowline (pipeline) for transport to the water disposal facility location (200' x 200') approved by the WOGCC and the BLM. Best Management Practices (BMPs) would be used for erosion control and the diversion of overland flows away from the facility. A typical water disposal facility consists of four 400 bbl water tanks, a pump house, piping, and a well house. Transfer pumping stations, consisting of a 400 bbl water tank with associated pump and piping, may be needed. Locations of water transfer facilities will be submitted via Sundry Notice.

The produced water from 14 CBM wells would be injected into the ARFederal 1591-9I well, an approximate minimum of 7,200 bbls/day and maximum of 19,200 bbls/day. The remaining 10 wells would be injected at the ARFederal 1591-8I well, an approximate minimum of 5,142 bbls/day and maximum of 23,500 bbls/day.

See attached diagrams of **Injection well, Water Transfer Facility and Water Disposal Facility** in **Appendix B**.

Aquifer Protection

The proposed injection targets for each injection well are the Cherokee Sandstone (approximately 3,900 to 4,400 feet below the surface) and the Deep Creek Sandstone (approximately 4,200 to 4,700 feet below the surface), stratigraphically below the coal zones being explored. These sandstones are isolated above and below by competent shale barriers that would prevent the initiation and propagation of fractures through overlying strata to any fresh water zones. The Cherokee and Deep Creek Sandstones consist of clean, medium to coarse-grained sandstone.

The injection wells would be drilled, cased, and cemented from TD (50 feet below the base of the Cherokee and/or Deep Creek Sandstone) to the surface. The Cherokee and/or Deep Creek Sandstone would be tested to determine its suitability for water disposal prior to any injection activities. Open hole logs and injectivity tests would be provided to all necessary agencies. Also, prior to injection of produced water from coalbed methane wells, a water analysis from the Cherokee and/or Deep Creek Sandstone would be obtained and provided to all necessary agencies. Produced water would come from coals in the Mesaverde Group.

Existing Natural Conditions

Watershed Characteristics and Surface Water Quality

The Blue Sky Project is located in Hydrologic Unit (HUC) 14050004, Muddy, located in the Upper Colorado Region. Cow Creek and Dry Cow Creek converge in the project area, and Cow Creek eventually flows into Muddy Creek. USGS Station 09259000, known as Muddy Creek near Baggs, WY, is located on Muddy Creek at the confluence of Muddy Creek and the Little Snake River and measures flow and water quality from the HUC. Data from this station are found in **Tables 1 and 2**.

Groundwater Quality

One permitted water well exists within one mile of the project area, but is not located within the circle of influence (one-half mile radius) of any proposed CBM well. The WRDS Water Quality Database groundwater data from the Mesaverde Group near the project area are reported in **Table3**.

Table 1
Surface Water Quality Data, Station 09259000

Parameter	Specific Conductance	pH	Nitrite (mg/L)	Hardness (mg/L as CaCO3)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	SAR	K (mg/L)	Cl (mg/L)	SO4 (mg/L)	Solids Evap (mg/L)	TSS (mg/L)
Mean	967	8	0.4	270	42	40	286	6.8	8.5	32.3	320	346	3191
Count	3	3	1	2	2	2	1	1	1	2	2	1	41

* All cation and anion concentrations are dissolved.

Table 2
Peak Flow Estimates from HUC 14050005

Mean Annual Flow Estimate (cfs)			322.88
Peak flow (PT) estimates:	Exceedence Probability	Peak Flow (cfs per square mile)	Peak Flow for Entire Watershed (cfs)
Recurrence Interval			
2 year	0.5	2.32	2,361.90
5 year	0.2	3.93	3,989.65
10 year	0.1	5.07	5,153.97
25 year	0.04	6.98	7,091.53
50 year	0.02	8.76	8,904.84
100 year	0.01	10.29	10,459.77

* Calculations taken from Lowham, Streamflows in Wyoming

Table 3
Groundwater Quality Data, Station 411608107373701

Parameter	Specific Conductance	pH	Bicarbonate (mg/L)	Carbonate (mg/L)	Nitrogen Amm + Org (Tot, mg/L)	NO2 +NO3 (Diss, mg/L)	P (Tot, mg/L)	Hardness (Tot, mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	SAR	K (mg/L)	Cl (mg/L)	SO4 (mg/L)	Fe (mg/L)	TSS (mg/L)
Value	2000.00	8.40	1300.00	14.00	0.82	0.01	0.07	11.00	2.80	0.90	510.00	68.00	4.30	39.00	11.00	40.00	1230.00

* Unless, listed otherwise, all cation and anion concentrations are dissolved

Certification

Pedco hereby certifies that:

1. All potentially affected landowners having properly permitted water wells with the WSE within each proposed wells Circle of Influence (one-half mile radius) were offered a Water Well agreement; and
2. If a Water Well Agreement is not reached with the landowner, Pedco agrees to mitigate the impacts of its coalbed methane wells in accordance with State of Wyoming water laws; and
3. Pedco has applied for a Permit to Appropriate Groundwater from the Wyoming State Engineers Office, concurrently with the Applications for Permit to Drill.

Lessees Representation and Certification – Blue Sky Project

Mr. Scott Hedlund

Compliance technician

Pedco

801 E. 4th St., Ste. 23

Gillette, WY 82716

(307) 682-4088

Scott Hedlund

Pedco

Date: January 9, 2002

APPENDIX E

Plant and Wildlife Species of Concern that May Potentially Occur on or Near the Blue Sky POD.

Plant Species of Concern¹					
Species	Counties of Distribution	Wyoming Range	Status ²	Probability of Occurrence	Habitat
smallflower androstephium (<i>Androstephium breviflorum</i>)	Carbon, Sweetwater	Peripheral	G5/S1	moderate potential	open, south-facing slopes; erosional slopes; deep sandy-silty-loamy soils
Crandall's rock-cress (<i>Arabis crandallii</i>)	Carbon, Sweetwater	Regional Endemic	G2/S1	unlikely	rocky-sandy ridges in juniper woodlands
Hayden's milkvetch (<i>Astragalus bisculatus</i> var <i>haydenianus</i>)	Carbon, Fremont, Lincoln?, Sweetwater, Uinta?	Peripheral	G5147/S1	moderate potential to occur along wet draws and riparian areas	moist clay soils; spring draws; associated with dense graminoids and shrubs
Wolf's orache (<i>Atriplex wolffii</i>)	Carbon, Sweetwater	Regional Endemic	G3G4/S1	moderate potential to occur in greasewood fans & flats	alkaline or clay soils; elevated mounds near aquatic sites; associated with greasewood
Payson's tansymustard (<i>Descurainia pinnata</i> ssp. <i>paysonii</i>)	Carbon, Laramie, Sweetwater	Regional Endemic	G5137/S2	potential to occur within the vicinity of the Dry Cow Creek pod	stabilized sand dunes
little golden-aster (<i>Heterotheca pumila</i>)	Carbon (unlikely in project area)	Regional Endemic	G4/S1	highly unlikely	sub-alpine and mountainous habitats
Weber's scarlet-gilia (<i>Ipomopsis aggregata</i> ssp <i>weberi</i>)	Carbon, Albany	Peripheral	R2, G5112/S1	highly unlikely	openings in coniferous forests and scrub oak woodlands.
Rusby's stickleaf (<i>Mentzelia rusbyi</i>)	Carbon, Albany	Peripheral	G3G4/S1	unlikely	barren, rocky slopes or banks with coarse, thin soils
Gibben's beardtongue (<i>Penstemon gibbensii</i>)	Carbon, Sweetwater	Regional Endemic	G1/S1 BLM	moderate potential to occur (known to occur within 20 miles of project area along southern border of Carbon and Sweetwater Counties)	barren, south-facing slopes on loose, pale, sandy-clay derived from Brown's Park Formation; may occur in grass-dominated sites with scattered shrubs; semi-barren fringed sagebrush (<i>A. frigida</i>) / thickspike wheatgrass communities with 15-20% vegetation cover, or ashy-clay barrens on steep slopes amid <i>Cercocarpus montanus</i> ; also may occur on outcrops of Green River Formation on steep, yellowish sandstone-shale slopes below caprock ridges
Rydberg twinpod (<i>Physaria vitulifera</i>)	Carbon, Albany	Regional Endemic	G4/S1	unlikely	rocky meadows; montane transition areas; bare ground in and among sagebrush associations (<i>Artemisia</i> spp)
many-headed broom groundsel (<i>Senecio spartoides</i> var <i>multicapitus</i>)	Carbon, Sweetwater	Peripheral	G4/S1	potential to occur within the vicinity of the Dry Cow Creek pod	stabilized sand dunes

Wildlife Species of Concern		
Common Name	Scientific Name	Sensitivity Status/Rank ²
Mammals		
Wyoming pocket gopher	<i>Thomomys clusius</i>	R2, G2/S1S2
swift fox	<i>Vulpes velox</i>	C, R2, G2/S2S3, SSC3
Birds		
Northern goshawk	<i>Accipiter gentilis</i>	R2, G5/S2S3B, S4N, SSC4

Columbian sharp-tailed grouse	<i>Tympanuchus phasianellus columbianus</i>	R4
snowy plover	<i>Charadrius alexandrius</i>	R2, G4/S1B, S2?N
burrowing owl	<i>Athene cunicularia</i>	R2, G4/S3B, SZN, SSC4
Brewer's sparrow	<i>Spizella breweri</i>	G5/S3B, SZN
Sage sparrow	<i>Amphispiza belli</i>	G5/S3B, SZN
Reptiles		
smooth green snake	<i>Lioclorophis vernalis</i>	G5/S2

1 - Sources: Dorn 1992, Fertig and Beauvais 1999, WYNDD 2000

2 - Definition of status:

Global Rank/Definition

- G1 Critically imperilled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factor of its biology that makes it especially vulnerable to extinction (Critically endangered throughout range).
- G2 Imperilled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range (Endangered throughout range).
- G3 Either very rare and local throughout its range or found locally (even abundant at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range (21 to 100 occurrences; Threatened throughout its range).
- G4 Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5 Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

State Rank

- S1 Critically imperilled in Wyoming because of extreme rarity (five or fewer occurrence, or very few remaining individuals) or because of some factor of its biology making it especially vulnerable to extinction (Critically endangered in state).
- S2 Imperilled in Wyoming because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range (Endangered in state).
- S3 Rare in Wyoming (on the order of 20+ occurrences) (Threatened in state).
- S4 Apparently secure in Wyoming.
- S5 Demonstrably secure in Wyoming.

Other Codes

- T Rank for a subspecific taxon (species or variety); appended to the global rank for the full species.
- ? Assigned status questionable.
- R2 Designated sensitive in U.S. Forest Service Region 2
- SSC3 WGFD Species of Special Concern (SSC) in which 1) habitat is not limited, but populations are greatly restricted or declining and extirpation appears possible; 2) habitat is limited or vulnerable, although no significant recent loss has occurred, and populations are declining or restricted in numbers or distribution, but extirpation is not imminent; or 3) significant habitat loss is ongoing, but the species is widely distributed and population trends are thought to be stable.
- SSC4 WGFD Species of Special Concern (SSC) in which 1) habitat is stable and not restricted, but populations are greatly restricted or declining and extirpation appears possible; 2) habitat is limited or vulnerable; although no significant recent

loss has occurred and species is not sensitive to human disturbance populations are declining or restricted in numbers and/or distribution but extirpation is not imminent; 3) habitat is restricted or vulnerable but no recent or on-going significant loss has occurred; species may be sensitive to human disturbance; species is widely distributed and population status is suspected to be stable; or 4) significant habitat loss is on-going but populations are stable or increasing and not restricted in numbers or distribution.

Source: HWA 2001
BLM BLM-identified Special Status plants in the Great Divide Resource Area, Rawlins District.