



U.S. Department of the Interior

Bureau of Land Management

Wyoming State Office

Rawlins Field Office

February 2002

**ENVIRONMENTAL ASSESSMENT for the
Atlantic Rim Coalbed Methane Project,
Cow Creek Pod, Carbon County, Wyoming**

MISSION STATEMENT

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BLM/WY/PL-02/011+1310

**ATLANTIC RIM COALBED METHANE PROJECT:
COW CREEK POD
ENVIRONMENTAL ASSESSMENT**

Prepared by

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

and

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February, 2002



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

Re: Cow Creek Pod Environmental
Assessment

Dear Reader:

Enclosed for your review and comment is the Environmental Assessment (EA) for Double Eagle Petroleum and Mining's Cow Creek 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 March 25, 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 Cow Creek 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 address shown above or phone (307) 328-4389.

Sincerely,

ACTING



Field Manager

Enclosure

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CHAPTER 1

PURPOSE AND NEED

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION AND LOCATION

1.1.1 Description

Double Eagle Petroleum and Mining Company (Double Eagle) of Casper, Wyoming has notified the Bureau of Land Management (BLM), Rawlins Field Office, that the company proposes to explore and potentially develop coalbed methane (CBM) wells in the Cow Creek Pod Project Area (CCPA) of the Atlantic Rim Project Area (ARPA) of southcentral Wyoming (Figure 1-1). The Double Eagle proposal is a part of interim drilling activity under consideration by the BLM, Rawlins Field Office for the purpose of gathering data for the preparation of an Environmental Impact Statement (EIS) for the entire Atlantic Rim CBM project area.

The interim development project consists of fourteen exploratory CBM wells and related facilities in the Cow Creek Pod of the Atlantic Rim CBM project area. Four of these wells were previously analyzed in an environmental assessment (EA) completed by the BLM, Rawlins Field Office on December 14, 2000, and two existing oil and gas wells were approved for recompletion as CBM wells in 1997 and 1999, respectively. This Proposed Action of this EA consists of drilling, completing, and operating eight new productive CBM wells and related production and water disposal facilities. Initial drilling operations are proposed to begin early 2002. The total life of the project (LOP) is estimated at 10 to 15 years.

1.1.2 Location

The ARPA is located within the administrative boundary of the BLM's Rawlins Field Office. The CCPA is located in Township 16 North, Ranges 91-92 West, Carbon County, Wyoming (Figure 1-2). Access to the CCPA is provided by the two-lane paved Wyoming State Highway 789 (SH 789) from Interstate 80 (I-80) at Creston Junction south towards Baggs, Wyoming, or north from Baggs, Wyoming. Access to the CCPA is by SH 789 north from Baggs for approximately 22 miles to the intersection with Carbon County Road 608 ("Dad Road"). The distance from SH 789 to the CCPA is approximately 3 miles. The CCPA is shown on Figure 1-2.

The CCPA encompasses approximately 2,050 acres, all of which are federal surface and federal minerals.

1.2 PURPOSE OF AND NEED FOR ACTION

1.2.1 Purpose and Need For the Proposed Development

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 under authority of 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.

CHAPTER 1: PURPOSE AND NEED

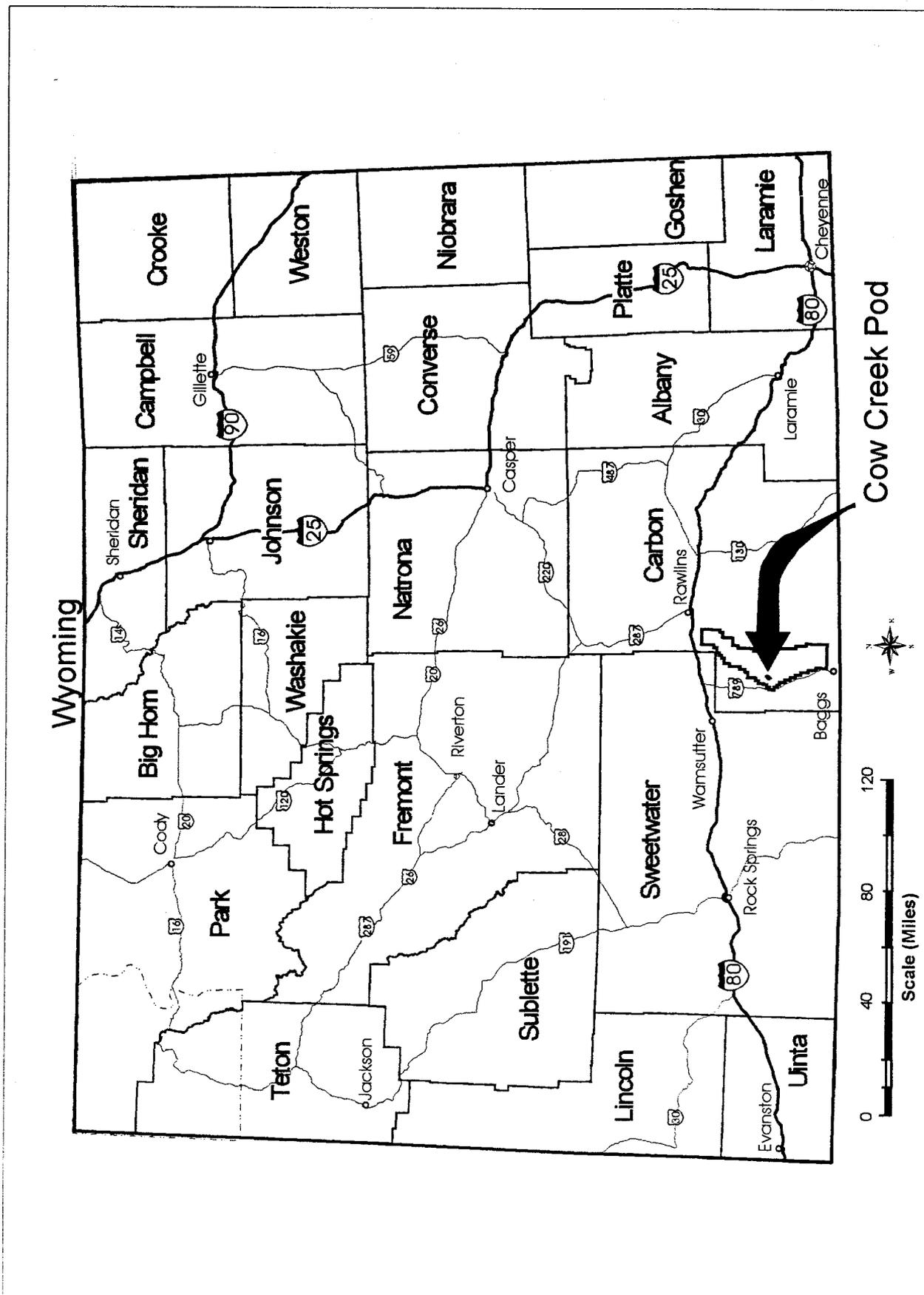


Figure 1-1. Location of the Double Eagle - Cow Creek Pod in Southcentral Wyoming.

CHAPTER 1: PURPOSE AND NEED

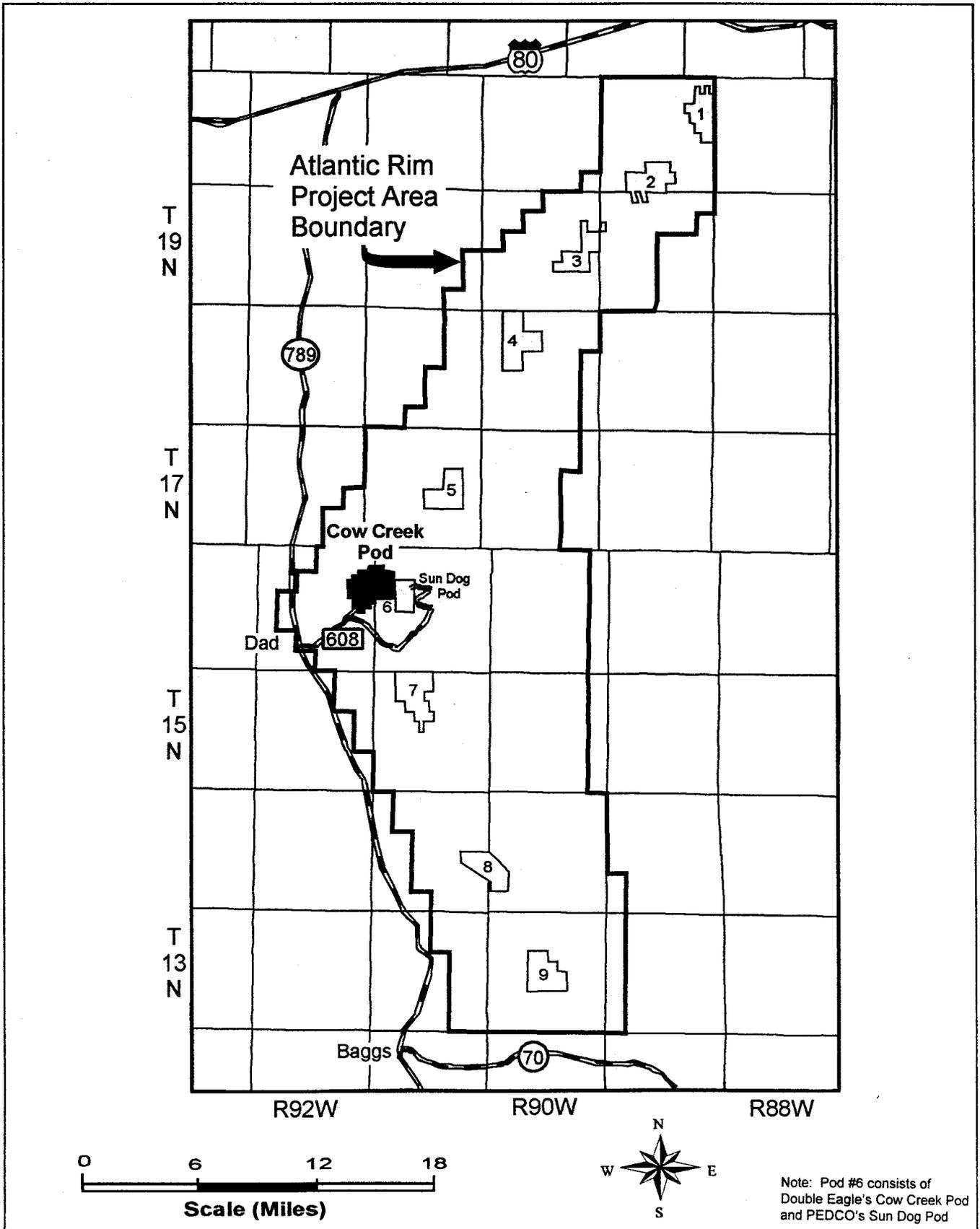


Figure 1-2. Cow Creek Pod in Relation to other Pods within the Atlantic Rim EIS Project Area.

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The purpose of the proposed CBM development is to exercise the lease holders' rights within the project area to drill for, extract, remove, and market gas products. National mineral leasing policies and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands so long as undue and unnecessary environmental degradation is not incurred.

Also included is the right of the lease holders 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. The proposed project would allow Double Eagle to determine through exploration and production of CBM if, and where, larger scale development is feasible.

1.2.2 Purpose of the Environmental Analysis Process

The purpose of this environmental assessment (EA) is to provide the decision-makers with information needed to make a decision that is fully informed and based on factors relevant to the proposal. It also documents analyses conducted on the proposal and alternatives in order to identify environmental impacts and mitigation measures necessary to address issues. The EA also provides a vehicle for public review and comment on the Double Eagle 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 coalbed methane project. The proposed exploration project would affect BLM lands managed by the Rawlins Field Office.

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 direction.

- A determination of whether the proposal and alternatives are in conformance with policies and regulations of other agencies likely associated with the project.

- The location of environmentally suitable well pad locations, access roads, pipelines, and production facilities that best meet other resource activities and minimize surface resource impacts yet honor the lease rights within the project area.

- A determination of impacts resulting from the proposed action and alternatives on the human environment, if conducted in accordance with applicable regulations and lease stipulations, and the development of mitigation measures necessary to avoid or minimize these impacts.

1.3 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

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

CHAPTER 1: PURPOSE AND NEED

1.3.1 Conformance with Great Divide Resource Area RMP

The BLM's Great Divide Resource Management Plan (RMP) and Record of Decision (ROD) (USDI-BLM 1987, 1988a, 1990) directs the management of BLM-administered lands within the project area. The objective for management of oil and gas resources as stated in the RMP is to provide for leasing, exploration and development of oil and gas while protecting other resource values. The ROD found that all public lands in the resource area are suitable for oil and gas leasing and development, subject to certain stipulations. The BLM considers existing RMP oil and gas decisions to be adequate for CBM and allows for the exploration and testing to determine the viability of CBM development.

1.3.2 Conformance With Interim Drilling Guidelines

The CCPA is within one of nine pods that are proposed for exploration and development within the ARPA. Drilling and development will be managed under the guidelines provided by the Interim Drilling Policy - Conditions and Criteria Under Which Development Activities May Occur Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project (see Appendix A).

1.3.3 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 (see Appendix B).

The development of this project would not affect the achievement of the Wyoming Standards for Healthy Rangelands (August 1977).

1.3.4 Issues and Concerns

Environmental and social issues of local importance associated with the Double Eagle exploratory CBM project are identified as follows:

Potential impacts to wildlife habitats within the project area and adjacent lands, primarily sage grouse and big game crucial winter range.

The project area has recorded historical/cultural resource values. There is concern that site disturbing activities associated with exploratory drilling operations may impact historic and cultural values currently unrecorded.

Reclamation of disturbed areas associated with construction activities and off-road travel is a management concern.

Potential impacts to surface water quality is a management concern.

There are concerns regarding potential impacts to air, soil, wildlife, and vegetation within the project area.

Potential impacts to groundwater is a management concern.

CHAPTER 1: PURPOSE AND NEED

There are concerns regarding potential impacts to air quality (mostly from generators and processing).

Cumulative impacts to all resources is a management concern.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

2.0 PROPOSED ACTION

The Double Eagle Petroleum and Mining Company (Double Eagle) Proposed Action consists of drilling, completing, and operating eight new exploratory coalbed methane (CBM) wells and related production and water disposal facilities in the Cow Creek Pod project area (CCPA) of the Atlantic Rim Project Area (ARPA)(Figure 2-1). The proposal is a part of the Interim Drilling Policy associated with the Atlantic Rim environmental impact analysis in Carbon County, Wyoming.

The Atlantic Rim CBM Project Environmental Impact Statement (EIS) began in late summer 2001, and is expected to take about 24 months to complete. During the interim period before the EIS is completed, the BLM, Rawlins Field Office (RFO) will allow, with compliance with criteria described in the Interim Drilling Policy (see Appendix A), the drilling of up to 200 exploratory wells. Currently, oil and gas operators have identified 9 areas or “pods” where these exploratory wells would be located, one of which is the CCPA. The Cow Creek pod is actually a portion of pod number six. The remaining portion of this pod is referred to as the Sun Dog pod, which will be developed by Petroleum Development Corporation (PEDCO). Because the Sun Dog pod will be operated by a different company, utilizing separate facilities, with plans to dispose of produced water by re-injection methods, a separate environmental analysis was prepared.

The proposed CBM development is based on a Wyoming Oil and Gas Conservation Commission (WOGCC) approved 40-acre well spacing pattern. In addition to well sites, other facilities, such as access roads, gas gathering and water disposal pipelines, electrical utilities, and compressors, would be developed to facilitate natural gas (methane) production in the well fields. The interim project would develop over a 6 to 12 month period. The productive life of the project is estimated between 10 and 15 years.

Specific components of the Cow Creek CBM project are shown in the Master Surface Use Plan (MSUP) and Master Drilling Plan (MDP) (Appendix C), and summarized in the following sections of the Double Eagle Plan of Operations.

2.1 PLAN OF OPERATIONS

2.1.1 Preconstruction Planning and Site Layout

Double Eagle would follow the procedures outlined below to gain approval for proposed activities on BLM-administered lands within the Cow Creek Pod. Development activities proposed on fee (private) surface would be approved by the WOGCC. The WOGCC permitting procedures require filing an APD with the WOGCC and obtaining a right-of-way (ROW) from the surface owner.

Prior to the start of construction activities, Double Eagle would submit a Notice of Staking (NOS), APD, or ROW Application to the BLM with a map 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 to 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

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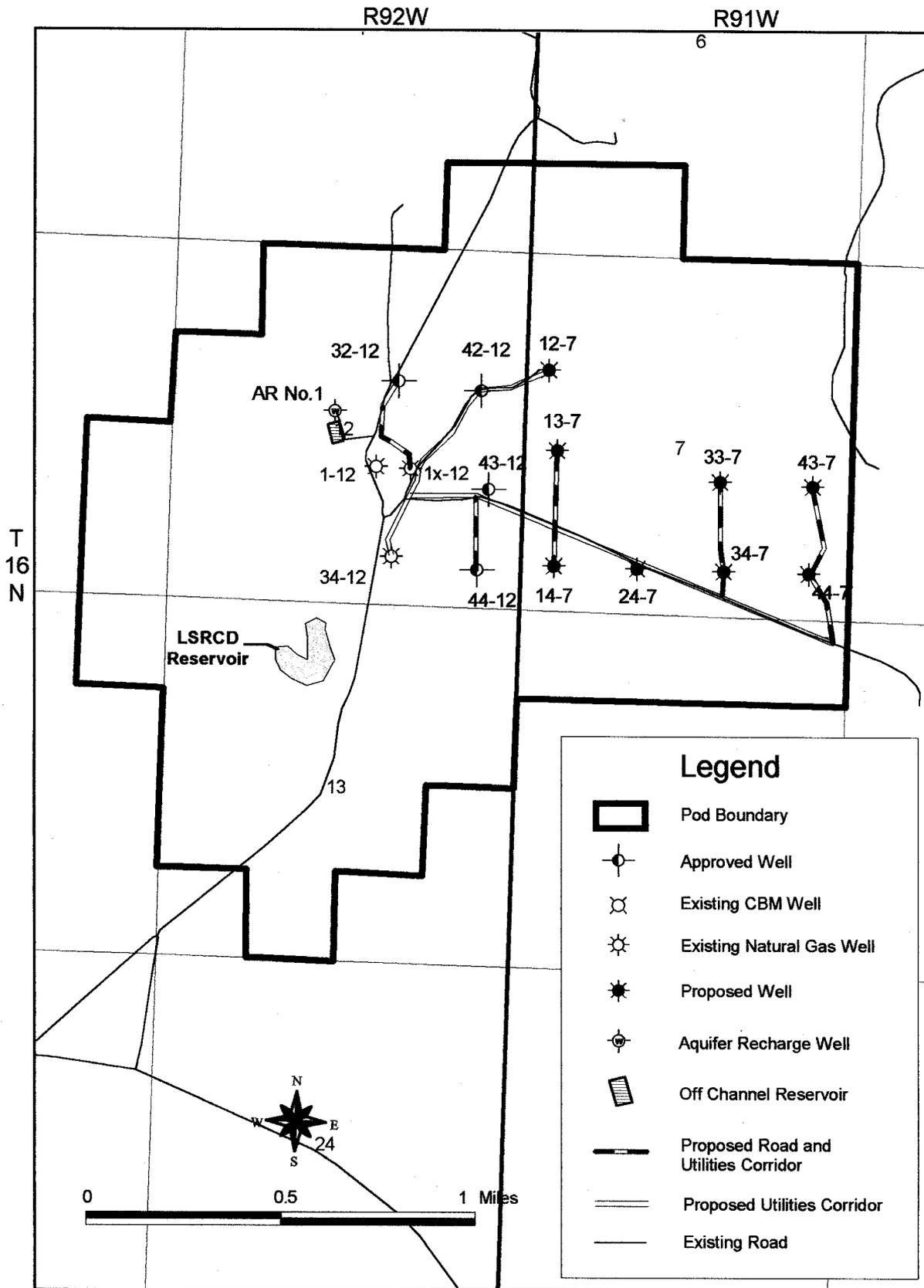


Figure 2-1. Proposed Developments in and Around the Cow Creek Pod.

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Oil and Gas Order No. 1 (Approval of Operations on Onshore Federal and Indian Oil and Gas Leases).

The proposed facility would be staked by the Double Eagle and inspected by an interdisciplinary team (IDT) and/or an official from the BLM to ensure consistency with the approved RMP, the Interim Drilling Policy (see Appendix A), and oil and gas lease stipulations.

More detailed construction plans, when required by the BLM for the proposed development, would be included in the MSUP. The plans would address concerns that may exist concerning construction standards, required mitigation, etc. Negotiation of these plans between Double Eagle 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 on-site inspection.

Double Eagle and/or its contractors would revise the MSUP and MDP 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. Double Eagle must then commence with the proposed activity within one year.

Following is a general discussion of proposed construction techniques to be used by Double Eagle. More detailed plans can be reviewed in Appendix C1, MSUP. These construction techniques would be applicable to drill site, pipeline, and access road proposals within the CCPA, and may vary between the well sites.

2.1.2 Construction and Drilling Phase

2.1.2.1 Access Road Construction

The primary road access utilized by Double Eagle to access the CCPA is Wyoming State Highway 789 (Figure 1-2). Access to the pod is provided by an existing graveled and partially graveled road off of County Road 608 (Figure 1-2). Access to drill site locations from the existing road network already in place would be provided by new and upgraded crowned, ditched, and surfaced roads.

Double Eagle 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. Due to the soil characteristics of the area, surfacing of all newly constructed access roads with an appropriate grade of gravel to a depth of four inches would be completed prior to moving the drilling equipment/rig onto the pad. 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 weather conditions that suggest excessive rutting or erosion may not occur without gravel. These access roads, or portions thereof, would be identified during the on-site inspection. Roads would be closed and reclaimed by Double Eagle 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 culverts. Where required, fish-friendly culverts would be installed. Low water crossings would be utilized in shallow channel crossings. Crossings of larger channels

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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 saved before channel crossing construction occurs. Also, the total area to be disturbed would be flagged on the ground before construction begins.

2.1.2.2 Well Pad Design and Construction

All of the proposed CBM wells would be drilled on lands administered by the BLM. A graded well pad would be constructed at each well site. Drilling operations on flat terrain would disturb an area approximately 180 feet by 200 feet at each well site.

A diagram showing the proposed drill pad layout is shown in Figure 2-2, and indicates drill pad orientation with cuts and fills. However, the amount of area actually used for the drillsite would be dependent on the drilling rig used. The only grading of the wellsite would be the part of the location where the drilling rig and ancillary facilities are positioned. Within the location dimension, a temporary pit would be excavated measuring approximately 15 feet wide, 15 feet long, and 12 feet deep. The estimated life of the pit would be 2 to 3 weeks to allow for evaporation of pit fluids and would be reclaimed after completion operations. The pit would be fenced and netted to prohibit livestock and wildlife from falling into it.

Where grading occurs, all topsoil up to 12 inches as identified in each site specific EA would be removed from the location, including areas of cuts, fill and subsoil storage areas, and would be stockpiled at the site. If ground frost prevents the segregation and removal of the topsoil material from the less desirable subsoil material, cross-ripping to the depth of the topsoil material would be completed as necessary.

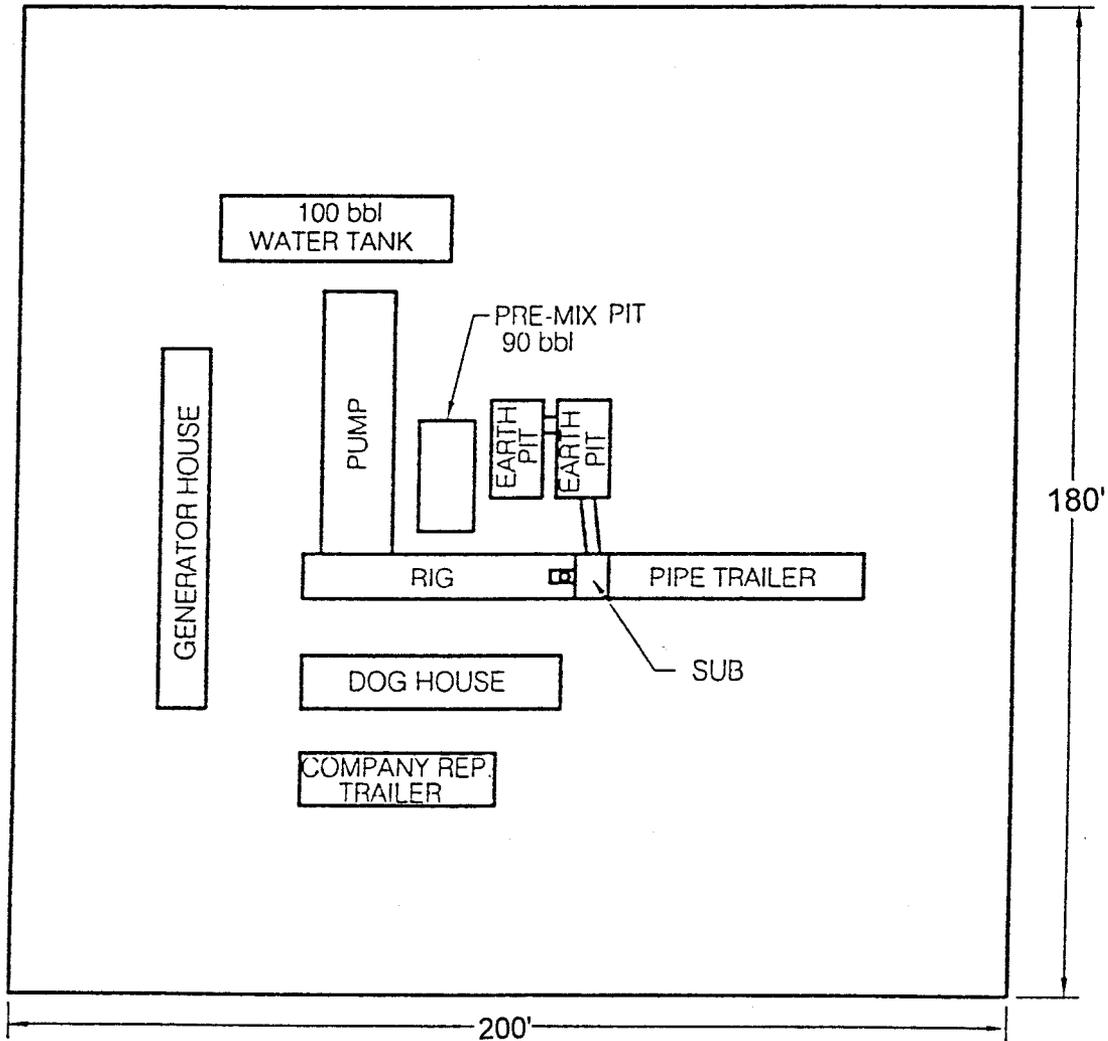
Care would be exercised to make certain that soil materials and overburden would not be pushed over side-slopes or into a drainage. All soil material disturbed would be placed in an area where it can be retrieved. If there is snow on the ground when construction begins, it would be removed before the soil is disturbed, and it would be piled downhill from the topsoil stockpile location.

The backslope and foreslope would be constructed no steeper than 1.5:1. The reserve pit would be constructed with a minimum of one-half the total depth below the original ground surface on the lowest point within the pit. The reserve pit would be fenced stock-tight on all sides when the well is suspended, completed, or abandoned. The reserve pit would be oriented to prevent collection of surface runoff. The pad would be constructed in such a manner as to prevent water from draining across the pad.

In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed 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 no longer needed.

TYPICAL DRILL SITE LAYOUT



NOT TO SCALE

Figure 2-2. Typical CBM Drill Site Layout - Cow Creek Pod.

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2.1.2.3 Drilling and Completion Operations

Drilling would determine whether CBM gas production is possible and economic. The CCPA is located in the Washakie Basin on the west flank of the Sierra Madre uplift in Carbon County. The primary targeted reservoir for the project is CBM gas from the coal seams within the Almond Formation, a member of the Upper Cretaceous Mesaverde Group. Double Eagle bases this proposed activity on their preliminary development plans submitted to the BLM in 1999.

Double Eagle has received approval from the WOGCC for 40-acre spacing on this project (WOGCC Docket #233-2001). This spacing is viewed by Double Eagle initially as the most warranted spacing since this area has only one producing CBM well and therefore no reliable reservoir data exists to date.

Drilling of the CBM wells would utilize a truck or trailer-mounted drilling rig. Additional equipment and materials needed for drilling operations would be trucked to the well site. Water for use in drilling wells in each pod would be obtained from the settling pond at the Cow Creek Unit tank battery. Approximately 3,000 barrels of water would be needed for drilling each well. 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 3,000 barrels of water per well for cement preparation, well stimulation, and dust control. Drilling mud usually is 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.

Each well would be drilled to a depth of 1,000 feet to 1,500 feet or deeper, and would have steel casing cemented from total well depth (TD) to the surface. 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 on Figure 2-3.

The drilling and completion operation for a CBM well normally requires approximately 10 to 15 people at a time, including personnel for logging and cementing activities. Each well would be drilled within a period of 5 to 7 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, erected, and used to complete a well. Completion operations are expected to average 5 to 7 days per well. Methane gas may be vented and water temporarily discharged into the reserve pit or tanks for a very short period of time during testing to determine whether wells would be produced. Once determined to be productive, wells would be shut-in until pipelines and other production facilities are constructed.

It is anticipated that there would be a maximum of 3 to 5 small trailers on location on the well pad during drilling and completion operations. Upon conclusion of the operations, the trailers or other facilities would be removed from the site.

All unproductive wells would be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for gas pipeline connection or for authorization from the Wyoming DEQ for temporary or permanent surface water discharge permits and/or approval of sundry notices by the BLM for production activities and facilities.

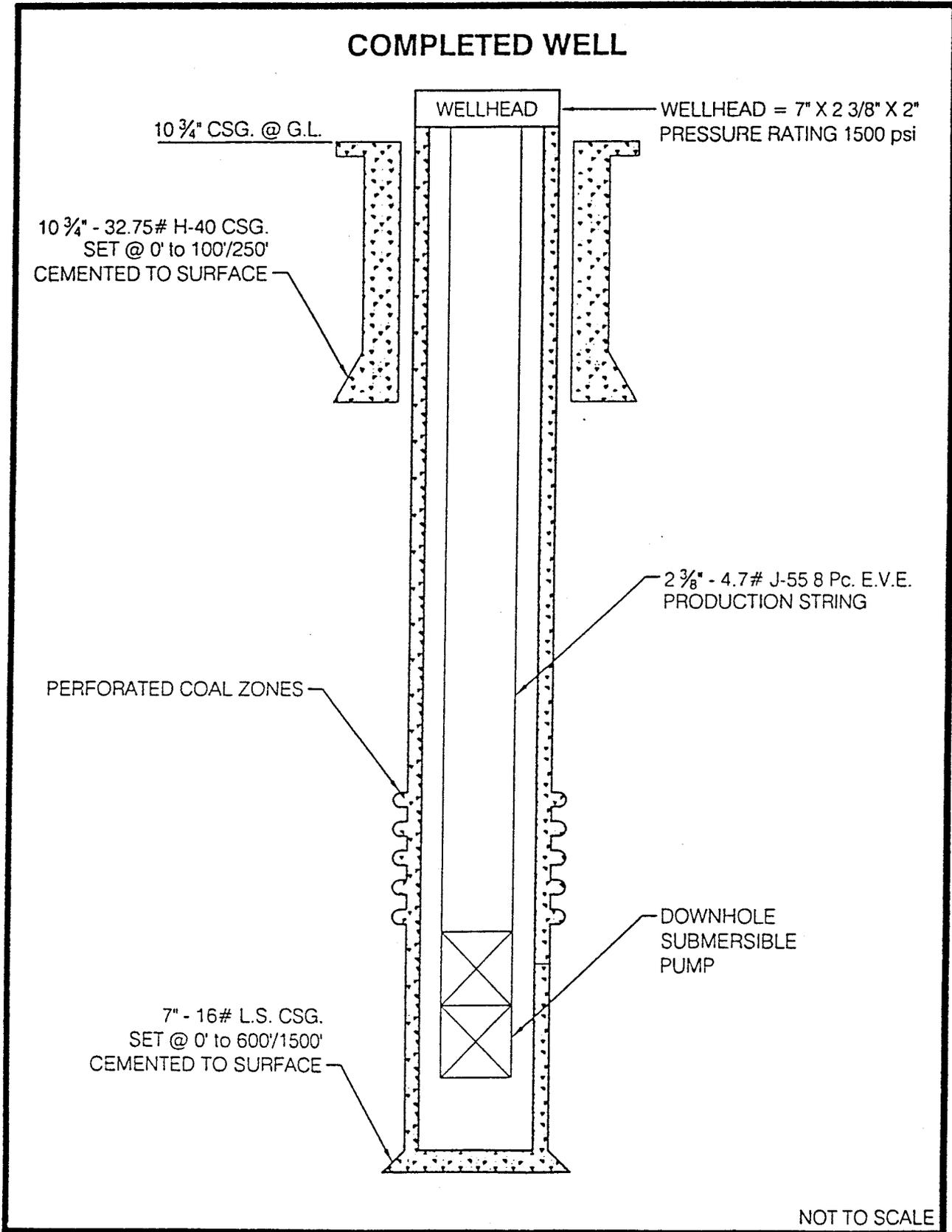


Figure 2-3. Typical Completed CBM Well Bore.

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2.1.2.4 Water Supply and Disposal

Water for drilling the proposed wells would be obtained from the settling pond at the central delivery point (CDP) located in the NW1/4SE1/4 of Section 12, T16N, R92W. Water would be hauled by truck to the well locations over existing roads. Water volumes used in the drilling operations are dependent upon the depth of the well and the losses that might occur during drilling.

Cuttings and drilling fluids would be put in the reserve pit during drilling. A wire fence would be installed around the pit during drilling and after the drilling rig leaves. There would be no oil, salt water, or other noxious fluids produced during drilling and completion operations.

For the protection of livestock and wildlife, all pits containing toxic liquids would be fenced. For the protection of migrating waterfowl, these pits would be covered overhead with mesh netting during spring and fall migration times.

2.1.2.5 Waste Disposal

All wastes that accumulate during the drilling operations would be contained in a trash cage that is fenced and completely enclosed with a fine wire mesh, and would be removed from the location and deposited in an approved sanitary landfill.

Immediately after removal of the drilling rig, all garbage and debris on the site would be removed from the site. The reserve pit would not be utilized for trash disposal. All state laws and regulations pertaining to containment and disposal of human waste would be complied with.

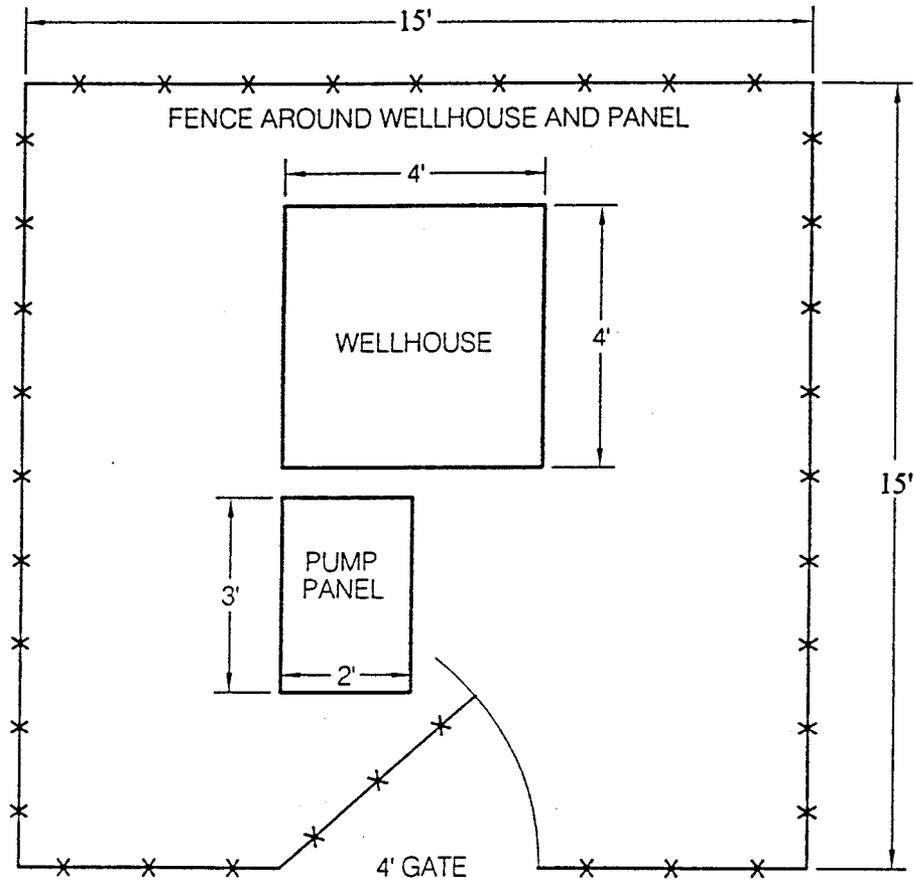
2.1.3 Production Operations

2.1.3.1 Well Production Facilities

Wellhead facilities would be installed if the CBM wells are productive. A weatherproof covering would be placed over the wellhead facilities. At this time, no additional facility would be constructed at the well site for gas-water separation facilities. A downhole pump would be utilized to produce water from the cased hole and perforated interval. Methane gas would flow to the surface using the space between the production casing and the water tubing. The long-term surface disturbance (10 to 15 years) at each productive well location where cut and fill construction techniques are utilized would encompass approximately 0.005 acre (15' x 15'; Figure 2-4). Well site production facilities typically would be fenced or otherwise removed from existing uses. A typical CBM production wellsite is shown on Figure 2-4.

At the conclusion of the project, roads, culverts, cattle guards, pipelines, stock watering facilities, or other structures could be left in place for any beneficial use as designated and approved 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 (SEO). Ponds and reservoirs would continue to store water if the BLM elects to manage the wells and continue pumping water from them. All federally-owned surfaces that contain disturbed areas or facilities that are no longer needed would be reclaimed.

TYPICAL CBM WELLSITE



NOT TO SCALE

Figure 2-4. Schematic of a Typical CBM Production Wellsite.

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2.1.3.2 Power Generation

Electricity would be used to power downhole pumps during well development and to initiate and maintain production. Natural gas-fired generators would be used during the entire interim drilling period at the CDP. Electrical distribution lines would not be installed during the interim period, but likely would be buried during the 10-15-year LOP. Impacts associated with burial of electrical distribution lines would be analyzed in the Atlantic Rim CBM EIS currently under preparation. Either electrical motors or natural gas-fired reciprocating or micro turbine engines would power booster or blower units.

2.1.3.3 Pipelines

Two buried pipelines and one buried power cable, each appropriate in length to travel the distance from each wellsite on the defined access routes to the CDP would be installed between the well location and the CDP. The pipelines and power cable would be installed in the same trench. Each trench would be 4 feet deep to prevent freezing of pipelines, which would be constructed of HDPE or steel pipe. One pipeline would transport the produced water and the other would transport gas.

All gas production and water production from Double Eagle wells would flow in underground pipelines to a CDP facility. The CDP would be located at the CCU #1X-12 wellsite at the NW1/4SE1/4 of Section 12, T16N:R92W. Once gas production enters the CDP it would be metered, compressed and sold into an existing third party gas sales tying beneath the CDP. Production water would enter the CDP and flow into an existing settling pond. From the pond, the water would be addressed in several ways as defined and approved by the Wyoming DEQ under the National Pollutant Discharge Elimination System (NPDES) permit. Water management is described in greater detail in Section 2.1.3.5, Produced Water Discharge.

A backhoe or small trencher would dig the pipeline trench(es) thus, surface disturbance would be minimized. Reclamation of pipeline corridors would occur as soon as practical after pipeline construction is completed.

2.1.3.3.1 Gas-Gathering Pipeline Systems

As part of the transportation corridor system linking the wells and ancillary facilities, gas-gathering pipelines and produced water-gathering pipelines would be constructed, placed together in the same trench/ditch, when practical, and buried. Construction and installation of pipelines would occur immediately after well drilling. Access roads typically would follow the pipeline ROW, 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 pod facilities and produced water away from wells to a settling pond.

Well gathering lines are expected to disturb portions of 30-foot wide corridors, and would transport gas from each compression station to a truckling.

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 10-20 million cubic feet per day (MMCFD), depending on the pipeline connecting locations.

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2.1.3.4 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 1,000 psi. One existing field compressor station contains a 200-HP engine. All compressors are expected to be housed within structures. A typical compressor station and meter facility is shown on Figure 2-5.

2.1.3.5 Produced Water Discharge

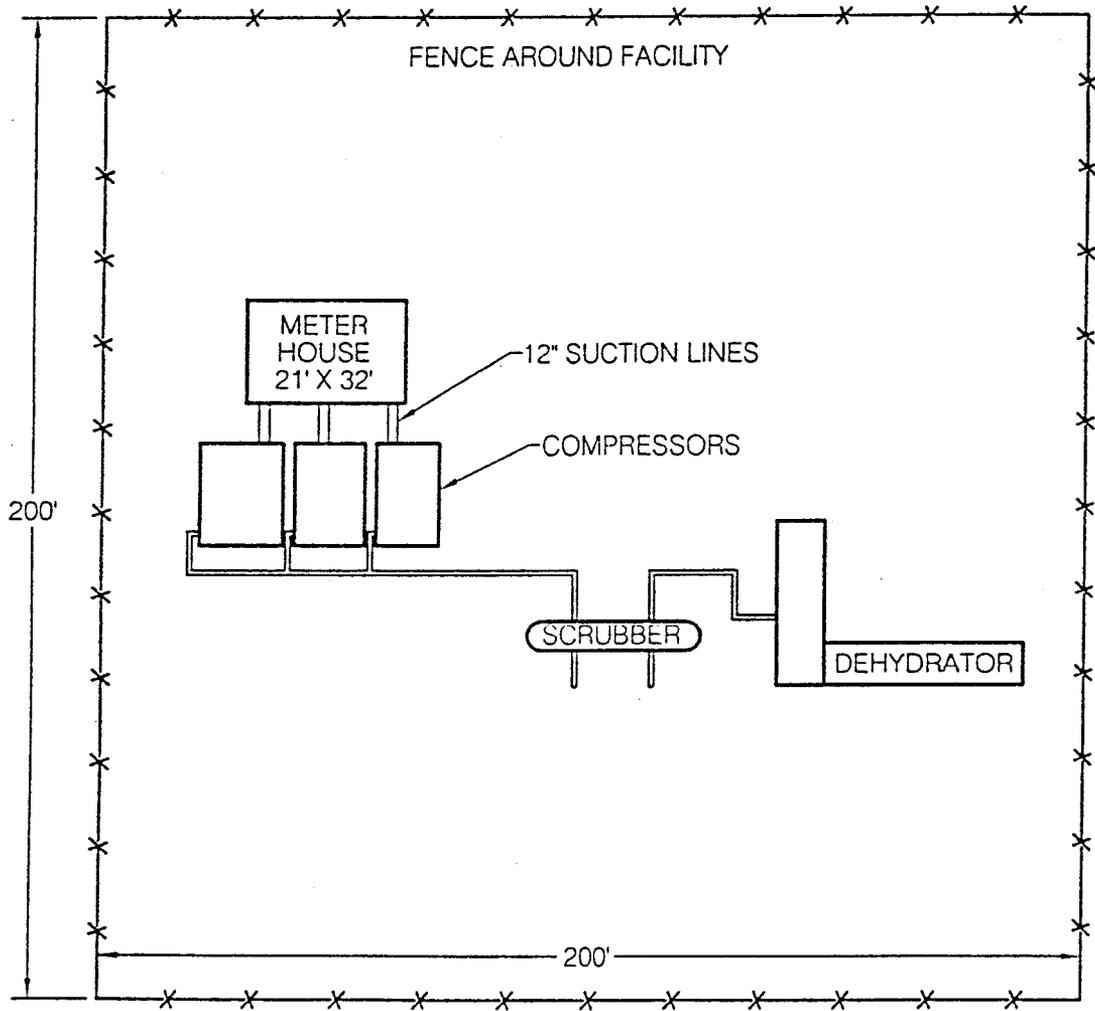
Prior to discharging any produced water on the surface, including temporary discharges, from the proposed wells, an NPDES permit or other applicable authorization from the Wyoming DEQ, and permits to appropriate ground water from the Wyoming SEO would be obtained. The quality of produced water is characterized on the NPDES permit application. After successfully completing a well, water monitoring would occur periodically as required by Wyoming DEQ.

Within 90 days of initial production, facilities/pits used for disposal of produced water will be applied for as outlined in Onshore Oil and Gas Order No. 7, via a Sundry Notice. Off-lease or unit disposal will require a sundry notice and right-of-way authorization.

Double Eagle has received an NPDES permit from the Wyoming DEQ to discharge CBM water from the project area. The requirements of this permit allow Double Eagle to discharge no more than 180,600 gallons of water and/or 1.34 tons of salt per day, into an ephemeral drainage, which eventually reaches an existing reservoir. This reservoir was constructed through a cooperative effort between National Fish and Wildlife Foundation, the Little Snake River Conservation District (LSRCD), the BLM, and the grazing permittee as a range improvement project to contain water which was being produced from a casing leak in an existing oil and gas well, the 1X-12. The water produced from CBM wells will be initially discharged to a low sloped channel that is rip-rapped at the discharge point. Calculated velocities of less than one ft/sec for the initial maximum allowable flow in the channel are below the erosion threshold for the fine-grained sediments in the channel. Initial water depths in the channel would be a few inches. Amounts in excess of 180,600 gallons per day (or 1.34 tons of salt per day) would be addressed in one or more of the following alternatives:

1. Construction of an off-channel reservoir facility west of the CDP. This structure would be approximately 280' x 400' with a maximum depth of 11 feet. The capacity of the pond would be 20 acre-feet covering 2.6 surface acres. The facility has been permitted by the Wyoming State Engineer and Wyoming DEQ.

TYPICAL COMPRESSOR STATION & METER FACILITY



NOT TO SCALE

Figure 2-5. Typical Compressor Station and Meter Facility.

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2. Drill up to four wellbores as Aquifer Recharge Wells under WDEQ Chapter 16 rules as a Class 5B2 facility. The wells would be located approximately 500 feet northwest of the CCPA tank battery which is the CDP for all CBM water discharges. One of the aquifer recharge wells has been drilled and is located in the SENW of Section 12, T16N:R92W immediately west of an existing reservoir enclosure. All of these wells have been permitted by the Wyoming DEQ. Approximately 0.8 acres would be disturbed during the drilling of a recharge well; during operations, the disturbance would be reduced to 0.25 acres. DEQ, with primacy from EPA, has approved the permit for the recharge wells. Prior to injection, a sample of produced water and a sample of water from the receiving zone (Lewis sands) must be analyzed and meet the standards contained in the permit. Theoretically, only the one existing aquifer recharge well would be required with an injection rate of 200 gpm (6,857 bpd).
3. Recomplete a plugged and abandoned wellbore and explore it for use as a DEQ approved Class 5B2 recharge well or drill a new well to an appropriate depth. Appropriate permits would be obtained from WDEQ. Recompletion, if necessary, of a plugged and abandoned well would disturb approximately 0.8 acres.
4. Construction of an off-channel reservoir/evaporation facility west of the CDP. The size of the reservoir could reach approximately 80 acre-feet.
5. Construction of an off-channel reservoir/evaporation facility east of the CDP. The reservoir capacity would be 20 acre-feet. Dimensions would be similar to the off-channel reservoir in alternative 1. This alternative will probably not be required; if needed, further analysis will be provided at that time.

Three of the four aquifer recharge wells described in item 2, and items 4 and 5 above would not occur during the life of the interim drilling program. They would likely be required during the life of the project (LOP) which is estimated at 10 to 15 years. Impacts associated with the three additional off-channel reservoirs, the three additional aquifer recharge wells are not analyzed in this EA but will be analyzed in the Atlantic Rim CBM EIS currently being prepared.

Double Eagle estimates initial water production from each well would be 42,000 gallons per day (29 g.p.m.; 1,000 bpd; 0.65 cfs), and expects this rate to decrease by 30-50% each year. This decline rate is consistent with figures released by the WOGCC in April, 2000 for over 1,000 CBM wells in the Platte River Basin (PRB). A 50% annual decline would lower the initial 29 gpm per well to 7.3 gpm in two years. The Green River Basin (GRB) coals are thinner, less continuous and higher-pressured than the PRB coals. The GRB coals may decline differently, but their greater heterogeneity could result in a greater decline rate than seen in the PRB.

All water produced from the proposed wells would be piped into the small settling pond at the existing water discharge facility constructed at the CDP for the #1X-12 well located in the NWSE of Section 12. Water pipelines carrying the produced water would be constructed of HDPE pipe rated to carry low pressured water, and would discharge into a settling pond located at the #1X-12 tank battery. Up to 180,600 gallons per day would be allowed to enter an ephemeral drainage by discharging onto rip-rap rock to prevent erosion and would travel approximately ½ mile before entering the LSRCD reservoir. The LSRCD reservoir is located in the NW1/4 of Section 13 (T16N,R92W) approximately ½ mile south of the proposed wells/locations. The reservoir occupies 15.8 acres and has a capacity of 121 acre feet. The reservoir was constructed with 20,000 cubic yards of fill creating a dam height of 27 feet with a maximum depth of 23 feet.

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The balance of the CBM water above the 180,600 gpd discharge limit to the LSRCD reservoir would be piped to the aquifer recharge well and the associated off-channel reservoir. The water management strategy for the CCPA is total surface containment of the produced CBM water (i.e. no surface flow away from the project site). The strategy would use a combination of surface discharge to the LSRCD Reservoir, piped discharge to a new, off-channel reservoir and piped injection into an aquifer recharge well. Additional details can be found in the Water Management Plan (Appendix C).

Long-term CBM well water production data within the project area is not available. Indications from short-term tests on recently drilled CBM wells are that discharge rates would be highly variable. Due to the difference in coal depth and thickness, comparison with water production rates in the Powder River Basin may not be accurate. Until production testing can be conducted, an average life-of-project discharge rate of 8 gpm per well was assumed for this analysis. This value would vary within the project area and throughout the life of a well. Average production through the life of the well is expected to be less, but in order to present a conservative analysis, the larger value was used for the life of the project. This value is likely to vary from well to well and pod to pod, with the maximum value occurring at the onset of production and declining through the life of the project. Long-term average water production would not be expected to exceed an estimated 0.04 ac-ft/day/well (11,500 gpd or 8 gpm per well). Analyses from existing wells in the project area indicate that the total dissolved solid (TDS) concentrations of produced water would range from approximately 400 mg/l to 2,000 mg/l.

2.1.4 Ancillary Facilities

The Proposed Action would utilize the existing ancillary facility infrastructure within the CCPA where possible, including water disposal facilities and gas gathering pipelines.

All wells, pipelines, and associated ancillary production facilities such as water wells and water treatment and disposal facilities would be operated in a safe manner by Double Eagle 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 on-site storage of produced water and condensates. Routine on-site 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.

2.1.5 Geophysical Operations

No additional geophysical operations are currently planned in the CCPA by Double Eagle.

2.1.6 Traffic Estimates and Work Force Loading Schedule

Estimated traffic requirements for drilling, completion, and field development operations are shown in Table 2-1. 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 pods), and internal (within the pod). The figures provided in Table 2-1 should be considered general estimates. Drilling and production activity levels may vary over time in response to weather and other factors.

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Table 2-1. Traffic Estimates

TRIP TYPE	ROUND TRIP FREQUENCY	
Drilling (2 rigs, 2 crews/rig)	External (to/from pod)	Internal (within pod)
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		
Smeal rig/crew ^f	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 pod weekly and stay in a trailer in the pod during the week. ^b Current plans are to establish a central supply area within a pod and deliver supplies on a weekly basis. ^c Water trucks would deliver water to rigs from a location within the pod. ^d Current plans are to establish a central mud location within a pod and deliver mud on a weekly basis. ^e It would require 4 trucks to move each rig to a pod. Upon completion of drilling in a pod, each rig would move to the next pod. ^f Smeal rig is used in completion; one ton truck with a derrick and boom, used to change pumps.		

2.1.7 Site Restoration and Abandonment

Reclamation procedures whether the well is completed as a successful production well or as a dry hole:

1. Excavations on the drill site not needed for completion and production operations would be filled immediately upon release of the drilling rig from the location.

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2. All sides of the reserve pit would be fenced immediately upon release of the drilling rig from the location.
3. All garbage, trash and debris would be removed and properly disposed of in accordance with Section 2.1.2.5 of this EA.
4. The liquid contents of the reserve pit may be hauled to the next well to be immediately drilled or would be allowed to dry before backfilling, or pit fluids would be removed and disposed of in a manner approved by the Authorized Officer (AO) of the BLM before the reserve pit is backfilled.
5. All rehabilitation work, including seeding, would be completed as soon as possible, but no later than one (1) year of completion of the operation. The areas not needed for production purposes would be recontoured, topsoil respread and seeded utilizing the seed mixture provided by the surface management agency.

If the well is completed as a dry hole the following additional reclamation procedures would be followed:

6. Notice of Intent to Abandon and Subsequent Report of Abandonment would be submitted to BLM for approval. A Final Abandonment Notice would be submitted when the rehabilitation is complete and the new vegetation is established.
7. An above-ground tubular metal dry-hole marker would be erected over the drill-hole location upon cessation of drilling and/or testing operations. The marker would be inscribed with the operator's name, well number, well location (1/4 1/4 section, township, range, etc.) and federal lease number. Upon request of the surface management agency, the casing may be cut-off three (3) feet below reclaimed ground surface (or below plow depth) with a metal plate affixed to the top providing the same well information as stated above. This monument would consist of a piece of pipe not less than four inches in diameter and ten feet in length, of which four feet shall be above the general ground level and the remainder being imbedded in cement. The top of the pipe would be closed by a welded or screw cap cement, or other means.
8. All disturbed areas would be restored as nearly as possible to resemble the surrounding terrain. Topsoil would be respread and reseeding would be done according to the directions of the surface management agency. Care would be taken to prevent erosion.

If the well is completed as a producing well the following additional reclamation procedures would be followed:

1. Those disturbed areas not required for production operations would be recontoured to resemble surrounding terrain. No depressions would be left that trap water or form ponds.
2. The backslope and foreslope would be reduced to 2.5:1 by pulling fill material up from the foreslope and placing it into the toe of cut slopes.
3. If warranted, water bars at least one foot deep would be constructed on the contour with approximately two feet of drop per 100 feet of water bar to ensure drainage, and would be extended into established vegetation. All water bars would be constructed with a berm on

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the downhill side to prevent the soft material from silting in the trench. Water bar spacing on the location would be midway between the top and bottom of the backslope, and midway between the top and bottom of the foreslope.

4. Topsoil would be distributed evenly over those areas not required for production, and would be reseeded as recommended by the surface management agency.
5. To maintain quality and purity, certified seed would be weed-free with a minimum germination rate of 80% and a minimum purity of 90%, in a mix directed by the surface management agency.

New off-channel reservoirs may be left for use by the grazing lessee upon approval of the BLM.

2.1.8 Summary of Estimated Disturbances

The following Table 2-2 summarizes the estimated disturbances that would result with implementation of the CCPA CBM project.

Table 2-2. Disturbance Estimates - Cow Creek Pod.

Double Eagle - Cow Creek Pod				
Facility	Development Phase			Operations
	Length (feet)	Width (feet)	Acres	Acres
New Roads (includes gas and water ROW's)	12,025	40	11.0	5.52
Drill Pads (8)	180	200	6.6	0.04
Off-Channel Reservoir	400	280	2.6	2.6
Total Disturbance			20.2	8.16

2.1.9 Project-Wide Mitigation Measures and Procedures

Double Eagle proposes to implement the following mitigation measures, procedures, and management requirements on public lands to avoid or mitigate resource or other land use impacts. The following describes applicant-committed and agency required measures and procedures to avoid or mitigate resource or other land use impacts. 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.

2.1.9.1 Preconstruction Planning and Design Measures

1. Double Eagle and a BLM interdisciplinary group would make on-site inspections of each proposed and staked facility site (e.g., well sites), new access road, existing roads that will

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be upgraded, and pipeline alignment projects so that site-specific recommendations and mitigation measures can be developed.

2. New road construction and maintenance of existing roads in the CCPA and ARPA on federal lands would be accomplished in accordance with BLM Manual 9113 standards.
3. Prior to construction, Double Eagle would submit an MSUP for each pod. This plan would contain individual APD's for each drill site and Sundry Notices and/or ROW applications for pipeline and access roads. APD's submitted by Double Eagle would show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of the cut and fill (when required), location and dimensions of reserve pit(s), and access road egress and ingress. The MSUP would include itemization of project administration, time frame, and responsible parties.
4. Double Eagle 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 start of construction.

2.1.9.2 Resource-Specific Requirements

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

2.1.9.2.1 Range Resources and Other Land Uses

Mitigation requirements listed under Soils, Vegetation and Wetlands, and Wildlife also apply to Range Resources and Other Land Uses.

1. Double Eagle would coordinate with the affected livestock operators to ensure that livestock control structures remain functional during drilling and production operations.
2. The BLM would recommend that the operator establish speed limits in the CCPA.
3. The proponent should coordinate with affected livestock operators to minimize disruption during livestock operations, including calving season.

2.1.9.2.2 Air Quality

1. All BLM conducted or authorized activities (including natural gas development alternatives) must comply with applicable local, state, tribal and Federal air quality regulations and standards. Double Eagle 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. Double Eagle would not allow burning garbage or refuse at well locations or other facilities. Any other open burning would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations.

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3. Double Eagle 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).
4. If air quality analyses indicate exceedances in NO_x, the following types of control measures could be implemented: the reduction of compression requirements, electric compression or the use of nonselective catalytic reduction (NCR), lean combustion, or selective catalytic reduction (SCR) control technologies. Currently, these levels are below required levels and the likelihood of requiring these measures is small.

2.1.9.2.3 Transportation

1. Existing roads would be used as collectors and local roads whenever possible. Standards for road design should 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 would be acquired prior to construction of additional roads. All roads on public lands which are not required for operation and maintenance of field production should be permanently blocked, re-contoured and reseeded. Roads on private lands should be treated similarly depending on the desires of the land owner.
5. The Proponent would be responsible for preventive and corrective maintenance of roads in the project area throughout the duration of the project. This may include balding, 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.

2.1.9.2.4 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 the BLM, WDEQ, and WOGCC casing and cementing policy.

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Paleontological resource values would be protected through the following mitigation measure:

1. If recommended by the BLM, each proposed facility located in areas with known and potential vertebrate paleontological resource significance) would be surveyed by a BLM-approved paleontologist prior to surface disturbance (USDI-BLM 1987, 1990).
2. Discovery Contingency. Contingency should 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 halt until a qualified paleontologist has determined the importance of the uncovered fossils and the extent of the fossiliferous deposits and made and implemented recommendations regarding further mitigation.
3. Field Survey. No specific data currently exists on deposits of high and undetermined paleontologic potential in CCPA. For that reason field survey for paleontologic resources would be conducted on a case by case basis, as directed by the BLM, in areas in which surface exposures of the Browns Park, Green River, and Wasatch formations crop out. 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 and fossil material, obtaining representative samples of fossil material, by monitoring excavation; or by avoidance. In some cases no action beyond that conducted during the field survey may be necessary.

2.1.9.2.5 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, 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 to a minimum depth of 6 inches on all well pads.
7. Where possible, minimize disturbance to vegetated cuts and fills on existing roads that are improved.
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 crossings to carry the 25-year discharge event, or as otherwise directed by the BLM.

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10. Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Maintain a 100-foot wide buffer strip of natural vegetation where possible (not including wetland vegetation) between all construction activities and ephemeral and intermittent drainage channels.
11. Include adequate drainage control devices and measures in the road design (e.g., road terms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipater) 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 a vegetal cover.
12. Upon completion of construction activities, restore topography to near pre-existing contours at the well sites, along access roads and pipelines, and other facilities sites; replace up to 12 inches of topsoil or suitable plant growth material over all disturbed surfaces; apply fertilizer as required; seed; and mulch.

2.1.9.2.6 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 drainage crossings to no-flow periods for ephemeral or intermittent drainages and low-flow for perennial drainages.
2. Minimize the area of disturbance within perennial, ephemeral and intermittent drainage channel environments.
3. Prohibit construction of well sites, access roads, and pipelines within 500 feet of surface water and/or riparian areas. Possible exceptions to this would be granted by the BLM 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. Maintain vegetation barriers occurring between construction activities and ephemeral and intermittent channels.
6. Design and construct interception ditches, sediment traps/silt fences, water bars, silt fences and revegetation and soil stabilization measures if 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 and the same or very similar bed material replaced.
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

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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 or compact and stabilize fill. Inspect the subsoil material of the pit to be constructed in order to assess soil stability and permeability and 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 with sufficient quantities and through appropriation permits approved by the State of Wyoming.
13. Discharge all concentrated water flows within access road ROW's onto or through an energy dissipater structure (e.g., riprapped aprons and discharge points) and discharge into undisturbed vegetation.
14. Develop and implement a pollution prevention plan (PPP) for storm water runoff at drill sites as required per WDEQ storm water NPDES permit requirements. All required WDEQ permits will be in place prior to discharge.
15. Exercise stringent precautions against pipeline breaks and other potential accidental discharges of toxic chemicals into adjacent streams. If liquid petroleum products are stored on-site 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.
16. Coordinate all crossings or encroachments of waters of the U.S. with the U.S. Army Corps of Engineers (COE).
17. Any changes in the produced water disposal method or location must have written approval from the BLM before the changes take place.

2.1.9.2.7 Fisheries

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

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2.1.9.2.8 Vegetation and Wetlands

Other mitigation measures under Soils and Water Resources 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.

2.1.9.2.9 Wildlife

1. During reclamation, establish a variety of forage species that are useful to native and resident herbivores.
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 as per BLM authorizations within big game crucial winter range from November 15 to April 30.
4. Complete a raptor survey of the CCPA 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 located 0.75 to one mile (depending on species and line of sight) of a proposed well site, construction activities will be restricted during the critical nesting season for that species. For listed and BLM sensitive species the distance should be increased to within one mile of a proposed well site.
7. Do not perform construction activities within 0.25 mile of existing greater sage grouse leks.
8. Provide for greater sage grouse lek protection during the breeding, egg-laying and incubation period (March 1 - 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.

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9. To eliminate any hazard to migratory birds or other wildlife, BLM would require netting (maximum 2 inch mesh) be installed over any pits identified as containing oil or toxic substances.
10. Require that regular drivers undergo training describing the types of wildlife in the area that are susceptible to vehicular collisions, the circumstances under which such collisions are likely to occur, and the measures that can be employed to minimize them.

2.1.9.2.10 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. Implement measures discussed in Chapter 4 in compliance with the Endangered Species Act (ESA).
2. Prior to production of waters associated with CBM production in the CCPA, the proponent agrees to collect water data to determine if water from the Mesaverde Formation is connected to surface waters associated with the Colorado River System. Results of this analysis will be submitted to USFWS and BLM. If data indicates that there is a connectivity between the waters produced concurrent with CBM production and the Colorado River Basin system, and that the project will result in depletions, formal consultation will be initiated with USFWS. Should this test indicate that depletions of the Colorado River system will occur from the implementation of this project, discharge from CBM wells will not be allowed until concurrence with these results is received by the BLM and USFWS.
3. Crossings of any streams having potential to support sensitive fish species will be designed to allow migratory passage following methods identified by Watts (1974). In addition, any stream crossings of the downstream section of Muddy Creek, constructed to access the project area, would be located and constructed to ensure passage for upstream spawning in migrations of these sensitive native fishes. All crossing construction will be limited to no-flow periods for ephemeral or intermittent drainage to low-flow periods for perennial streams. Additionally, crossing designs will be approved by a BLM fishery biologist prior to installation.

2.1.9.2.11 Visual Resources

1. 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

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

2. Utilize existing topography to screen roads, pipeline corridors, drill rigs, well heads, and production facilities from view.
3. Roads will follow contours or vegetation whenever possible to blend with the environment. Tops of facilities will be kept below ridge lines as seen from roads.

2.1.9.2.12 Noise

1. Muffle and maintain all motorized equipment according to manufacturers' specifications.
2. In any area of operations (drill site, compressor site, etc.) where noise levels may exceed federal OSHA safe limits, Double Eagle would provide and require the use of proper personnel protective equipment by employees.
3. 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 (1999b).

2.1.9.2.13 Recreation

Measures under Wildlife, Transportation, Soils, Health and Safety, and Water Resources of this 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.

2.1.9.2.14 Socioeconomic

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. Double Eagle 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.

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2.1.9.2.15 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 AO would be immediately notified. Work would not resume until a Notice to Proceed is issued by the BLM AO.

2.1.9.2.16 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 will 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, Double Eagle would have a chemical or hazardous substance inventory for all such items that may be at the site. Double Eagle 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 drilling location 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. 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, if quantities exceeding 10,000 pounds or the threshold planning quantity (TPQ) are to be produced or stored in association with the Proposed Action. 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.

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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.

2.2 ALTERNATIVE A - NO ACTION

Section 1502.14(d) of the NEPA requires that the alternatives analysis "include the alternative of no action". "No Action" implies that on-going natural gas production activities would be allowed to continue by the BLM in the CCPA, but the proposed field development program (Proposed Action) would be disallowed. Disturbances associated with the existing LSRCR reservoir (15.8 acres), two existing oil and gas wells (X1-12 and 34-12) that have been completed as CBM wells (8.9 acres), and the four recently approved CBM wells, aquifer recharge well, and associated facilities (22.0 acres) will be considered under the No Action Alternative. Additional APD's 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 CCPA that are currently productive. Additional gas development could occur on private lands within the project area under APD's 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 CCPA 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.

CHAPTER 3

AFFECTED ENVIRONMENT

3.0 INTRODUCTION

The Affected Environment chapter of this environmental assessment (EA) for the proposed Cow Creek coalbed methane project discusses environmental, social, and economic factors as they currently exist within the Cow Creek Pod project area (CCPA). The material presented here has been guided by management issues identified by the Bureau of Land Management (BLM), Rawlins Field Office (RFO); public scoping; and by interdisciplinary field analysis of the area.

This proposal could potentially affect critical elements of the human environment as listed in BLM's National Environmental Policy Act (NEPA) Handbook H-1790-1 (USDI-BLM 1988b). The critical elements of the human environment, their status in the CCPA and their potential to be affected by the proposed project are listed in Table 3-1.

Table 3-1. Critical Elements of the Human Environment¹, Cow Creek Pod Coalbed Methane Project, Carbon County, Wyoming.

Element	Status on the CCPA	Addressed in text of EA
Air quality	Potentially affected	Yes
Areas of critical environmental concern	None present	No
Cultural resources	Potentially affected	Yes
Environmental justice	Potentially affected	Yes
Prime or unique farmlands	None present	No
Floodplains	None present	No
Native American religious concerns	Potentially affected	Yes
Noxious weeds	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Hazardous or solid wastes	Potentially affected	Yes
Water quality (surface and ground water)	Potentially affected	Yes
Wetlands/riparian zones	Potentially affected	Yes
Wild and scenic rivers	None present	No
Wilderness	None present	No

¹ As listed in BLM National Environmental Policy Act Handbook H-1790-1 (BLM 1988b) and subsequent Executive Orders

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In addition to the critical elements, this EA discusses potential effects of the project on range resources, transportation, geology/minerals/paleontology, soils, fisheries, vegetation, wildlife, special status species, visual resources, noise, recreation, socioeconomics, and health and safety.

3.1 GEOLOGY/PALEONTOLOGY

3.1.1 Geology

3.1.1.1 Regional Geologic Overview

The SDPA 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 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 SDPA lies along the eastern edge of the Washakie Basin, at the junction with the Sierra Madre Uplift and is underlain at the surface by the Lewis Shale of Late Cretaceous age. The Lewis Shale consists of a thick sequence of shale, siltstone and sandstone that accumulated in deltaic, interdeltic, and marginal marine environments in 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).

By Latest Cretaceous time this seaway had retreated eastward and the marine deposits of the Lewis Shale was replaced progressively upward by beach and 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 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 sand that are late Pleistocene to Holocene in age.

Late Cretaceous rocks at the surface and underlying the SDPA consist of a complex sequence of sedimentary units, including sandstone, shale, coal, and carbonaceous shale. They 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 SDPA 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 SDPA.

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Numerous thin coal seams are present in the upper Almond Formation, a member of the Mesaverde Group. These coal beds are targeted as having the greatest potential for CBM production. The lateral continuity of the Almond coal seams is variable (Hamilton 1993). Geophysical logs of CBM test wells within the CCPA indicate that the Almond 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 rock that ranges from Cretaceous to Cambrian in age. The Phanerozoic sediments are underlain by Precambrian metamorphic bedrock that comprises part of the ancient North American cratonic shield.

3.1.1.2 Mineral Resources

The three primary mineral commodities in Carbon County are coal, natural gas, and oil (Hoffman and Nunley 2000). All three occur in the CCPA, although coal mining has been of least significance to date. Additional mineral resources occurring within the CCPA 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 CCPA, coal primarily occurs within the Almond Formation of the upper Mesaverde. It 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 (T12N, R90W), and the Cow Creek Field (T16N, R92W), both of which target Mesaverde coal seams.

3.1.1.3 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 but none have been mapped in the project area (Case et al. 1991). Slope gradients are mild to steep in the area and are steepest along Muddy Mountain, Browns Hill, Ketchum Buttes, Cow Creek Butte, and Wild Horse Butte. Although not specifically mapped, unstable soils in these steep areas may be susceptible to slumping, sliding, and soil creep. Generally, slope gradients within the CCPA are best described as mild.

3.1.2 Paleontology

Paleontologic resources include the remains or traces of any prehistoric organism which has 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, asphaltum, 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

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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 SDPA. Fossils known from the Lewis comprises 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 so the formation satisfies BLM Condition 2, which may require additional consideration, the potential for discovery of scientifically significant fossils in the SDPA is consider to be moderate to low, when compared to other Late Cretaceous age formations of Wyoming.

3.2 CLIMATE AND AIR QUALITY

3.2.1 Climate

The CCPA is located in a semiarid (dry and cold), mid-continental climate regime. The area is typified by dry, windy conditions, with limited rainfall and long, cold winters. The nearest meteorological measurements were collected at Baggs, Wyoming (1979-present), approximately 20 miles southwest of the project area at an elevation of 6,240 feet (WRCC 2001).

The annual average total 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 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 the snowiest months. In the project area, annual average precipitation is about 8 to 9 inches, based on local BLM precipitation information and 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 affects 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

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and transport). Dispersion conditions will be the greatest to the north and along the ridge and mountain tops.

Mean annual lake evaporation is 50 inches (Martner 1986). The average annual precipitation is 11 inches. This results in a net annual evaporation rate of 39 inches. These meteorological and climatological characteristics of the project area combine to produce a predominantly dry climate where evaporation exceeds precipitation.

3.2.2 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 (PSD) 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 PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. The CCPA and the surrounding areas are classified as PSD Class II. Four PSD Class I areas, the Bridger, Fitzpatrick, Mount Zirkel, and Rawah Wilderness Areas, exist in the region and could be impacted by cumulative project source emissions.

All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a "threshold of concern," and do not represent a regulatory "PSD Increment Consumption Analysis." The determination of PSD increment consumption is an air quality regulatory agency responsibility (with EPA oversight). Such an analysis would be conducted as part of a major New Source Review, including a Federal Land Management Agency's evaluation of potential impacts to Air Quality Related Values (AQRV) such as visibility, aquatic ecosystems, flora, fauna, etc. A "PSD Increment Consumption Analysis" may also be performed by the responsible air quality regulatory agency (or by EPA) in order to determine minor source increment consumption.

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 10 microns in effective diameter (PM-10), and sulfur dioxide (SO₂). Assumed background air pollutant concentrations, applicable Wyoming and National Ambient Air Quality Standards, and PSD 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-AQD1997) 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 CCPA. 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

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Table 3-2. Air Pollutant Background Concentrations, State and Federal Ambient Air Quality Standards, and PSD Increments (ug/m³)

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 8-hour	2,299 a 1,148 a	40,000 10,000	n/a n/a	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 Annual	20 c 12 c	150 50	8 4	30 17
Sulfur Dioxide (SO ₂) 3-hour (National) 24-hour (National) 24-hour (Wyoming) Annual (National) Annual (Wyoming)	29 e 18 e 18 e 5 e 5 e	1,300 365 260 80 60	25 5 n/a 2 n/a	512 91 n/a 20 n/a
<p>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: <u>Wyoming Air Quality Standards and Regulations, Chapter 2– Ambient Standards</u> National Ambient Standards from: 40 CFR Part 50 PSD Increments from: <u>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.</u></p>				

Background Air Quality Data Sources:

- a Data collected at Rifle and Mack, Colorado, in conjunction with proposed oil shale development during early 1980's (CDPHE-APCD 1996).
- b To supplement monitored NO₂ data, separate NO₂ modeling analysis was performed, including many oxides of nitrogen (NO_x) emission sources (USDI-BLM 1996).
- c Data collected UCG Project, 9 miles west of Rawlins, Wyoming, June 1994 – November 1994 (WDEQ-AQD 1997).
- d Data collected at Chevron Chemical Company Phosphate Project, 4.5 miles southeast of Rock Springs, Wyoming, 1984 (Cote' 1984).
- e Data collected at Craig Power Plant site and at Colorado oil shale areas (CDPHE-APCD 1996).

important that each pollutant's background concentration, model predictions, and air quality standards are all based on the same averaging times.

Continuous visibility-related optical background data were collected at the PSD Class I Bridger Wilderness Area in Wyoming and the PSD Class I Rocky Mountain National Park (just south of the PSD Class I Rawah Wilderness Area) in Colorado, as part of the Interagency Monitoring of

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PROtected Visual Environments (IMPROVE) 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 CCPA air pollutant emission sources before they become operational. Unlike the conceptual "reasonable, but conservative" engineering designs used in this NEPA analysis, the WDEQ-AQD air quality preconstruction permitting would be based on very site-specific, detailed engineering values, available as part of the permit application.

3.3 SOILS

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 proposed project area. Natural Resource Conservation Service (NRCS) mapping 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.

The soil survey for the CCPA was initially divided into two tasks: (1) verify existing Order 3 mapping units where existing mapping was available, and (2) gather soil samples on proposed surface disposal areas for laboratory analyses. The primary purpose was to verify existing soil series and to determine the reclamation potential of each series, as mapped. However, based on the decision to not utilize surface disposal of produced water, Task 2 was deleted.

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 CCPA were Absher-Forelle complex and Rallod-Abston-Pinellie complex. Absher-Forelle complex is on nearly level and gently sloping footslopes and alluvial fans. Slopes are smooth. Rallad-Abston-Pinelliis is 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. In other words, 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 degrees Fahrenheit.

Plant growth begins about April 15 and continues to about July 15. 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 plants with 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

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squirreltail, Indian ricegrass, and Gardner saltbrush. The vegetation of this area is a mixture of 55% grasses and grass-like plants, 5% forbs, and 40% woody plants.

The Absher-Forelle complex map unit is 50% Absher silty clay and 30% Forelle loam. The Ralod-Abston-Pinelli complex map unit is 40% Ralod clay, 25% Abston clay and 20% 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 torrfluents.

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 CCPA is presented in Table 3-3.

Table 3-3. BLM Map Units Found in and Adjacent to the CCPA

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	Ralod-Abston-Pinelli complex, 2-25%
333S	Laclede alkali-Laclede complex, 0-3%
449	Dines-Dines overflow complex, 0-2%

3.4 WATER RESOURCES

Water resources in the project area include both surface water and groundwater. Surface waters include the Little Snake River (perennial), Muddy Creek (intermittent-ephemeral downstream of the project area and perennial upstream), Dry Cow Creek (ephemeral) and several unnamed ephemeral channels and man-made ponds. Groundwater resources include free water contained within relatively shallow aquifers that are or could be utilized for culinary, agricultural, and/or industrial purposes. The occurrence and distribution of water resources in the project area are dependent on climate, soils, and structural geology.

3.4.1 Surface Water

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3.4.1.1 Quantity

The project area is located within the Little Snake River drainage basin. An unnamed tributary to Dry Cow Creek, an ephemeral tributary to Muddy Creek, is 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. Dry Cow Creek has for some time received water from a non-hydrocarbon producing oil well (1X-12), which produced 180,600 gallons of water per day from a casing leak. This water was the source of supply for the Little Snake River Conservation District (LSRCD) Reservoir located in the NW 1/4 of Section 13, T16N:R92W and was constructed by the LSRCD, BLM and Game & Fish in 1997 to supply water for use by stock and wildlife by containing the water discharged from the Double Eagle 1X-12 well. The channel immediately below the dam at this reservoir is moist and can contain small pools of water. This is not a flowing condition and is attributed to seepage from the dam outlet structure.

The Little Snake River drains the largest basin in the Yampa River basin (Driver et al. 1984). It joins the Yampa River in northwest Colorado. The Yampa River flows southwest to its confluence with the Green River in Utah. The Green River drains to the Colorado River, which drains to the Pacific Ocean.

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).

The channel reach above the LSRCD reservoir is well-vegetated and stable, having received discharge water from the 1X-12 well for several years. The natural character of this reach is ephemeral; in no way should it be characterized as perennial. The channel reach immediately below the LSRCD reservoir is moist and can contain small pools of water. This condition is attributed to seepage from the dam outlet structure. It is not a flowing condition.

3.4.1.2 Quality

There are six 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 and Dry Cow Creek. Average sample data from each of the stations are shown on Table 3-4. The data suggest that surface waters in the project area are of moderately high pH (8.1 to 9.2) and moderately dissolved oxygen (9 to 11 mg/l). Constituents not shown had no analyses available.

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 3-5 averages select parameters from Table 3-4 into ephemeral, intermittent, and perennial classes.

Water quality in ephemeral streams is represented by the Cow Creek and Dry Cow Creek monitoring stations. The ephemeral quality is characterized by high TDS (1,620 mg/l) and sodium and bicarbonate dominance as the major dissolved ions. Sodium dominance is reflected in the

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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 3-5. 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.

Table 3-4. Surface Water Quality in the Project Area

	USGS Surface Water Quality Station ¹					
	Cow Creek	Dry Cow Creek	Muddy Creek	Muddy Creek	Little Snake River	Little Snake River
Station Number	09115080	09258200	09258900	09259000	09257000	09259050
Sample Period	1978-1979	1975-1980	1976-1978	1957-1991	1957-1988	1980-1997
Number of Samples²	20	9	3	41	107	100
pH, standard units	9.2	8.6	8.6	8.2	8.1	8.1
Conductance, mmhos/cm	2925	2162	1350	966	259	366
Total Dissolved Solids³	1801	1438 ⁴	913	630 ⁴	158	243
Suspended Solids	133	1111	6198	3191	154	228
Turbidity	284 NTU	1013 JTU	1260 NTU	NM ⁵	13 JTU	167 NTU
Hardness as CaCO₃	174	37	315	270	111	151
Oxygen	9	11	11	10	9	10
Sodium	560	98	200	286	11	26
Calcium	19	9	54	42	30	34
Magnesium	31	4	44	40	8	12
Potassium	11	4	7	9	2	2
Bicarbonate	870	170	373	308	159	190
Carbonate	186	4	0.5	NM	0	1
Sulfate	181	65	380	320	25	54
Chloride	132	21	65	32	3	2
Fecal coliform, #/100 ml	535	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

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

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classes have been identified as follows (WDEQ 2001):

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.

Table 3-5. Surface Water Quality Comparison

	Stream Class		
	Ephemeral	Intermittent	Perennial
Representative Surface Waters	Cow Creek and Dry Cow Creek	Muddy Creek	Little Snake River
Total Dissolved Solids¹	1,620	772	201
Sodium	329	243	19
Calcium	18	42	10
Magnesium	14	48	32
Potassium	8	8	2
Bicarbonate	520	341	175
Carbonate	95	0.5	0.5
Sulfate	123	350	40
Chloride	77	49	3
SAR	14.1	6.1	0.7

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

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.

Dry Cow Creek has been classified as a Class 4 stream. Cow Creek is classified as a Class 3 stream. The Little Snake River and Muddy Creek are designated Class 2. The portion of the Little Snake River below Baggs has been further classified as a secondary body contact recreation water. This classification adds fecal coliform restrictions normally reserved for Class 1 water

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bodies.

3.4.1.3 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 which are not considered to be waters of the U.S. by the COE. Any activity that involves discharge of dredge or fill material into or excavation of such areas 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 SEO of Wyoming. Special aquatic sites and wetlands are discussed in greater detail in the Vegetation Section 3.5.

3.4.2 Groundwater

The project area occurs in the Colorado Plateau and Wyoming Basin groundwater regions described by Heath (1984); the Upper Colorado River Basin groundwater region described by Freethey (1987); or 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 oil and gas well records from the WOGCC, water-well records from the Wyoming SEO, and from the USGS (Weigel 1987). Regional aquifer systems pertinent to the project area are discussed by Heath (1984), Freethey (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).

3.4.2.1 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). Site-specific hydrologic parameters would be generated once the project wells are drilled, completed and tested. Table 3-6 summarizes the water-bearing characteristics of the geologic formations present in the project vicinity. Hydraulic conductivity is shown in the table as permeability. 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. Following is a brief description of the major aquifers of the project area.

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Table 3-6. 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
Mesozoic	Upper Cretaceous	Fort Union Fm.	0-2,700+	3-300	<2,500	<1
		Lance Fm.	0-4,500+	<25	<20	0.007-8.2
		Fox Hill Sandstone	0-400	NM	10-20	0.9
	Lower Cretaceous	Lewis Shale	0-2,700+	2-25 ²	0.03-50	0.002-0.9
		Almond Fm. ³ (Mesaverde Group)	0-600	NM	2,000-8,000	100-800
		Mesaverde Group (excl. 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.	190-1,1900+	1-100+	<100-6,500	NM
		Mowry Shale	150-525	Regional aquitard. Hydrologic data unavailable.		
		Thermopolis Shale (incl. Muddy Sandstone)	20-235	Considered a leaking confining unit. Hydrologic data unavailable.		
	Upper Jurassic	Cloverly Fm.	45-240	25-120	340-1,700	1-177
		Morrison Fm.	170-450+	Confining unit between Cloverly and Sundance-Nugget aquifers. Hydrologic data unavailable.		
	Lower Jurassic-Upper Triassic	Sundance Fm.	130-450+	27-35	12-3,500	NM
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+	Probable poor water-bearing capabilities due to predominance of fine-grained sediments.		
	Mississippian	Madison Limestone	5-325+	<400	Variable	NM
Paleozoic	Cambrian	Indef. rocks	0-800+	4-250	NM	NM
Precambrian	N/A	Igneous and metamorphic rocks	Unknown	10-20	1<1,000	Generally high in upper 200 ft of unit

¹ Adapted from Table V-1 in Collentine 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

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,

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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).

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 is exposed along the eastern slopes of the project area, although a mantle of Tertiary deposits unconformably overlies large areas of the 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. The Almond Formation coal seams, which are the targeted reservoir for the CCPA, are classified as confined to semi-confined aquifers because they are bound by impervious to semi-pervious layers of shale and siltstone. CBM test wells completed in the Almond Formation coal seams located within the project area exhibit shut-in hydrostatic pressures indicative of flowing artesian conditions. Based on existing hydrogeologic information, groundwater in the Almond Formation coal seams at the completions depths in the existing CBM wells is hydraulically isolated from shallow groundwater and surface water resources. This supports the potential for groundwater discharge in the form of springs along the eastern margin of the Washakie Basin. In fact, the Mesaverde Group is a source of many springs along the Atlantic Rim and flowing wells can probably be obtained by completing wells in the Mesaverde.

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 final 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).

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An SEO records review revealed 63 permitted wells in the vicinity of the project area. They are apportioned as follows: 2 domestic, 4 domestic/stock, 20 stock, 1 stock/irrigation, 2 stock/miscellaneous, 1 municipality, 32 miscellaneous/monitoring, and 1 miscellaneous use. Of the 63 permitted wells, 30 reported positive yields. Geologic units and yields of the 30 wells are listed in Table 3-7. The majority of these wells were developed in the Upper Cretaceous age Lance Formation, Lewis Shale and Mesaverde Group, and the Quaternary age Alluvium.

3.4.2.2 Quality

Groundwater quality is related to the depth of the aquifers, flow between aquifers, and the rock type. Groundwater quality is variable in the CCPA. 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).

Table 3-7. Existing Groundwater Wells in Project Vicinity

Formation	Number of Wells	Yield ¹ (gpm)
Alluvium	5	1.5-20
Browns Park Formation	2	8-25
North Park Formation	2	2-25
Wasatch Formation	2	5-10
Fort Union Formation	2	11.5-20
Lance Formation	4	2-7.5
Lewis Shale	7	1-25
Mesaverde Group	5	2-20
Unknown	1	2

¹ obtained from SEO well completion permits

Because most existing groundwater wells and the proposed CBM wells of the CCPA occur in Mesaverde aquifers, a detailed Mesaverde groundwater quality analysis has been included. Table 3-8 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.

Table 3-8. Major Ion Composition of Mesaverde Groundwater

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

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Table 3-9 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.

There is no published data available for the Lewis sands in the project area.

Regional ground-water flow is generally westward into the basin within each aquifer, from recharge areas of aquifer outcrops at higher elevations to the east. If local geologic structures bring these aquifers into outcropping positions downgradient from the respective recharge areas, springs can occur. 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. It should be noted that ground-water flow occurs at very slow rates, typically a few feet per year. 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. However, injection wells must pass periodic mechanical integrity tests to assure that cross-flow out of the injection zone in the wellbore does not occur.

3.5 VEGETATION/WETLANDS/NOXIOUS WEEDS

3.5.1 Introduction

The CCPA is located in the sagebrush steppe plant community that is typical of the high intermountain desert of south central Wyoming. Vegetation in the CCPA is typical of the semi-arid Wyoming Basin floristic region, where precipitation and soil parent material are controlling factors for plant composition. Vegetation often appears sparse. The primary vegetation cover types in the CCPA, as identified by the Wyoming Gap Analysis Program (GAP, Merrill et al. 1996), are Wyoming big sagebrush, desert shrub, and greasewood. The Wyoming big sagebrush (*Artemisia* spp.) cover type typically consists of more than 25% shrub cover with interspersed mixed grasses. The desert shrub vegetation cover type is often dominated by saltbush (*Atriplex* spp.) but may also contain a large component of greasewood or Wyoming big sagebrush communities. The greasewood (*Sarcobatus remiculatus*) type occurs along the alluvial fans and riparian flats of a tributary drainage of Dry Cow Creek.

3.5.2 Waters of the U.S. Including Special Aquatic Sites and Wetlands

Waters of the U.S. consist of bodies of open water such as lakes and streams as well as special aquatic sites, including jurisdictional wetlands. These are unique and important cover types due to their ecological value and protection under the federal Clean Water Act (CWA). Jurisdictional wetlands and other aquatic habitats merit special concern due to their relative rarity in the region, their functional role in and as components of hydrologic systems, their unique and important wildlife

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Table 3-9. 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 groundwater 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

habitat and forage value, their heritage value, and their protection and regulation under the CWA. Under the CWA, wetlands are defined as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil

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conditions.”

To qualify as a jurisdictional wetland, the area of interest must meet all three of the criteria used to positively determine the existence of a wetland. These include: (1) dominance of hydrophytic plants; (2) presence of hydric soils; and (3) wetland hydrology (i.e., presence of surface or subsurface water) suitable to sustain criteria 1 and 2. Hydrophytic plants are those species which either require or tolerate wet or saturated soils and are therefore indicative of these conditions. A hydric soil is a soil that is saturated, flooded, or ponded with water for a time sufficient to develop anaerobic soil conditions during the growing season (i.e., reduced soil oxygen levels). These soils develop certain characteristics that are indicative of the wet and anaerobic conditions. These conditions may include an undecomposed organic surface layer (histic epipedon), surface horizons with low chromas (i.e., very dark brown to black), organic staining and streaking, grey-colored layers or horizons, iron concretions, and/or light grey- or rust-colored mottles or specks of highly contrasting color, all of which generally occur within 18 inches of the soil's surface. Wetland hydrology is characterized as permanent or periodic inundation or soil saturation for a significant time during the growing season. Wetland hydrology may be supplied by surface water (i.e., streams), groundwater, and/or direct precipitation.

Wet meadows and marshlands of the Great Basin are generally characterized by a very dense (nearly 100 percent) to sparse (10 to 80 percent) vegetative growth. The soils are generally saturated or inundated for a portion of the growing season. Species such as sedges, muskgrasses, saltgrass, spike rushes, water-weeds (*Elodea* spp.), mannagrasses, rushes, stoneworts, pond weeds (*Potamogeton* spp.), three-square, cattail dominate the dense groundcover. Various species of willow as well as cottonwood may also be distributed across this type (Brown 1994).

Within the project area, only one site, the LSRCD reservoir and its inflow and outflow channels have the potential to support marsh/wetland vegetation. The source of the reservoir water is a non-hydrocarbon producing oil well (1X-12 well) that is located approximately ½ mile upstream from the reservoir. This well has yielded flow for many years and the water flow into the inflow channel now supports a well established riparian vegetative community downstream. The remainder of the drainage channels occurring within the project area are ephemeral and only carry water during spring runoff and summer storm events. None of the other channels within the study area exhibit wetland characteristics.

The wetted characteristics of the LSRCD reservoir area are artificial and entirely supported by CBM produced waters. Additionally, the relatively short time span since the reservoir's impoundment in 1997 has limited the extent to which wetland soils and vegetation have developed at this site. Emergent vegetation has not become established in the reservoir. Hydric soils are beginning to develop, although the soil evolution is still incomplete. The impoundment of this CBM produced water has generally dried the channel downstream from the reservoir. Limited seepage from the outflow structure on the dam keeps the channel wetted immediately downstream, with a few isolated pockets of standing water.

3.5.3 Threatened and Endangered Species

One federally endangered plant species, blowout penstemon (*Penstemon haydenii*), has the potential to occur on or near the CCPA according to the USFWS (2000) and the Wyoming Natural Diversity Database (WYNDD 2000). No other threatened or endangered plant species are

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expected to occur on the CCPA.

Blowout Penstemon. Blowout penstemon is a member of the snapdragon family. The species is most commonly found in the bowls and along the rims of sandy blowouts (Fertig 2000). In Wyoming, the species has been documented on very steep, unstable sand dunes (Fertig 2001). Within these limited habitats, blowout penstemon typically occurs in large, multi-stemmed clumps. When in bloom, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts. In addition to features of its leaves and flowers, blowout penstemon's lavender or vanilla-like fragrance is a characteristic that distinguishes it from other *Penstemon* species. Blowout penstemon typically blooms between late May and late June. This short flowering period is the best time of year to survey for the species.

A large area of sand dunes and blowouts exists in and around the Sandhills Area approximately 5 miles northeast of the CCPA. This area may provide potential habitat for blowout penstemon, however, the species was not found during field surveys of this area conducted by the Wyoming Natural Diversity Database in June, 2000 (Fertig 2001). Very small and limited areas of sandy blowouts may occur in the vicinity of the CCPA, however, the closest known population of blowout penstemon is located just south of the Ferris Mountains (Fertig 2000) and blowout penstemon was not found in the Sandhills Area, therefore blowout penstemon is unlikely to occur on the CCPA.

3.5.4 Species of Concern

Species of concern includes candidates for federal listing under the ESA, BLM special status species, FS sensitive species, WGFD special concern species, and species that are designated rare by The Nature Conservancy and WYNDD. Species which 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. Eleven plant species of concern may potentially occur within or near the CCPA (WYNDD 2000). Of these, Gibbens penstemon and Crandall's rock-cress have the highest conservation priority (WYNDD 2000). Appendix D 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 on the CCPA, and descriptions of habitat types in which these special concern plants are found. Five of the species are unlikely to occur on or near the CCPA because their respective required habitat types do not occur there. The remaining six special concern plant species have low to moderate potential to occur in or near the CCPA.

3.5.5 Invasive/Noxious Weeds

The area which includes the CCPA is vulnerable to infestations of invasive/noxious weeds such as Canada thistle, musk thistle and black henbane. Infestations of invasive/noxious weeds are relatively minimal within the CCPA at present. However, any newly disturbed surface within the CCPA 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.

3.6 RANGE RESOURCES AND OTHER LAND USES

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3.6.1 Range Resources

The CCPA lies within and occupies a portion of the Doty Mountain Grazing Allotment (#0415) which includes approximately 83,368 acres, 71 percent of which is public land. The Doty Mountain Allotment supports 6,974 AUM's (all cattle) and the average stocking rate is about twelve acres per AUM. The season of use extends from April 1 to December 1. The project area lies within the winter pasture of the allotment where livestock use is rotated within a nine pasture system. The winter pasture is used with a low stocking rate of livestock during May, with the principle use period occurring in September through November with a moderate stocking rate of livestock (USDI-BLM 1972, Warren 2000).

3.6.2 Other Land Uses

The CCPA contains approximately 2,050 federally owned acres. There are no State of Wyoming or privately owned acres within the CCPA. Federal lands within the project area are administered by the BLM Rawlins Field Office in accordance with the Great Divide RMP.

Other land uses within and adjacent to the CCPA 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). No developed recreation facilities exist within or adjacent to the project area. For more information on recreational resources in the project area see Section 3.8.

Right-of-way (ROW) and lease data for the sections were obtained from BLM records. There are five road ROW's and one pipeline ROW currently on record for the CCPA.

3.7 WILDLIFE/FISHERIES

3.7.1 General Wildlife

The CCPA includes approximately 2,050 acres of sagebrush steppe and desert shrub 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 CCPA, 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 area of the Cow Creek Pod 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 ARPA EIS.

Information regarding the occurrence of species being considered for threatened or endangered status, big game species, raptors, and greater sage grouse near the CCPA was obtained from several sources. Greater 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 (WOS) and BLM's raptor nest overlays. WGFD big game herd unit annual reports were used for herd unit population statistics. This existing wildlife information for the CCPA was supplemented through survey data

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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 on the pod area; (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.

3.7.2 Big Game

Three big game species: pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*) occur on or may utilize the CCPA during the course of a year. However, due to low shrub diversity, lack of hiding cover, and proximity to county and BLM improved roads, the CCPA is most often frequented by pronghorn antelope. The types of big game seasonal ranges designated by WGFD which are discussed are winter, winter/yearlong, and crucial winter/yearlong. Winter ranges are used by substantial numbers of animals only during the winter months (December through April). Winter/yearlong ranges are occupied throughout the year but during winter they are used by additional animals that migrate from other seasonal ranges. Crucial big game range (e.g. crucial winter/yearlong 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 8 out of 10 winters.

Pronghorn Antelope. The CCPA is located within the 1,394-square-mile Baggs Herd Unit. The CCPA contains pronghorn winter/yearlong range (1,899 acres) and crucial winter yearlong (151 acres; Figure 4-1). The project area lies within the transition area between crucial winter range and terrain to the east which is often unusable in winter. 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. No major pronghorn migration routes pass through the CCPA (WGFD 2000a). 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. The population objective was increased 25 percent in 1994, from 7,200 to 9,000. Therefore, the current population estimate of 7,000 is 22 percent below the WGFD management objective. According to WGFD (2000a), 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. The CCPA is located within Hunt Area 53, where the hunter success rate for 1999 was 95.4%.

Mule Deer. The CCPA is located 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 CCPA contains winter/yearlong mule deer range (1,596 acres) and crucial winter/yearlong range (454 acres). No major mule deer migration routes pass through the CCPA (WGFD 1999a). The 1999 post-hunt population estimate for the Baggs Herd Unit was 18,300. This estimate is slightly below the WGFD management objective of 18,700. The CCPA is located within Hunt Area 82, where the hunter success rate for 1999 was 56%.

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Elk. The CCPA 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 CCPA (WGFD 2000a). The habitat in the CCPA is designated as elk winter range (2,050 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 CCPA is located within Hunt Area 21, where the hunter success rate for 1999 was 37.7%.

3.7.3 Upland Game Birds

Greater Sage Grouse. The CCPA is located within the extensive sagebrush/grassland habitat of southcentral Wyoming where greater sage grouse are common inhabitants. Strutting grounds (leks), nesting, brood-rearing, and wintering habitats are all important habitat components required by greater sage grouse. Sometimes these habitats are contiguous and other times occur in a patchy, disconnected pattern (Call and Maser 1985). A high proportion of nesting habitat is usually located within two miles of leks (Call 1974, Braun et al. 1977, Hayden-Wing et al. 1986, Lyon 2000). The greater sage grouse is not formally listed as a threatened, endangered, or sensitive species, however the greater sage grouse receives special consideration because of population declines over much of its range and its importance as an upland game bird in the state of Wyoming.

The CCPA is located within the Sierra Madre upland game management unit area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 1999, 857 greater sage grouse were harvested in Area 25 providing 631 hunter recreation days (WGFD 2000b). The Sierra Madre Upland Game Management Area accounted for approximately 4.0 percent (857 birds out of 21,556) of the state-wide harvest of greater sage grouse in 1998.

Approximately 88% of the CCPA (1,809 AC) is classified as Wyoming big sagebrush habitat, and the remainder is classified as desert shrub (180 acres; 9% of CCPA) and greasewood fans and flats (61 acres; 3% of CCPA). Aerial surveys were conducted by HWA biologists during February 2001 to identify greater sage grouse concentration areas during winter. Winter 2000-2001 was worse than most years and snow cover was extensive and deep. This forced greater sage grouse to seek out habitat with sagebrush tall enough to remain above the snow. Those areas of habitat where greater sage grouse were found during the winter aerial survey were classified as crucial or severe winter relief habitat. Although several areas outside, but within the vicinity of the CCPA, were identified as severe winter relief habitats during the 2000-2001 winter survey, there could be additional areas that qualify but went undetected because they did not have grouse on them during the day the survey was conducted. Additional surveys during severe winters would need to be conducted in order to locate previously undetected severe winter relief habitats. No patches of greater sage grouse crucial winter habitat were located within the CCPA, however 2 patches were located within 1 mile of the pod boundary (Figure 4-1). Aerial surveys were also conducted by HWA biologists in late March and early April, 2001 to check the status of known greater sage grouse leks and document new leks. Linear transects were flown at 1/4 mile spacing intervals at an average altitude of 300 feet using a fixed-wing aircraft. Lek locations were recorded with a handheld GPS receiver. Two active greater sage grouse leks were located within 2 miles of the pod (Figure 4-1). The 2-mile buffer around the 2 leks includes 919 acres (45%) of the CCPA.

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Five of the eight proposed wells and/or related facilities are located within the 2-mile buffer areas of the active leks, and it is likely that greater sage grouse nest on the CCPA, given the presence and proximity of the leks to the pod.

3.7.4 Raptors

Raptor species that may occur on the CCPA include golden eagle, bald 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 of raptor nests on and around the CCPA were conducted by HWA biologists during late May 2001. The helicopter survey protocol consisted of flying low-level, ½ mile interval transects within a one mile buffer zone of each pod. Areas of potential raptor nest habitat (cliffs, rock outcrops, etc.) were surveyed more intensively. Nest locations were recorded with a GPS unit. One active ferruginous hawk nest was located approximately ¾ mile southwest of the CCPA (Figure 4-1). Thirteen inactive ferruginous hawk nests and one unknown raptor nest were located on or within 1 mile of the CCPA (Figure 4-1).

3.7.5 Threatened and Endangered Species

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies. The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). In Wyoming, white-tailed prairie dog (*Cynomys leucurus*) colonies provide habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising their young (Fagerstone 1987).

Prairie dog colonies on the CCPA were mapped on the ground during the summers of 2000 and 2001 by HWA. The edges of the prairie dog towns were mapped using a handheld GPS receiver and an ATV. If prairie dog burrows are located within 200 meters of each other they are considered to be in the same town. One prairie dog town (town # 1) occurs within the pod boundary (Figure 4-1). Burrow density in this town is greater than 8 burrows/acre and qualifies the town as suitable black-footed ferret habitat. Given the current location of the proposed development, (roads, wells and pipelines) ferret surveys would not need to be conducted in this prairie dog town since all development would occur outside the town.

Mountain Plover. The mountain plover nests over much of Wyoming, but preferred habitat is limited throughout its range (Oakleaf et al. 1982, Dinsmore 1983, Leachman and Osmundson 1990). This ground-nesting species is typically found in areas of short (less than four inches) vegetation on slopes of less than five percent. Any short grass, very short shrub, or cushion plant community could be considered plover nesting habitat (Parrish et al. 1993), however, mountain plovers prefer shortgrass prairie with open, level or slightly rolling areas dominated by blue grama and buffalograss (Graul 1975, Dinsmore 1981, Dinsmore 1983, Kantrud and Kologiski 1982). Loss of wintering and breeding habitats and prey-base declines from pesticide use are thought to be factors contributing to the decline of mountain plovers on the North American Continent (Wiens and Dyer 1975, Knopf 1994).

Although prairie dog towns usually provide potential habitat for mountain plovers, the town that is

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located on the pod is covered with such dense and tall sagebrush that it is very unlikely to be used by plovers. This prairie dog town was surveyed for mountain plovers in May 2001 by HWA biologists and no birds were found (Figure 4-1).

Bald Eagle. Primary bald eagle wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available, and near ungulate winter ranges that provide carrion (Steenhof et al. 1980). Wintering bald eagles are also known to roost in forests with large, open conifers and snags protected from winds by ridges, often near concentrations of domestic sheep and big game (Anderson and Patterson 1988).

Incidental sightings of bald eagles have been recorded in the vicinity of the CCPA (WGFD 2000c). Most observations were documented between November and March, indicating that the area is commonly used by bald eagles during the winter months. No communal winter roosts are known to exist on or near the CCPA. Inspection of BLM and WGFD raptor nest records, and results of aerial and ground raptor nest surveys conducted by HWA reveal that no bald eagle nests occur within a 2-mile buffer of the CCPA. The closest known nest is located in Section 11, T12N:R93W (Cerovski 2000), approximately 24 miles southwest of the CCPA. This nest has been active each of the last five years.

Canada Lynx. Records of lynx in Wyoming indicate that most lynx or lynx sign between 1973 and 1986 were in lodgepole pine (18%) and spruce-fir (41%) communities (Reeve et al. 1986). According to Reeve et al. (1986), more than 50 percent of lynx records in Wyoming occurred in the northwestern region of the state. The nearest records of lynx to the CCPA were from the Medicine Bow River in 1856 (Reeve et al. 1986). Since then, no lynx sightings or sign have been documented in Carbon County.

Due to the facts that: (1) the CCPA does not include high elevation lodgepole pine/spruce-fir habitat types preferred by this species, (2) the CCPA does not support a population of snowshoe hares (preferred prey item), (3) there are no recorded lynx sightings near the CCPA (WGFD 2000c, WYNDD 2000), and (4) the closest potential habitat is more than ten miles away in the Sierra Madre Mountains, it is unlikely that lynx occur on or near the CCPA.

Threatened and Endangered Fishes and Other Aquatic Species. Four federally endangered fish species may occur as residents of the Little Snake River system downstream from the CCPA: Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) (FWS 2000a). The last sighting of any of these fish in the Little Snake River was of a single Colorado pikeminnow in 1990. Currently, these fish species are not likely to be found in the mainstem Little Snake River nor its tributaries within the specific project area, and critical habitat for these species has not been designated in Wyoming (Upper Colorado River Endangered Fish Recovery Program 1999), however, the potential for project-related impacts to these tributaries in the Colorado River system warrant their inclusion in this NEPA document. The lack of perennial waters within the CCPA and for several miles downstream probably precludes potential for the occurrence of the four species of endangered fish endemic to the Little Snake River watershed. Although highly unlikely, any of these fish species may potentially occur in Muddy Creek or farther downstream in the Little Snake River or Yampa River on a seasonal basis for spawning and/or rearing. Currently, it is not known whether suitable spawning, age-0, or juvenile habitat for any of these species may still be present in the waters downstream from the CCPA. To date however, critical habitat for these fish species has not been

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designated anywhere in Wyoming (Upper Colorado River Endangered Fish Recovery Program 1999).

Four species of fish from the Colorado River Basin have been listed as threatened or endangered. 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 their populations 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). One adult Colorado Pikeminnow was collected from the Little Snake River in Carbon County, Wyoming in 1990. Subsequent survey attempts by WGFD personnel failed to yield any other specimens of Colorado pikeminnow from this area of the Little Snake River (Baxter and Stone 1995). Neither the bonytail, nor humpback chub has ever been reported within waters of the project area or immediately downstream from this project area. Suitable habitat for razorback sucker is not believed to be available on the project area and the species is not known from the Little Snake River drainage. Although unlikely, both Muddy Creek and the Little Snake River may have the potential to support these species of fish at certain times.

Currently, there are no threatened or endangered amphibian species that are known to occur in this portion of Wyoming.

3.7.6 Species of Concern - Wildlife, Fish, and Other Aquatic Species

Wildlife Species of Concern. Species of concern includes candidates for federal listing under the ESA, BLM special status species, FS sensitive species, WGFD special concern species, and species that are designated rare by The Nature Conservancy and WYNDD. Species which 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. Nine wildlife species of concern may occur on or near the CCPA. The wildlife species include Wyoming pocket gopher (*Thomomys clusius*), swift fox (*Vulpes velox*), smooth green snake (*Liochlorophis vernalis*) northern goshawk (*Accipiter gentilis*), burrowing owl (*Athene cunicularia*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus*), snowy plover (*Charadrius alexandria*), white-faced ibis (*Plegadis chihi*), long-billed curlew (*Numenius americanus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*). These species and their sensitivity status/rank are listed in Appendix D.

One perennial water body occurs on the permit area (LSRCD reservoir) that may receive use by waterfowl. It results from waters recovered during hydrocarbon development in the area. This impoundment is located in the NW ¼ of Section 13, T16N:R92W, has 15.8 surface acres and was first impounded in 1997. The recent impoundment of the LSRCD reservoir has provided limited time for the establishment of an emergent vegetation complex in association with this reservoir. Due to the limited open water habitat and absence of perennial streams, waterfowl and shorebird use of the project area is minimal.

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 have been included as species of concern. In addition, other species considered sensitive to human development have been included in this list. An ephemeral and locally intermittent stream drains the CCPA and is an

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unnamed tributary to Dry Cow Creek. Dry Cow Creek drains into Cow Creek several miles downstream from the project area. Cow Creek is generally an intermittent stream with localized areas of perennial water. All of the drainages within the CCPA are Class 5 (WGFD 1991) ephemeral drainages. Although the majority of streams on the CCPA do not have the potential to support fish species of concern on a year-round basis, studies indicate that these species may ascend ephemeral tributary streams to spawn (USFWS 1985, Maddux and Kepner 1988, Weiss et al. 1998). Thus, the ephemeral drainages fed by runoff from the project area may provide habitat for fish on a seasonal basis. Fish species of concern are known to occur in waters downstream from the CCPA, and it is possible that Dry Cow Creek and/or its tributaries within the project area may be utilized seasonally for spawning and/or rearing habitats.

Four fish species of concern are known to occur downstream from the project area: roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) (WYNDD 2000). One game-fish, the Colorado River cutthroat trout generally occurs much farther downstream from the project area in the Little Snake River (Baxter and Stone 1995). This species has been petitioned for listing as threatened or endangered. The three non-game fish species can be found within Muddy Creek, approximately seven miles downstream from the project area.

One reservoir currently exist within the project area and is fed by waters recovered from hydrocarbon wells drilled at upstream locations. This reservoir was constructed by the LSRCD, BLM, and WGFD in 1997 to supply water for livestock and wildlife use by impounding water discharged from the Double Eagle 1X-12 well. Although this reservoir has been stocked for use as a recreational fisheries in the past, it is not currently known to support a sport fishery.

Other Aquatic Species of Concern. The wide variety of vegetation types and habitats occurring within the greater Atlantic Rim project area supports a diverse fauna including a relatively large number of non-listed amphibian species. Of the amphibian species that occur in Wyoming, six potentially occur within the CCPA. These species include five frogs and toads, and one salamander. Four of these species are species of concern (WYNDD 2001): the northern leopard frog (*Rana pipiens*), Great Basin spadefoot (*Scaphiopus intermontanus*), boreal toad (*Bufo boreas boreas*), and Columbia spotted frog (*Rana pretiosa*). Northern leopard frogs have been documented in all counties of Wyoming and this species has a high probability of occurring in any areas of the CCPA having perennial water (WGFD 2000 and 2001, WYNDD 2001). The Great Basin spadefoot is little known in Wyoming (Baxter and Stone 1992), although it has the potential to occur throughout the CCPA. One Great Basin spadefoot was reported in the WOS (WGFD 2000) several miles southwest of the project boundary and the Wyoming Species Atlas (WGFD 1999b) indicates the species' range encompasses the project area. Boreal toads are generally restricted to relatively moist conditions although their range is thought to encompass the Muddy Creek watershed located just west of the project area (Baxter and Stone 1992). The Wyoming Species Atlas (WGFD 1999b) and WYNDD (2001) indicate sightings within both Sweetwater and Carbon counties, although no sightings of this species are reported within six miles of the greater Atlantic Rim project area boundary in the WOS (WGFD 2000 and 2001). In Wyoming, Columbia spotted frogs have been documented in the northwest corner of the state (Baxter and Stone 1992), however none have been found within a six mile perimeter of the project area (WGFD 2000 and 2001, WYNDD 2001) and it is unlikely that suitable habitat for this species occurs on the project area. These species and their sensitivity status and rank are listed in Appendix D. The WGFDs' Strategic Plan (1978) identifies the need to maintain populations of amphibians and reptiles in their natural habitats throughout Wyoming, since the number of amphibian species found in Wyoming

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is quite limited due to geography and climate (Baxter and Stone 1992).

3.8 RECREATION

Recreation resources in the CCPA are typical of those found in the Red Desert Region of Wyoming. Recreation use of BLM and private lands within the CCPA are best characterized as dispersed; there are no developed recreation sites or facilities. Most recreation activities occur during the fall hunting seasons. The area attracts small game hunters in September and October during 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 and hunting for rabbits and predators later in the fall and winter. During other seasons, the area attracts small numbers of recreationists engaged in rock collecting, camping and hiking, wild horse and wildlife observation, outdoor photography and picnicking. The area also has 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.

3.9 VISUAL RESOURCES

The CCPA is typical of the more rugged sections of Wyoming Red Desert Region. The characteristic landscape is moderately undulating with occasional areas of steep topography (badland breaks and buttes) which stand out as contrasting forms across most of the rest of the area. Numerous small drainages dissect the landscape adding diversity. The combination of topography, buttes and badland breaks subdivide the area into a number of small viewsheds. Larger views that encompass several viewsheds are available from high points. The sky/land interface is a significant aspect of all distant views. The predominant vegetation, typical of cold desert steppe, is alkali and low sage brush, mixed desert scrub, 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 exist within the study 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 CCPA include improved and unimproved roads, power lines and some oil and gas production facilities. Motorists traveling Wyoming Highway 789 would not have visual access, or limited access, to the CCPA because of viewing distance (3 to 6 miles) and intervening elevated topography. However, facilities and activities located on ridge lines or buttes are visible over longer viewing distances. The area receives moderate use by recreationists including big and small game hunters, rock collectors, wild horse and wildlife watchers, backpackers and ATV operators. 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 resources.

The intent of the BLM VRM program is to preserve scenic values in concert with resource

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development. BLM personnel responsible for visual resource management have classified the CCPA as Class 3. The VRM describes the levels of change to the visual resource permitted in Class 3 landscapes as:

Class 3: *Contrasts to the basic elements caused by a management activity are evident but should remain subordinate to the existing landscape.*

Thus, for projects in Class 3 areas, project facilities, activities and site disturbance that contrast enough to attract viewer attention and are evident in the landscape are allowed, but they should be constructed in a manner that reflects the lines, forms, colors and textures of the characteristic landscape.

3.10 CULTURAL RESOURCES

3.10.1 Culture Chronology of the Project Area

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 Table 3-10.

Table 3-10. Prehistoric Chronology of the Wyoming Basin.

Period	Phase	Age (B.P.)
Paleoindian		12,000 - 8500
Early Archaic	Great Divide	8500 - 6500
	Opal	6500 - 4300
Late Archaic	Pine Spring	4300 - 2800
	Deadman Wash	2800-2000/1800
Late Prehistoric	Uinta	2000/1800 - 650
	Firehole	650 - 300/250
Protohistoric		300/250 - 150

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

Historic use of the 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. Previously recorded historic sites are represented by a ranching/stock herding site, three historic debris sites, one historic cairn, and the Rawlins-Baggs stage road.

3.10.2 Excavation Data

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No sites have been extensively tested or excavated in the CCPA. 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 analysis 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 ca. 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 (48CR4419) is located ca. 4 miles north of the CCPA block. The site is a Uinta phase housepit dating from 1098 to 1285 B.P. 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.

3.10.3 Summary

Block cultural surveys were conducted by John Albanese of Casper, Wyoming on eight(8) proposed wellsites, access roads and one reservoir site of the CCPA. These cultural surveys have been submitted to the BLM in Rawlins Wyoming. A total of eight(8) sites were located and inventoried on these surveys. Seven(7) of the sites were identified as historic stock herder camps, none considered significant. One prehistoric site, identified in an earlier survey, was noted but considered as non significant by Albanese.

3.11 SOCIOECONOMICS

The primary geographic area of analysis for potential socioeconomic effects of the Proposed and No Action alternatives 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.

3.11.1 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 the Proposed and No Action alternatives.

In 1998 Cabon County employment totaled 9,780 full and part-time jobs, which was about one

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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 Seminole # 2 mines (USDI-BLM 1999) 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 (1997) to a high of 6.1 (1993). The 1999 Carbon County unemployment rate was 5.3, 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.

3.11.1.1 Oil and Gas Activity

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 APD's, 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).

3.11.1.2 Economic Activities in the Vicinity of the Proposed Action

Other economic activities occurring on and near the CCPA 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. Currently 35 commercial hunting outfitters hold permits for the hunt areas where the CCPA is located, although the project area comprises only a small portion of these hunt areas (Clair 2000).

3.11.2 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

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population of 79.

3.11.3 Temporary Housing Resources

The nature of CBM drilling and field development activities (relatively short duration tasks performed primarily by contractors) results in demand for temporary housing resources such as motel rooms and mobile home and recreational vehicle (RV) spaces near the project area.

3.11.3.1 Baggs/Dixon 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 RV's 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 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.

3.11.3.2 Craig, Colorado

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).

3.11.3.3 Wamsutter

There are temporary housing resources available in the Town of Wamsutter (Carnes 2000). Including several mobile home parks and two motels, the Town is at the center of a 200 well per year BP drilling and field development program. Wamsutter town officials recently stated that there 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)

3.11.3.4 Rawlins

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).

3.11.4. Law Enforcement and Emergency Response

Law enforcement services in the southwestern portion of the county are provided by the Carbon County Sheriff's Department. Currently coverage is provided by one full-time and one part-time deputy. The deputies provide coverage for the Town of Dixon and the community of Savery; the

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Town of Baggs has one police officer (Colson 2000).

Medical services in Baggs are provided by the county-owned clinic, which is staffed by a physician's assistant (PA), supported by other medical and administrative personnel. Emergency response is provided by six volunteer emergency medical technicians (EMT) who staff two county-owned ambulances. Seriously injured patients are transported to Craig or Rawlins, depending on the location of the accident. Casper-based Flight-for-Life is also available if appropriate (Herold 2000).

3.11.5 Local Government and State Government Revenues

Local and state government fiscal conditions most likely to be affected by the proposed action and No Action alternatives 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 mineral royalty distributions. Some county, municipal and special district service expenditures may also be minimally affected.

3.11.5.1 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 5 percent of total valuation (WTA 2000).

3.11.5.2 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 is anticipated to expire in the summer of 2001 (WDAI 2000b).

3.11.5.3 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.

3.11.5.4 Federal Mineral Royalty Distributions

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. Fifty percent 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. In FY 2000, a total of \$309 million in federal mineral royalty funds were distributed to Wyoming entities (WDAI 2000d)

3.11.6 Attitudes and Opinions

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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 wild life 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.

Coal-bed methane development was not considered during the survey, therefore resident attitudes and opinions about unique aspects of CBM are not known (Hewitt 2000).

3.11.7 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 a CBM 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

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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.

3.12 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.

3.12.1 Access to the Project Site

Access to the project site is provide by a combination of Interstate, state highways, and county and BLM roads. Table 3-11 displays specific access routes to the CCPA. The Wyoming Department of Transportation (WYDOT) measures average daily traffic (ADT) on federal and state highways. ADT on highways providing access to the CCPA are shown in Table 3-11.

Table 3-11. Access Routes to the Cow Creek Pod 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 (Wild Cow 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 CCPA are also shown in Table 3-11.

Access to the CCPA is provided by the two-lane paved Wyoming State Highway 789 (SH 789) from

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Interstate 80 (I-80) at Creston Junction south towards Baggs, Wyoming, or north from Baggs, Wyoming. Access to the CCPA is by SH 789 north from Baggs for approximately 22 miles to the intersection with Carbon County Road 608 ("Dad Road"). The distance from SH 789 to the CCPA is approximately 3 miles. CCR 608 is a two-lane improved and unimproved native material road, and currently provides access to oil and gas fields in the area (Evans 2000).

3.13 HEALTH AND SAFETY

Existing health and safety concerns in and adjacent to the CCPA include occupational hazards associated with CBM exploration and operations; risk associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents during hunting season and by casual firearms use such as plinking and target shooting; and low probability events such as land slides, flash floods and range fires.

3.14 NOISE

Other than vehicle traffic on Wyoming State Highway 789; jet aircraft overflights at high altitudes; and localized vehicular traffic on county, BLM and two-track roads in the project area; only on-going drilling and production operations on lands adjacent to the project area create even modest sound disturbances within, and in the immediate vicinity of, the CCPA.

CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental assessment provides an analysis of the potential environmental consequences that would result from implementation of the Proposed Action (federal land development of eight well locations, access roads, associated facilities and reclamation) and No Action (denial of further federal land development beyond the existing LSRCD reservoir; two existing wells; four recently-approved CBM wells, access roads, and associated facilities which total 46.7 acres of disturbance) in the CCPA. Measures that would avoid or reduce impacts under the Proposed Action 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 Mitigation Summary for each resource discipline.

As discussed in Chapters 1 and 2 of this EA, the CCPA lies within the proposed Atlantic Rim CBM project area (Figure 1-2). Drilling and field development activities proposed for the CCPA EA Proposed Action could be allowed under terms and conditions described in the Interim Drilling Policy (see Appendix A).

This analysis of environmental consequences addresses only those direct and indirect impacts associated with exploration and development of the Cow Creek interim development pod.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Impacts The level and duration of impacts that would occur as a result of the Proposed Action or the No Action Alternative. The impact evaluation assumes that the applicant-committed practices described in Chapter 2 would be implemented

Mitigation - 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, Double Eagle would coordinate with private land owners to determine which measures would be applied, to what degree, and where. Also, because of the similarity between the Proposed Action and No Action, it is assumed that the mitigation described applies to both alternatives. The measures identified under this section would be considered for application to all BLM administered lands. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts - A summary of impacts that are unavoidable and cannot be reduced or eliminated through the application of available and 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 on-going 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 RFFA's).

CHAPTER 4: ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

This EA addresses cumulative impacts associated with exploration and development of 200 interim CBM wells and other activities, on-going or proposed, within the Atlantic Rim project area. Cumulative impacts associated with exploration and development of the Cow Creek pod are shown in Section 4.15 of this EA.

4.1 GEOLOGY/MINERALS/PALEONTOLOGY

4.1.1 Impacts

4.1.1.1 Proposed Action

Utilization of proper construction techniques described in Chapter 2 would minimize impacts resulting from the topographic alteration of developing eight CBM wells and associated facilities. As discussed in Chapter 3, no major landslides have been mapped within the project area. Following prescribed procedures construction activities would not likely activate landslides, mudslides, debris flow, or slumps. Seismic activity is low in the area, so the potential for damage of project facilities is minimal.

Inventory of geologic resources revealed no major mineral resources that would be impacted by implementation of the project other than CBM reserves. Drilling of CBM wells would better define the location and nature of CBM resources available within the CCPA. Recovery of CBM would result in the depletion of the natural gas resource.

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 impacts to 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 impacts to the subsurface geologic environment.

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 and 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 on-going production activity, may lead to fossils being damaged or destroyed by unauthorized collection or vandalism. The Lewis Shale of Cretaceous age, which underlies the area, has produced scientifically significant fossils elsewhere in Wyoming (and thus meets BLM Condition 2), but there are no reported occurrences in the project area. The potential for recovery of significant vertebrate fossils in the CCPA is considered to be low to moderate. Mitigation measures discussed in Chapter 2 are reasonable measures to protect potential paleontologic resources that may be inadvertently uncovered during excavation.

4.1.1.2 Alternative A - No Action

Under the No Action Alternative, denial of further federal land development would result in impacts similar to those under the Proposed Action, but slightly reduced.

CHAPTER 4: ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.2 AIR QUALITY

4.2.1 Impacts

4.2.1.1 Proposed Action

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 CCPA.

Under the Proposed Action, air emissions would occur from the construction and production of CBM wells within the CCPA. Construction emissions would include PM-10, SO₂, NO_x, CO, and VOC's, 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 HAP's (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 LOP.

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 CCPA 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 2000 and 1999) indicated potential near-field increases in CO, NO₂, PM-10, 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 8-well project described in this EA is well under 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 Proposed Action when compared to the magnitude of these projects, no ambient air quality standards would be violated and no adverse air quality conditions would result from the Proposed Action.

CHAPTER 4: ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.2.1.2 Alternative A - No Action

Air quality impacts from the previously approved CBM wells are similar but less than those described under the Proposed Action.

4.3 SOILS

4.3.1 Impacts

4.3.1.1 Proposed Action

Approximately 20.2 acres of soils resources would be temporarily disturbed during drilling and field development; after initial reclamation, approximately 8.16 acres would remain disturbed over the life-of-project (see Table 2-2).

Increased susceptibility to wind and water erosion would be a direct impact in newly disturbed areas and may cause sedimentation into 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 impacts to the soil resource would include reduction of overall fertility based on length of stockpiling of material and loss of nutrients; 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 from 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 impacts to 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.

CHAPTER 4: ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

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 CCPA are anticipated to be minimal.

4.3.1.2 Alternative A - No Action

Under this alternative, impacts to the soils environment would be similar to those described for the Proposed Action but of a smaller magnitude.

4.4 WATER RESOURCES

4.4.1 Impacts

4.4.1.1 Proposed Action

Surface Water Potential impacts that could occur to the surface water system due to the Proposed Action include increased surface water runoff, off-site sedimentation due to soil disturbance associated with construction activities, water quality impairment of surface waters due to increased sedimentation and lower quality CBM water, and stream channel morphology changes due to road and pipeline crossings and increased water flow. The magnitude of the impacts to 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, water management methods, soil character, duration of time within which construction activities occur, and the timely implementation and success/failure of mitigation measures. Adverse sedimentation is not expected to occur as a result of the implementation of the Proposed Action due to compliance with RMP management directives and Executive Order 11990. Both regulations require avoidance of stream channels to the maximum extent possible. Where total avoidance is not practical the BLM AO will be shown why a stream channel and/or floodplain can not be avoided and how the impacts would be minimized.

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.

With total surface containment, there would be no increase in overall surface flow and no increased erosion and sedimentation due to the discharge of CBM water. Due to the rip-rapped outfall and low slope and stability of the ephemeral channel receiving discharge to the LSRCD reservoir, increased erosion would be slight. The NPDES permit and Water Management Plan require periodic monitoring of the drainage for erosion. If erosion is occurring, prompt mitigation using appropriate BMP's (best management practices) is required. By allowing water contained in the reservoirs to infiltrate, a dynamic hydrologic system is created, minimizing the concentration of salts due to evaporation and recharging shallow aquifers in the project area. The point of compliance is positioned near the LSRCD reservoir to provide early detection of surface flow from the reservoir; it is not intended to detect infiltration. The seepage from the outlet structure of the LSRCD reservoir is a preexisting condition, localized at the dam. It will be carefully monitored for any increase. The POC for the NPDES permit is located down-channel from this reach. The POC must be monitored daily by Double Eagle for flow; if flow is observed, it must be reported and a

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sample taken. Water reaching the POC must meet the stringent standards of the discharge permit. If the water is out of compliance, the discharge of CBM water into the LSRCD reservoir must cease until there is no flow at the POC or the water meets the discharge standards.

A required 2.5 feet of free board in the reservoir alleviates concern of the reservoir's holding capacity for a 25-year storm event. A 25-year storm event is a statistic indicating a storm of that size has a probability of occurring once every 25 years. Given a project life of 10 to 15 years, a 25-year event may never occur while the project is in operation. Should it occur, a larger storm event (>25-year) could lead to temporary water discharge from the reservoir. If that occurs, the water would be significantly diluted. For example, two hours of peak flow from a 50-year event would generate 100 ac-ft of water. Given the reservoir capacity of 120 ac-ft, this is a dilution of 45%. In any case, any water discharged from the LSRCD reservoir must meet the standards set in the NPDES permit at the point of compliance. If the standards are not met, discharge of CBM water into the reservoir must cease until surface containment in the reservoir is reestablished. The NPDES permit also requires daily monitoring of the POC for surface discharge. It should also be noted that a discharge from the reservoir during an event greater than the 25-year storm would be temporary and short-lived, with the water rapidly being lost to infiltration into the stream sediments and to evapotranspiration. In a large storm event the impact of natural sheet flow over a large area, dissolving surface salts and moving sediment, would have a much larger impact than diluted water temporarily discharged from the LSRCD reservoir. The impacts from this type of event should be minimal because of the requirements of the NPDES permit.

Reservoir water loss to infiltration and evaporation is expected to be approximately 200 gpm for each reservoir, based on industry experience in the Powder River Basin (PRB). It is beneficial to have water infiltrate into the subsurface from reservoirs. It reduces the buildup of salts due to evaporation and the interaction of the water with the rock matrix filters, dilutes and allows geochemical reactions to modify the water to natural quality. If the projected water rates are correct, only one off-channel reservoir would be needed.

The proposed project would require relatively little water demand and would not adversely affect existing surface or groundwater sources or rights.

Ground Water The primary impact of the Proposed Action on ground water resources is best described as the loss of some hydraulic pressure head in the affected coal seam aquifer. The partial removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head, thus lowering the water levels in nearby wells completed in the same coal seam. The lowering of water levels in an aquifer is also referred to as drawdown.

The Lewis sands would be the receiving aquifer for the aquifer recharge well. The DEQ permit for the recharge well requires the analysis of a sample of Lewis sand water to confirm the water quality is the same or less than the CBM water. This is possible and must be done prior to any injection of CBM water into the Lewis sands. The requirement for a downhole submersible pump would be waived by DEQ. The hydrostatic head would be increased at the recharge well location(s) due to the gravity injection of CBM water. This, in effect, creates a "mound" in the potentiometric surface (pressure) of the ground water that decreases with increasing radial distance from the injection well. The westerly geologic dip and flow gradient of the Lewis sands would transport the injected water westward, deeper into the Washakie sub-basin. Shale aquitards above and below the Lewis sands would confine the injected water to the Lewis sands aquifer. The recharge area for the Lewis sands are their outcrops trending north-south along the east edge of the project area. The Lewis Formation does not outcrop again until the eastern edge of the Rock Springs Uplift, approximately 50 miles west of the project. The Lewis sands are over 300 ft thick at the location

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of the aquifer recharge well. If the sands are unsaturated, and the effective porosity is 15%, one square mile can contain 223,430,400 bbls of produced water. Fourteen wells, producing 8 gpm each for 10 years, will produce a total of 14,016,000 bbls of water. There would be more than adequate storage capacity. If the Lewis sands are saturated, calculations using a hydraulic conductivity of 10 gpd/sq ft (friable sand, Driscoll) and storativity of 0.0001 result in a gravity injection rate of 211 gpm (7,235 bpd) after one year. One recharge well should provide adequate injection capacity for the project. The project area would be monitored for the surface release of water injected into the Lewis sands. If such a release is directly related to the recharge well, injection would cease. Given the large volume of Lewis sands, the relatively short life of the project and the finite volume of produced water, it is unlikely that any surface discharge would occur into the Colorado River drainage.

Infiltration from the LSRCD Reservoir and the off-channel reservoir would provide recharge to shallow aquifers. This could provide a shallow, beneficial water supply within the project area. The CBM water quality is acceptable for livestock watering.

Based on the performance of the #1X-12 and #34-12 wells, the initial water production rate of each of the 8 CBM wells in the CCPA is expected to be approximately 29 gpm (1,000 bpd, 0.065 cfs). A 50% annual decline results in a per well water rate: 14.5 gpm after one year and 7.3 gpm after two years. Because of the expected initial rates, a combination of discharge into the existing LSRCD reservoir, discharge into a new, off-channel reservoir and injection into an aquifer recharge well would be needed to manage the produced CBM water. This approach would also allow a site-specific, operational evaluation of each method used.

SEO records indicate only one permitted well completed in the Mesaverde Group is within a one-mile radius of a project CBM well; this is a BLM well converted to stock watering (NWSE Section 12, T16N:R92W). SEO records show the well is completed in an interval above the coal zones being completed by Double Eagle; the well is also presently non-productive and shut in, therefore it would not be impacted by CBM production. It is known that water wells completed in coals in the Powder River Basin have historically produced some associated gas, prior to any CBM development. Observation of stock-water wells in the project area indicates the same to be true. There are no known springs or seeps within the project area.

Double Eagle has reviewed the **Ground Water Vulnerability Study** conducted by the State of Wyoming at the office of the LSRCD and has received their indications that the proposed alternative would not conflict with the results of that study.

Well drilling and completion should have little adverse impact on existing ground-water quality. The improbable degradation of ground-water quality within any aquifers in the project area essentially eliminates the possibility of adverse effects to the area's groundwater right holders. A description of the geology and hydrology of the CCPA is given in Chapter 3. The focus of this groundwater impact assessment is the coal seam aquifers within the Almond Formation, a member of the Upper Cretaceous Mesaverde Group. 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 Almond Formation 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 aquifer by dewatering activities may induce a slight leakage of water through

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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 dewatered coal seams would be minimal, and only after a significant period of time would drawdown effects in any overlying aquifer become apparent.

It is acknowledged that implementation of the Cow Creek Project would temporarily decrease water levels from present static conditions within the coal seam aquifer. Relative to the available drawdown within the aquifer, these impacts would not be significant. A complete drawdown analysis will be presented in the Atlantic Rim EIS. There will be a slight increase in the water levels in the Lewis sands during injection. The injection permit requires the injected water to be of a similar or better quality than the water in the Lewis sands. No significant impacts to ground-water quantities or qualities are expected from this project.

4.4.1.2 Alternative A - No Action

Impacts to water resources under this alternative would be similar to the Proposed Action but of a lesser magnitude.

4.5 VEGETATION/ WETLANDS/NOXIOUS WEEDS

4.5.1 Impacts

4.5.1.1 Proposed Action

The Proposed Action assumes construction of 8 CBM wells and associated roads, pipelines and water disposal facilities. Construction and installation of well sites, access roads, and ancillary facilities would directly reduce the extent of vegetation cover types.

During the production phase, all pipelines and portions of well pads would be reclaimed. A portion of each well pad (15 x 15 feet, approximately 0.005 acre) would remain disturbed for the life of the project. Disturbance associated with the compressor station, injection well, water disposal facilities, and pumping stations would remain for the life of the project. Total vegetation disturbance would be reduced from 20.2 acres to approximately 8.16 acres after reclamation.

The Wyoming big sagebrush, greasewood, and desert shrub cover types disturbed under the Proposed Action are commonly found across southwest Wyoming. The short- or long-term loss in acreage described above would have little impact to the overall abundance and quality of these habitats.

In general, the duration of impacts 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 re-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 ROW's and out-compete more desirable plant species. Increased weed invasion may render a

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site less productive as a source of forage for wildlife and livestock. However, application of mitigation measures summarized in Chapter 2, would minimize the introduction of weed species.

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

The distribution of plant species of concern is likely limited on the CCPA due to a lack of suitable habitat for most of the species. Due to the low likelihood of the sensitive plant species to occur on the CCPA and the small amount of disturbance associated with the Proposed Action, minimal impacts upon the plant species of concern are expected.

Special Aquatic Sites and Wetlands. Water discharged into the ephemeral drainage from the leaking well (1X-12) and other CBM wells will not exceed 180,600 gallons (0.28 cfs). The channel into which the additional produced water will be discharged is stable, and supports a well developed riparian vegetation community as a result of years of well water discharge into this channel. However, without the input of artificial flows, this would be an ephemeral channel, exhibiting no wetland characteristics.

The recently impounded LSRCD reservoir currently does not exhibit well developed wetland vegetation or soil characteristics. The source of flow for this impoundment is the flow from a leaking well (1X-12) and other CBM produced waters. Again, without this artificial water source, the reservoir would not remain filled.

Thus, wetlands within the project area occur and remain intact due to human development activities. Placement of rip-rap at the produced water discharge point, in addition to the well developed riparian vegetation along the inflow channel will prevent channel erosion and major downstream sediment inputs due to surface well water discharge. The reservoir is designed to totally contain the produced waters, and no downstream discharge of water downstream from the reservoir is proposed. Additionally, the LSRCD reservoir will act as a stilling basin to prevent downstream movement of sediments and other hydrocarbon pollutants. The continuation of stream flow and potential for wetland evolution along the channel upstream from the reservoir and at the LSRCD reservoir, may provide a beneficial impact from the CBM development. Furthermore, the absence of any natural wetlands within the project area will preclude adverse impacts associated with this habitat type due to implementation of this project.

4.5.1.2 Alternative A - No Action

Impacts to vegetation and wetlands would be similar to those described under the Proposed Action but of a lesser magnitude.

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4.6 RANGE RESOURCES AND OTHER LAND USES

4.6.1 Impacts

4.6.1.1 Range Resources

4.6.1.1.1 Proposed Action

Anticipated impacts to range resources associated with the Proposed Action are limited to a minimal loss of forage and associated AUM's, an increased potential for vehicle/livestock collisions and an increased potential for the spread of noxious and invasive weeds.

The CCPA lies within the Doty Mountain grazing allotment, described in Section 3.6. 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 CCPA during the drilling and field development phase would correspondingly increase the potential for vehicle/livestock accidents during that period.

The Proposed Action would result in an estimated 20.2 acres of short-term disturbance during drilling and field development, an estimated 8.16 acres of long-term disturbance would remain after the initial reclamation activities described in Chapter 2 are completed (see Table 2-2). The short-term drill pad and ancillary facility disturbance would be reclaimed as soon as possible, but no later than one year of completion of the operation, 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 other use.

The average stocking rate for the for the Doty Mountain allotment is 12 acres per AUM. Consequently, the Proposed Action would result in a short-term loss of forage associated with about two AUM's, and long-term loss of only one AUM. These losses would amount to a negligible loss of total AUM's in the allotment.

There is potential for conflict between Proposed Action-related activities and range operations. The increased activity associated with drilling and field development would result in increased opportunities for vehicle/livestock collisions, particularly during and just after calving season when calves are difficult to see and tend to congregate on roads (Warren 2000). Since most of the livestock use in this pasture occurs in the fall when calves are larger, impacts would be minimal. Given the low traffic volumes associated with field operations (one to two trips per day on average), vehicle/livestock collisions are of less concern for the long term.

Based on the assumptions and estimates contained in this assessment, the Proposed Action would result in minimal impacts to range resources.

4.6.1.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

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4.6.1.2 Other Land Use

4.6.1.2.1 Proposed Action

Potential impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

As described in section 3.6, other land use on and adjacent to the Proposed Action include wildlife habitat; oil and natural gas exploration, development, and transportation; and dispersed outdoor recreation (primarily hunting in the fall). Effects on wildlife resources are described in Section 4.7. Effects on recreation resources are described in Section 4.9. The preconstruction planning and site coordination process and measures described in Chapter 2 would reduce the potential for conflict with existing oil and gas pipelines, road ROW's and other oil and gas leases.

4.6.1.2.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.7 WILDLIFE/FISHERIES

4.7.1 Impacts

4.7.1.1 Proposed Action

The proposed development would disturb approximately 20.2 acres of general wildlife habitat as a result of the Proposed Action. Analysis of potential impacts of the proposed development upon wildlife assumes development of the wells, roads and pipelines in the approximate locations identified in Figure 4-1.

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 10-15 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 predisturbance 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 impacted 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.

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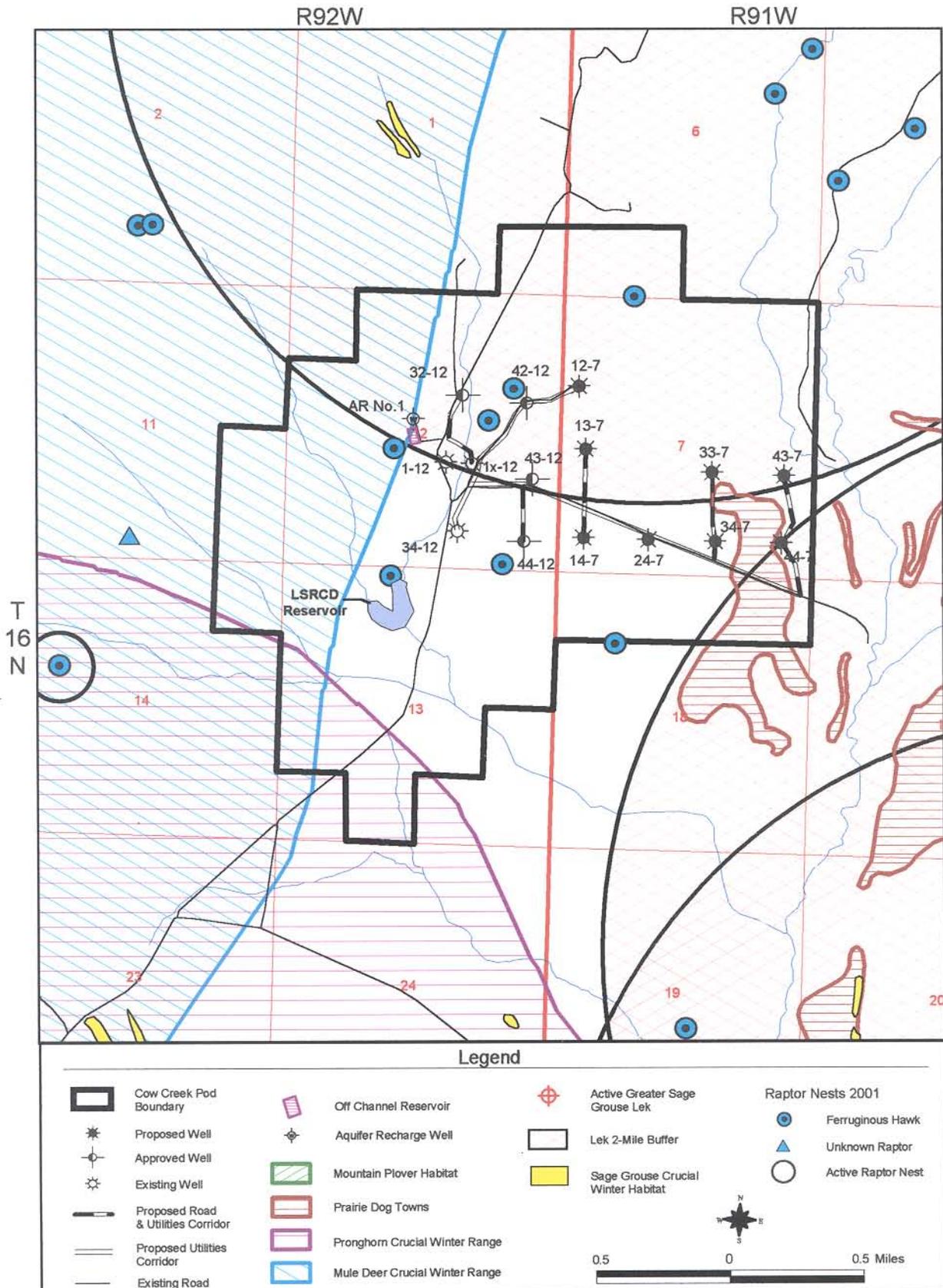


Figure 4-1. Wildlife Concerns in and around the Cow Creek Pod.

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4.7.1.1.1 General Wildlife

The direct disturbance of wildlife habitat in the CCPA under the proposed development would reduce habitat availability and effectiveness for a variety of common small mammals, birds and their predators. The initial phases of surface disturbance 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 is expected. Quantification of these losses is not possible; however, the impact is likely to be low over the short-term. 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 impacts to populations of small mammals and songbirds are expected.

4.7.1.1.2 Big Game

In general, impacts to big game wildlife species would include direct loss of habitat and forage, and increased disturbance from drilling, construction, and maintenance operations. Disturbance of big game species during the parturition period and while 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 new construction from November 15 - April 30; this closure of areas located in crucial big game winter ranges will reduce disturbance to wintering big game. This closure would also limit the potential for poaching and/or harassment of big game species wintering in the area. A small area of pronghorn crucial winter/yearlong range and mule deer crucial winter/yearlong range overlaps in the southwest portion of the CCPA (Figure 4-1). According to the Interim Drilling Policy, no development or disturbance will be allowed in areas of overlapping big game crucial winter ranges. As currently proposed, no disturbance is expected to occur in this area of overlapping crucial ranges. The potential for vehicle collisions with big game would likely increase as a result of increased vehicular traffic and speeds associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the operations.

Mule Deer. The CCPA supports mule deer year round. The pod contains winter/yearlong range (1,596 acres) and crucial winter/yearlong range (454 acres). Construction of the proposed development would not disturb any of the crucial winter/yearlong mule deer range. Approximately 20.2 acres of mule deer winter/yearlong range would be disturbed. Following reclamation, approximately 8.16 acres of mule deer winter/yearlong range (0.0008% of that range type in the Baggs Herd Unit) would remain disturbed for the remaining life of the project. No major mule deer migration routes pass through the CCPA (WGFD 1999a).

During winter, mule deer primarily utilize shrubs including sagebrush, mountain mahogany, and antelope bitterbrush (DeBolt 2000). Mountain mahogany is also an important mule deer forage during the spring, summer, and fall (DeBolt 2000). Specific placement of roads and wells to avoid destroying habitat patches containing these shrub species will lessen the impact upon the winter/yearlong range vegetation in the pod. Overall, impacts upon mule deer winter habitat should be limited, and no long-term significant impacts to mule deer in the area are expected because a very small percent of the winter/yearlong range in the herd unit would be disturbed.

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Disturbances from drilling activities and traffic could affect utilization of the habitat immediately adjacent to these areas and displace some animals. Mule deer, however, are known to be extremely tolerant of most human activities, except hunting, and quickly adjust to non-threatening, predictable human actions (Irby et al. 1988, Gusey 1986). During a three-year study of response of pronghorn and mule deer to petroleum development on crucial winter range in central Wyoming, Easterly et al. (1988) found that mule deer “did not avoid oil fields” and that “deer did not move significant distances from the well site after the start of drilling activity.” Similarly, in an assessment of the effects of winter 3D seismic operations on mule deer in western Wyoming, HWA (1994) found that although deer avoided areas of major seismic activities, they quickly moved back onto such areas following completion of work. Furthermore, the deer were not displaced long distances and remained immediately adjacent to active seismic operations. Although seismic activities were seen to displace mule deer, there was no evidence that such displacement caused undue stress or negative effects. Most deer responses consisted of avoidance of uncomfortable proximity to the operations and deer carried out normal activities of feeding and bedding within 1/8 to 1/2 mile of most active seismic operations (HWA 1994). Impacts upon the mule deer population utilizing the pod are expected to be minimal, provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

Elk. The CCPA supports elk during the winter months and all of the pod is classified as elk winter range. A total of 20.2 acres of elk winter range would be disturbed under the Proposed Action. Following reclamation, approximately 8.16 acres of elk winter range would remain disturbed (0.004% of that range type in the Sierra Madre Herd Unit) for the remaining life of the project. Major elk migration routes do not cross the pod (WGFD 2000a).

During winter, elk primarily consume grasses. Despite differences in diet, elk and mule deer will utilize the same areas (DeBolt 2000). Overall, impacts upon elk winter range habitat will be minimal because only 0.004% of the elk winter range in the herd unit will be disturbed. The primary impact upon elk will be due to disturbance during the development phase. Human activities within 0.5 miles of elk may result in evasive movement by elk (Ward et al. 1973). Elk are known to avoid disturbances associated with active logging areas and road construction operations (Ward 1976, Lyon 1979), however, elk do become easily conditioned to patterned human activity (Ward 1973). Therefore, elk may become accustomed to human activity on the project area during the long-term production phase of the project. Minimal impacts upon the elk population utilizing the CCPA are expected provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

Pronghorn Antelope. The CCPA supports antelope throughout the year. The pod contains both winter/yearlong (1,899 acres) and crucial winter/yearlong (151 acres) pronghorn range. As currently proposed, developments under the Proposed Action would not disturb any pronghorn crucial winter/yearlong range. Approximately 20.2 acres of pronghorn winter/yearlong range would be disturbed. Following reclamation, approximately 8.16 acres of winter/yearlong range (0.004% of that range type in the Baggs Herd Unit) would remain disturbed for the remaining life of the project. Major pronghorn migration routes do not cross the pod (WGFD 2000a).

Activities associated with the construction phase of the project will likely temporarily displace antelope, however, once construction is complete antelope will 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. The displacement of pronghorn and disturbance of habitats is considered minimal because of the temporary nature of the displacement and the availability of comparable habitats in adjacent areas. Overall, impacts upon the antelope population utilizing the pod are expected to be minimal,

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provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

4.7.1.1.3 Upland Game Birds

Greater Sage Grouse. Suitable greater sage grouse habitat is abundant on and around the CCPA. The amount of habitat disturbance is minimal considering the amount 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 noises.

The RMP contains stipulations that nesting activities of greater sage grouse be protected 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. The area of the CCPA included within the 2-mile buffer areas of the active greater sage grouse leks is a sensitive resource area according to the Interim Drilling Policy and mitigation measures and stipulations must be followed to protect this area. If all avoidance and mitigation measures in this document, the RMP, and the guidance provided by the IDP are implemented, impacts to greater sage grouse are expected to be minimal.

4.7.1.1.4 Raptors

The principal potential impacts of the Proposed Action on raptors are: (1) nest abandonment and/or reproductive failure caused by project related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) small, temporary reductions in prey populations. During 2001 surveys, one active ferruginous hawk nest was located approximately 3/4 mile southwest of the pod boundary. The RMP states that no activity or surface disturbance will be allowed near raptor nesting habitat from February 1 - July 31. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether or not the nest is within the line of sight to construction activities. According to the current proposed development, no disturbance would occur within 1 mile of this active nest. Twelve inactive ferruginous hawk nests were located within 1 mile of the CCPA. One additional inactive unknown buteo nest was located within 1 mile of the pod. Steps would be taken to ensure that these inactive nests are not destroyed. Impacts to breeding raptors are expected to be minimal, provided that avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

4.7.1.1.5 Threatened and Endangered Species - Wildlife, Fish, and Other Aquatic Species

The following species are either threatened, endangered, or proposed for listing under the ESA. These species may have potential to occur on or near the project area and therefore potential impacts to these species caused by the Proposed Action are considered.

Threatened and Endangered Wildlife Species

Black-Footed Ferret. 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). One prairie dog town is located within the CCPA (town #1; Figure 4-1). This prairie dog town meets the requirements to be considered suitable black-footed ferret habitat (Biggins et al. 1989). Ferret surveys would need to be conducted in this prairie dog town prior to any disturbance (USDI-FWS

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1989). The proposed development would avoid the prairie dog town. Therefore, no impact to black-footed ferrets would occur provided avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy have been implemented.

Mountain Plover. Given the unsuitable nature of the habitat for plovers within the CCPA and the fact that the proposed development avoids the prairie dog town, no impacts to mountain plovers are expected.

Bald Eagle. Bald eagles typically build stick nests in the tops of large coniferous or deciduous trees along streams, rivers or lakes. This type of habitat is not present on the CCPA, therefore, bald eagles are not expected to nest on the pod. Bald eagles may utilize the CCPA during winter months when big game species are more concentrated on winter ranges. However, the CCPA does not support concentrated use by bald eagles and bald eagle use of the pod is likely incidental. Bald eagles may feed on road-killed carrion in the general vicinity of the pod and workers should be educated about the danger of striking a bald eagle with a vehicle along the main highways and roads providing access to the CCPA (especially Wyoming Highway 789). The Proposed Action is not expected to impact bald eagles provided that the avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are implemented.

Canada Lynx. The Canada lynx is not expected to occur on the CCPA because of the lack of suitable habitat, therefore, the Proposed Action is not expected to impact Canada lynx.

Threatened and Endangered Fish and Other Aquatic Species

Contemporary occurrence of these endangered fish species has not been confirmed for the Muddy Creek drainage or immediately downstream in the Little Snake River, although their probability of 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 will consult with the FWS and develop a protection plan for the fish.

Construction and use of well access road crossing and road grades within the CCPA could contribute to an increase in sediment levels in Muddy Creek. Offsite sediment movement will only be a major problem during spring thaw and other heavy runoff events such as localized thunderstorms. Implementing reasonable precautions, such as the measure described in Chapter 2, would limit offsite sediment movement from disturbed areas and prevent substantial increases in sediment loadings in the downstream section of Muddy Creek and downstream from its confluence with the Little Snake River, and remain in compliance with Wyoming Surface Water Quality Standards (WDEQ 2001).

According to the water management plan for the CCPA, effects of the subterranean water withdrawals are not expected to be detrimental to current instream flows. Additionally, to avoid impacts to downstream fisheries, no downstream surface discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dams outlet structure and is a pre-existing, localized condition. This site would be closely monitored to identify any increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the point of compliance (POC). All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on threatened or endangered fish species that may potentially occur

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downstream from the CCPA, since all CBM produced water would be contained in the LSRCD reservoir.

4.7.1.1.6 Species of Concern - Wildlife, Fish, and Other Aquatic Species

Wildlife Species of Concern. The wildlife species of concern with the highest potential to occur on the CCPA are the burrowing owl, Columbian sharp-tailed grouse, and the Wyoming pocket gopher. Since suitable habitats for the remaining species (northern goshawk, snowy plover, swift fox, and smooth green snake) do not occur on the project area, the likelihood of impacts associated with the Proposed Action is expected to be low. Burrowing owls are typically associated with prairie dog burrows. Burrowing owls may utilize the prairie dog town located within the CCPA, however the total disturbance that would occur is small, therefore the proposed development is not expected to impact burrowing owls. However, if an active burrowing owl nest is found within 0.75 - 1.0 mile of proposed disturbance, construction would be restricted during the critical nesting season. No Columbian sharp-tailed grouse leks are located within 2 miles of the CCPA, and no winter habitat (upland shrub communities and wooded riparian areas) for Columbian sharp-tailed grouse is located on the pod. Therefore, use of the CCPA by Columbian sharp-tailed grouse is unlikely and no impacts are expected. The Wyoming pocket gopher is typically associated with loose gravelly soils in greasewood plant communities. Although the Wyoming pocket gopher may be present on the CCPA, the small amount of disturbance associated with the Proposed Action is not expected to significantly impact the species if it is present. Two sagebrush obligate species, Brewer's sparrow and sage sparrow, may be present within the CCPA. Because of the small amount of disturbance associated with the project, their inherent mobility, and the availability of suitable habitats on undisturbed land, the effects on these species should be minimal.

Suitable waterfowl and shorebird nesting sites within the ½ mile of perennial riparian areas found on the CCPA are severely limited and are present only as a result of surface discharge of produced CBM waters. Well developed riparian vegetation occurs along the inflow /outflow stream channel, however the floodplain is only a few feet wide and limited development of the wetland vegetative community associated with the LSRCD reservoir restricts its usefulness as a waterfowl and shorebird nesting and nursery site. Perennial water bodies that support more extensive riparian vegetation probably comprise the bulk of breeding/brood rearing habitat for waterfowl and shorebirds in this region. Therefore, stopovers by migrant groups of waterfowl for feeding and resting is probably the predominant use of the area by waterfowl and shorebird species, and impacts to this use are expected to be minimal.

Two shorebird species of concern (white-faced ibis and long-billed curlew) have been observed in the vicinity of the CCPA. White-faced ibis (*Plegadis chihi*) were observed southwest of the project area in Muddy Creek near Dad, Wyoming in 1988 (one individual) and 1992 (two individuals) (WGFD 2000). Nine other sightings of this species occurred near the northern end of the greater Atlantic Rim project area (WGFD 2001). Additionally, five white-faced ibis were observed in 2001 seven miles northeast of the project area by HWA personnel. In Wyoming, long-billed curlew (*Numenius americanus*) are uncommon summer residents, but may be locally common in suitable habitat (WGFD 1999b). Long-billed curlew have been observed in Carbon and Sweetwater counties (WYNDD 2001) and one was observed approximately three miles west of the greater Atlantic Rim project area (WGFD 2000) and three within six miles of the northern boundary of this area (WGFD 2001). However, none of the observations of these species were reported within five miles of the CCPA.

In summary, only minimal impacts upon the wildlife species of concern would be expected,

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provided that avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

Fish Species of Concern. Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may provide some new habitat for fish species within the CCPA. To avoid impacts to downstream fisheries, no downstream discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dam's outlet structure and is a pre-existing, localized condition. This site will be closely monitored to identify any increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the POC. All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on fish species of concern found downstream from the CCPA, since all CBM produced water would be contained within the project area.

Other Aquatic Species of Concern. Two species, the northern leopard frog and the Great Basin spadefoot, may exist on the CCPA and could be impacted by increased human activities within the project area, in proportion to the amount of their habitat disturbed or removed. A slight increase in amphibian mortality would be expected from increased traffic within the project area. Additional impacts to these species would be limited, since project-wide mitigation measures including avoidance of wetland/riparian areas (which are essential amphibian habitats) would occur during project implementation.

Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may create some new habitat for amphibian species. Overall, the project is expected to result in minimal impacts to amphibian species of concern and may potentially provide some benefits for these species through increased available habitat.

4.7.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.8 RECREATION

4.8.1 Impacts

4.8.1.1 Proposed Action

Impacts to recreation would involve a temporary displacement of some hunters, particularly during construction and drilling. 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 CCPA.

Undisturbed landscapes, isolation and solitude are often important to non-consumptive users such

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as photographers and back packers. 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 the project. Some long term displacement, permanent or relocation, of hunters and non-consumptive users would result from the project. Further, there may be reduced levels of satisfaction for those recreationists who might continue to use the area. Overall impacts to the recreation resource would be minimal due to the short term nature of drilling and construction activities, and concentrated locations of activities. Conversely, fisheries recreation experiences may benefit from the development. Should discharge from the CBM wells produce water of sufficient quality and quantity to fill the LSRCD reservoir, the WGFD may consider stocking fish. If a fishery is feasible, it would result in a beneficial impact in an area with few fishing opportunities.

4.8.1.2 Alternative A - No Action

Under the No Action alternative, similar impacts as described for the Proposed Action are expected to occur, but of a lesser magnitude.

4.9 VISUAL RESOURCES

4.9.1 Impacts

4.9.1.1 Proposed Action

As noted in Chapter 3, Affected Environment, the CCPA is not pristine. Several two-track roads exist throughout the area used by ranchers, recreationists and mineral developers.

Short term impacts to the visual resource associated with construction and drilling in the CCPA 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 CCPA 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 highly visible to potentially large numbers of viewers.

The short term impacts would exceed the level of contrast permitted in Class 3 areas; however,

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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 in the long term.

These facilities would create contrasts in line, form, color, texture and overall pattern in the landscape and would remain for the duration of the project. Fugitive dust impacts as part of on-going operations would also persist. However, as noted for short term impacts, these contrasts would not be visible to many viewers. With the application of measures described in Chapter 2, the level of contrast would not exceed Class 3 standards. Levels of contrast would, however, detract from the experience of those recreating in the immediate 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 3 standards. However, contrasts could diminish the experience of motorists and recreationists.

4.9.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.10 CULTURAL RESOURCES

4.10.1 Impacts

4.10.1.1 Proposed Action

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 CCPA 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 ¼ mile buffer zone or outside the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors.

Block surveys have been completed in the CCPA, as required by the Interim Drilling Policy.

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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.

4.10.1.2 Alternative A - No Action

Under this alternative, impacts to cultural resources would be similar to those described above, but of a lesser magnitude.

4.11 SOCIOECONOMICS

4.11.1 Impacts

4.11.1.1 Proposed Action

Socioeconomic Impacts of the Proposed Action 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 significant demand for temporary housing or local government services.

4.11.1.1.1 Economic and Employment Effects

The Proposed Action as described in Chapter 2 of this assessment 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 over a 15 year period (see Table 2-1).

Development and operation of the Proposed Action 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 direct and indirect effects of CBM on the Wyoming economy have not been specifically analyzed. However, the BLM commissioned a study in the mid-1990's to assess the economic effects of a variety of activities which occur on public lands in southeast Wyoming, including oil and gas development. The study, prepared by the University of Wyoming Agricultural Economics Department (UW), estimated that one job (direct and indirect) was created for every 203 million cubic feet (MCF) of natural gas produced in the state, at a gas sales price of \$1.30/MCF (University of Wyoming 1997). This ratio yields a peak of about eight direct and indirect jobs associated with the Proposed Action in the second year of production, decreasing to about one job during the fifteenth year of production. Because gas sales prices may be substantially different in the future than in the 1997 study (this analysis uses a range of \$3.00 to \$2.25/MCF) and the employment, infrastructure and maintenance requirements for CBM are lower than traditional natural gas development, actual employment per MMCF of gas produced from the Proposed Action could be higher or lower than the UW estimate.

Similarly, the UW study found that \$1,606 of economic activity was generated in southwest

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Wyoming by every MMCF of traditional natural gas production, at a sales price of \$1.30/MCF. Using this ratio, total economic activity generated by the Proposed Action would range from a high of about \$2.6 million during the second year of production, decreasing to about \$188 thousand in the fifteenth year of production. Again, gas sales price estimates used for this assessment are higher than \$1.30/MCF, which would tend to push economic activity higher, but the lower labor and development requirements of CBM fields would tend to reduce resultant levels of economic activity per unit of gas produced.

Although the UW study did not specifically address CBM development, it is reasonable to assume that the direct and indirect economic benefits of the Proposed Action would be positive.

4.11.1.1.2 Carbon County Oil and Gas Activity

Successful completion of the Proposed Action would slightly increase natural gas production in Carbon County, particularly during the first several years of production. For example, the Proposed Action would result in an estimated 1.6 MMCF of methane during the second year of production. This is about one percent of total 1999 Carbon County natural gas production. Proposed Action methane production is anticipated to decrease each year thereafter (see Figure 4-2).

In 1999, a total of 127 APD's were issued for Carbon County. The 8 wells associated with the Proposed Action would be about six 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.

4.11.1.1.3 Effects on Economic Activities in the Vicinity of the Proposed Action

As outlined in Section 3.11, economic activities occurring in the vicinity of the Proposed Action include other oil and gas exploration, grazing, and recreation, primarily hunting.

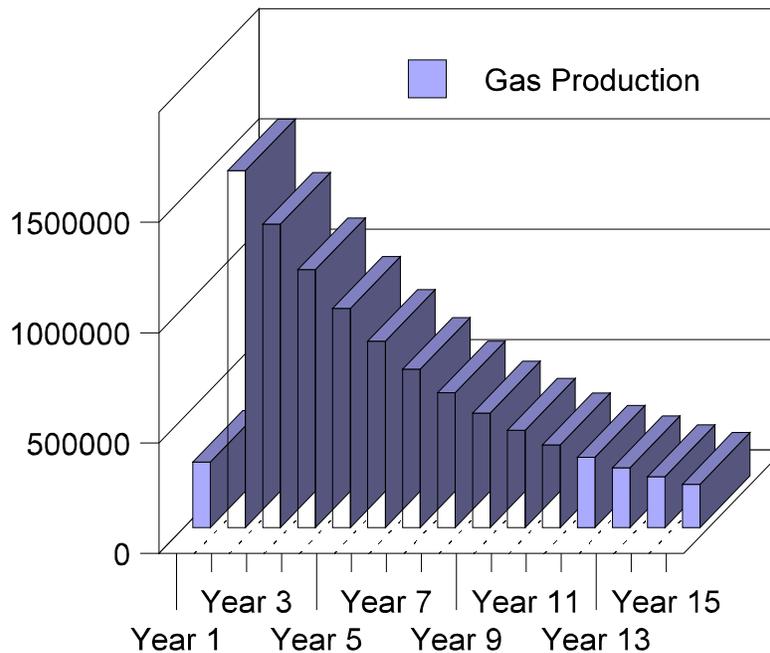
Properly performed, the pre-construction planning and coordination activities outlined in Chapter 2 would avoid economic effects on other oil and gas interests in the vicinity of the Proposed Action.

Economic effects on grazing activities would include losses of forage due to temporary and long-term disturbance. As described in Section 4.6, temporary disturbance would result in a minor loss of AUM's. 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 Proposed Action would result in a loss of \$846 in total economic activity during field development, and \$260 annually for the life of the project.

According to the recreation analysis conducted for this assessment (see Section 4.8), some hunters and other recreationists may be temporarily displaced from the area associated with the Proposed Action during drilling and field development, and perhaps a lesser number during project operations. The effects of the Proposed Action on the Carbon County hunting and recreation economy are anticipated to be minimal, given the short term nature of the drilling and field development period, the relatively few hunters and recreationists who use the CCPA and the potential that hunters and recreationists may use other areas within Carbon County during this period.

Figure 4-2. Projected Proposed Action-Related Total Annual Gas Production.

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Source: PEDCO

4.11.1.1.4 Population Effects

Population effects of the Proposed Action would be minimal. Some of the skills and services required for the Proposed Action are available in the local labor pool, although the recent increase in both conventional 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, a portion would likely be contractors from other areas of Wyoming (Rock Springs, Gillette, Casper) and from the Craig area of northern Colorado. The remainder would be hired from the local workforce. Given the short duration of the drilling phase (under two months), most non-local workers would be likely to relocate to Carbon County single status, i.e., without family members.

Non-local 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, Rock Springs or Craig, Colorado. Given the current level of drilling and field development activity occurring in Wamsutter, it is unlikely that Cow Creek 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 Proposed Action, it is likely that area businesses would accommodate the increase in economic activity with existing employees.

For the operations phase, it is assumed that eight total direct and indirect jobs in south west

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Wyoming would be generated by the Proposed Action during the peak operations year, decreasing to one job by the fifteenth year. Consequently, the population associated with the operations phase of the Proposed Action would be minimal.

4.11.1.1.5 Temporary Housing Demand

The relatively small Proposed Action-related demand for temporary housing during drilling and field development would 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.

4.11.1.1.6 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.

4.11.1.1.7 Fiscal Effects

The Proposed Action would generate tax revenues including:

- local ad valorem property taxes on production and certain field facilities;
- sales and uses taxes to the State of Wyoming, Carbon County and its incorporated municipalities;
- mineral royalties to the federal government, a portion of which are returned to the State and local governments; and
- state severance taxes.

Ad valorem and severance taxes and federal mineral royalties are calculated using gas prices contained in the January 2001 Wyoming Consensus Revenue Estimating Group (CREG) projections (\$3.00/MCF for 2002 and \$2.25 MCF thereafter).

4.11.1.1.7.1 Ad Valorem Taxes

The Proposed Action would generate ad valorem property tax to Carbon County, the Wyoming School Foundation Fund, Carbon County Schools and various taxing districts within the county. Ad valorem taxes would be generated from two sources: (1) the fair market value of methane produced and sold; and (2) the value of certain capital facilities within the well fields (all underground facilities associated with wells are exempt by state statute). Well field facilities are depreciated after the first year of production.

Constant 1999 Carbon County mill levies were used to prepare these estimates. In reality some mill levies are set each year by the Carbon County Commissioners, officials of the various special and school districts and the state; some change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity. Natural gas is assessed based on the previous year's production, therefore the revenues associated with these levies would be received the year following these estimates.

According to estimates provided by the proponent, gas production peaks in the second year of production and declines thereafter over the projected life of the project. Consequently, production-related ad valorem property tax revenues associated with the Proposed Action would be highest

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in the third year of production, and diminish annually thereafter.

Under the assumptions described above, ad valorem tax revenues from production and facilities would total \$1.4 million over the life of the project, including about \$277,000 for the county and its districts based on 12 mills, \$23,000 to the weed and pest district based on 1 mill, \$1.04 million for schools based on 45 mills (12 for the State School Fund, 6 for the countywide school levy and 27 for the school district levy and other school taxes) and \$79,000 for a variety of special districts (museum, cemetery, water conservancy and conservation) based on levies totaling 3.42 mills.

Table 4-1. Estimated Ad Valorem Property Tax Revenues Tax over the life of the Proposed Action.

Carbon County (12 mills)	Weed & Pest (1 mill)	Total Schools (45 mills)	Special Districts (3.42 mills)	Total
\$277,000	\$23,000	\$1,040,000	\$79,000	\$1,400,000

Source: Blankenship Consulting LLC based on production estimates provided by Double Eagle. All estimates rounded.

4.11.1.1.7.2 Federal Mineral Royalties and Wyoming Severance Taxes

The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund. Actual Mineral Royalty revenues collected would vary based on actual production levels, gas sales prices, and production and transportation costs.

Table 4-2. Estimated Federal Mineral Royalties and Severance Tax over the life of the Proposed Action.

Federal Mineral Royalties	Wyoming Severance Tax
\$2,358,000	\$990,000

Source: Blankenship Consulting LLC based on production estimates provided by Double Eagle. All estimates rounded.

The State of Wyoming collects a six percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and transportation costs are exempt from this tax. The state uses revenues from this fund for a variety of purposes (e.g., General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve) and returns a portion to counties and municipalities. Estimated severance tax revenues are displayed in Table 4-2. Actual severance tax revenues would vary based on actual production levels, gas sales prices, and production and transportation costs. Actual severance tax revenues may be less than these estimates if a portion of the gas is used for production purposes.

4.11.1.1.7.3 Sales and Use Tax

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Wyoming levies a four percent sales and use tax on the gross receipts of tangible goods and certain services (drilling services are exempted). The state returns 28 percent of the revenue (less administrative costs) to the county and municipalities where the taxes were collected. Carbon County also levies a one percent local option sales and use tax which is distributed to the county and its municipalities. A one percent facilities tax, which is used for capital facilities in the county, is set to expire before the Proposed Action would take effect and has not been included in this assessment.

During the field development phase of the Proposed Action, an estimated \$438,000 would be spent for goods and services subject to state and local sales and use taxes. This amount would generate about \$12,600 for the State of Wyoming and about \$9,200 for Carbon County and its municipalities.

4.11.1.1.8 Local Attitudes and Opinions

The 1996 resident survey conducted for the Carbon County Land Use Plan (discussed in Section 3.11.6) did not specifically address CBM development, but it provides a basis for assessing attitudes and opinions about issues associated with the Proposed Action. For example, it is reasonable to assume that survey respondents would have similar attitudes about CBM development activities that are similar to traditional natural gas development activities (i.e., seismic exploration, drilling, field development and production).

However, the importance that survey respondents placed on water conservation and the availability of water to support future land use suggests that the produced water aspects of CBM development could be of concern to them. Successful implementation of the produced water discharge program described in Section 2.1.3.5 may mitigate those concerns.

According to the Carbon County Land Use Plan, resident response to the survey suggests “a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county.” This sentiment coupled with partial support for leasing more federal lands for oil and gas development (about 50 percent countywide, somewhat higher in every community but Rawlins and Saratoga) suggests that development of CBM resources would be generally supported by residents of the Little Snake River Valley, as long as they perceive that such development does not damage water resources or wildlife habitat, or degrade the quality of recreation resources in the area. The conclusions of the analyses conducted for this assessment are that impacts to water, wildlife and recreational resources would not be significant. If these conclusions are correct, the Proposed Action should not generate high levels of dissatisfaction among Carbon County residents. Conversely, if unanticipated impacts to water resources, wildlife habitat or recreation resources occur, resident dissatisfaction with the Proposed Action could be high.

4.11.1.1.9 Environmental Justice

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

4.11.1.2 Alternative A - No Action

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Implementation of the No Action alternative would result in socioeconomic conditions similar to but less than those described above.

4.12 TRANSPORTATION

4.12.1 Impacts

4.12.1.1 Proposed Action

4.12.1.1.1 Federal and State Highways

The Proposed Action 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 2-1 in Chapter 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 CCPA 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 at a trailer at the drill site during the work week. Based on these plans and the estimates contained in the table, the Proposed Action 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 Proposed Action 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 Proposed Action 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 Proposed Action is negligible.

4.12.1.1.2 County Roads

The Proposed Action would result in increases in traffic on the county roads that provide access to the CCPA (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 in Section 4.11.

Increased traffic would generate an increase in the potential for vehicle/stock accidents, although

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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) and implementation of measures described in Chapter 2 could further reduce potential for vehicle/stock accidents.

4.12.1.1.3 Internal Roads

Section 2.1.2.1 (Access Road Construction) describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the CCPA. Based on these proposals, an estimated 2.3 miles of new roads would be constructed within the project area. The proponent 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.

4.12.1.2 Alternative A - No Action

Under this alternative approximately 2.0 miles of road have been previously approved for construction. The implementation of this alternative would require continued use of Federal, State and county roads for access, resulting in similar types of impacts as those described under the Proposed Action, but of a lesser magnitude.

4.13 HEALTH AND SAFETY

4.13.1 Impacts

4.13.1.1 Proposed Action

Health and safety impacts of the Proposed 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

Two types of workers would be employed by the Proposed Action: 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 OSHA Worker's Safety Division is meeting with CBM company officials to consider changes in worker safety standards and revised training requirements.

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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 the low level of employment (one worker).

The US BLM, OSHA, USDOT, WOGCC, and OSHA 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 occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

Pipeline Hazards

Increasing the miles of gathering line within the project area would increase the chance of a pipeline failure. Accidents 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). Therefore, the relatively small amount of new pipeline associated with the Proposed Action, 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 ROW's would reduce the likelihood of pipeline ruptures caused by excavation equipment--particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Other Risks and Hazards

Highway safety impacts are discussed in Section 4.12 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.1.9.2.16.

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

The risk of fire in the project area would increase under the Proposed Action. This is an unavoidable impact associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. However, this risk would be reduced by the placement of facilities on pads and locations that are graded and devoid of vegetation which could lead to wildfires. 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 would help to 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 Proposed Action.

Based on the foregoing assessment, risks to public health and safety should not increase as a result of the Proposed Action.

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4.13.1.2 Alternative A - No Action

Under the No Action alternative, health and safety risks would be the similar to those described under the Proposed Action, but of a lesser magnitude.

4.14 NOISE

4.14.1 Impacts

4.14.1.1 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 modifies 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. Under typical conditions, excess levels decline below the level of significance (55 dBA) at 3,500 feet from the source. 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 described under the Proposed Action 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.

4.14.1.2 Alternative A - No Action

Implementation of the No Action Alternative would result in impacts similar to those described under the Proposed Action, but of a lesser magnitude.

4.15 CUMULATIVE IMPACTS

Cumulative impacts are those that would result from the incremental impacts of the Proposed Action when added to past, present, and RFFA's. Reasonably foreseeable development is that development likely to occur within the CCPA, or cumulative impact assessment area (CIA) within the next 5 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 allowed under the Interim Drilling Policy for the Atlantic Rim Coalbed Methane area. The interim drilling policy allows a maximum of 200 coalbed methane wells within the Atlantic Rim project area, for research and exploratory purposes, during the interim period in which 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

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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, long-term disturbance associated with the 200 well interim drilling program would likely affect an estimated 200 acres for the LOP. Total distance between Pod 1 and Pod 9 is about 40 miles. The distances between the individual pods vary, from 1 ½ miles between pods 2 and 3, to over 6 miles between pods 7 and 8 (see Figure 1-2).

The Cow Creek pod is part of Pod #6 of the 200 well interim drilling program. PEDCO intends to drill 10 wells in the Sun Dog Unit of Pod #6, as part of the interim drilling program. These wells have been analyzed in a separate EA due to development by a separate operator using different methods of water disposal.

Past or existing actions on or in the vicinity of the CCPA that continue today and have major influences on the area include the road network; oil and gas wells; ranching/livestock facilities (i.e. fences, stock watering facilities, ranch houses, power lines, a pipeline etc.); and previously approved CBM wells and associated facilities.

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 wells have been drilled within this area. Of that total, 59 oil and gas wells have been plugged and abandoned and are probably within various stages of reclamation; 37 oil and gas wells are in various stages of completion, resulting in approximately 337 acres of long-term disturbance (related facilities disturbance included); and 13 CBM and water injection wells, and related facilities, have been drilled, resulting in approximately 13 acres of long-term disturbance. Pods 5, 6, 7, and 8 of the interim drilling program are located within this CIA area and would account for approximately 93 acres of additional long-term disturbance. The existing disturbance of 359 acres resulting from current oil and gas activities, added to the approximate 93 acres associated with the four pods under the 200 CBM well interim drilling program proposed for the Atlantic Rim area totals 452 acres (0.2 percent) of long-term oil and gas related disturbance within the 219,500-acre Muddy Creek CIA area. Within the entire 310,335-acre Atlantic Rim Project Area, a total of 165 wells have been drilled. Of these wells, 80 have been plugged and abandoned and are in various stages of reclamation. The 165 well total includes those wells described within the Muddy Creek watershed.

Table 4-3 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 6.

4.15.1 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 RFFA's would require the restoration of disturbed lands to predisturbance 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.

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Table 4-3. Cumulative Impacts Analysis Matrix - Cumulative Impacts Associated with the Cow Creek Pod (Pod 6).

RESOURCE VALUE	POD1	POD2	POD3	POD4	POD5	POD7	POD8	POD9	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	O	Limit impact discussion to the Muddy Creek CIA area
Surface water	O	O	O	O	X	X	X	O	Pod 6 located in Muddy Creek CIA area; Pod 6 would have no impacts to other watersheds
Ground water	X	X	X	X	X	X	X	X	Production of ground water for all pods from Almond Formation
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
Wildlife	X	X	X	X	X	X	X	X	Greater sage grouse habitat in all pods, no surface occupancy within 1/4 mile of leks & within greater sage grouse crucial wintering areas. No drilling in prairie dog towns without black-footed ferret clearance
Crucial WR	O	O	O	O	O	X	X	X	Cow Creek & Blue Sky pods - pronghorn CWR; Pods 8 & 9 - mule deer 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 EA; O - Not discussed in the EA (no cumulative relationship)

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

No cumulative adverse impacts are expected to occur to potential fossil resources beyond those discussed in Section 4.1.1.1 as a result of the Proposed Action in combination with existing, proposed, and reasonably foreseeable actions. Adoption of mitigation measures prescribed in that section could foster cumulative beneficial impacts of the project by either resulting in the discovery of new fossil resources or providing paleontologists with evidence of absence of such resources in the area.

4.15.2 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 Continental Divide. 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 would still be covered under the air quality model completed for the Continental Divide project.

4.15.3 Soils

The CIA area for soils includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. Cumulative impacts include soil impacts from on-going exploration and development activities, recently constructed projects, and RFFA's, as described in Section 4.15. Cumulative long-term disturbance of 452 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of cumulative impacts upon the soil resources would be minimal, provided that all mitigation and avoidance measures are implemented.

4.15.4 Water Resources

The water resources CIA area includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. Existing and future disturbance consists of approximately 26.7 acres, or 0.01 percent of the Muddy Creek Drainage CIA area. The area of possible water impacts related to the full development of the local watershed containing the Cow Creek pod is 2,720 acres, or 1.2 percent of the CIA area. This cumulative disturbance would minimally impact surface water or ground-water quantity or quality.

The impacts 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.

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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 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. The source of the springs is infiltrating precipitation, and this source would not be removed by pumpage of the underlying coal seams. For these reasons pumping water from Almond Formation coal seams during exploration drilling within the ARPA would likely have little impact on the ability of these springs to produce water.

Due to thick confining layers, wells completed in water-bearing strata above or below the Almond coal seams are not likely to be impacted. Wells completed in the Almond Formation coal seams in close proximity (less than one mile) to the pod could be impacted.

Cumulative impacts to the groundwater resources within the Mesaverde Group would be limited to a temporary decline in hydrostatic head in coal seams within the Almond Formation resulting from development of the Cow Creek pod and subsequent pods associated with the interim drilling program. For purposes of this EA, existing impacts to groundwater resources within the Mesaverde Group resulting from prior development are so limited as to be non-existent.

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.

4.15.5 Vegetation and Wetlands

The CIA area for vegetation and wetlands includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. The CIA area includes impacts to vegetation and wetlands from on-going exploration and development activities, recently constructed projects, and RFFA's.

Cumulative long-term disturbance of 452 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of vegetation loss would be minimal, provided that all mitigation and avoidance measures are implemented. Water discharged from the leaking well casing (well 1X-12) and additional discharge from CBM wells developed for this project will continue to provide flow in the channel upstream from the LSRCD reservoir. The wetland characteristics associated with perennial stream flow will continue to develop along this section of the stream's course. Additionally, as the LSRCD reservoir ages, wetland characteristics will continue to evolve at this site. This evolution will eventually result in a functional wetland system having hydric soils that will likely support a stable and reasonably well developed emergent and aquatic vegetation community by the end of this project.

The LSRCD reservoir currently exhibits few wetland qualities, although wetland characteristics are expected to develop over the life of the project. Wetlands have the ability to assimilate sediments and pollutants. This ability results in the release of waters having quality that may be much

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improved over that entering the wetland. Wetlands also provide habitats for waterfowl and other shore birds, as well as amphibians. The limited number of naturally occurring wetlands within the Muddy Creek CIA will be enhanced by the development of the LSRC D reservoir. Although the LSRC D reservoir was developed for livestock watering and as a catchment basin for discharged water from the Double Eagle 1X-12 well, it may ultimately provide a temporary additional benefit of creating wetland habitat in the arid environment associated with the project area.

The distribution of plant species of concern is likely limited within the Atlantic Rim 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 is expected to provide adequate protection for threatened, endangered, and special status plant species. Thus, impacts to Special Status Species are expected to be minimal.

4.15.6 Range Resources and Other Land Uses

4.15.6.1 Range Resources

Pods 5, 6, and 7 of the 200 well interim drilling program are located within the Doty Mountain Grazing Allotment. Based on the known LOP disturbance to Pod 6 (including the CCPA and PEDCO's Sun Dog Unit) and an average per pod for Pods 5 and 7, the total LOP disturbance would be approximately 69 acres, as a result of CBM drilling operations on the three pods. The approximate 69 acres of long-term disturbance equates to a reduction of six AUM's (0.09 percent) from the total of 6,974 available, which would be a minimal impact.

4.15.6.2 Other Land Use

Potential cumulative impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

4.15.7 Wildlife and Fish

General Wildlife. The CIA area varies with species, as indicated within the respective analyses. The disturbance of wildlife habitat resulting from implementation of the interim drilling program of the nine pods 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 in the areas of the nine pods. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed (0.006% 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.

Although habitat for waterfowl and other shorebirds is limited on the pods, the habitat that exists is often a result of human development creating a surface discharge source from wells or manmade impoundments. As the wetland features evolve, they may provide waterfowl and shorebird nesting and nursery habitat in the future. However, while the developed wetland areas may prove attractive to wildlife, the system is designed to retain produced waters and allow their evaporation and infiltration. As evaporation continues over time, the increasing salt content of these waters may eventually reduce their suitability for waterfowl and shorebird use. Application of mitigation measures for protection of water resources identified in Sections 2.1.9.2.5 and

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2.1.9.2.6 in this assessment should prevent any adverse impacts to waterfowl or other shorebirds or their habitat.

Big Game. Activities associated with the construction phase of each of the nine 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 project activities. Pronghorn CWR occurs within the Cow Creek and Blue Sky pods; however, no disturbance within the CWR of the Cow Creek pod is proposed. 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 on 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 - Nov 14. The performance of proposed actions on the nine pods is not expected to block the movement of big game animals between seasonal ranges. The distance between pods ranges from approximately 1.5 to 5.0 miles. Elk may avoid development areas by ½ mile or line-of-sight. However, big game species will likely habituate to the physical presence of the gas wells and predictable, non-threatening human activity associated with well maintenance (Knight 1981, Segerstrom 1982, Reeve 1984, Easterly et al. 1988). Cumulative impacts on the animal movements are expected to be minimal. 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.

Upland Game Birds. Greater sage grouse occupy the area of the nine pods year-round and make seasonal use of the habitats. One crucial winter habitat unit and two leks occur on Pod #1, and a portion of Pod #8 lies within the 1/4-mile radius of a lek. Approximately 11,274 acres (56.4 percent of the total surface area of the nine pods) overlap the 2-mile radius of the historical leks in the area. Therefore, approximately 368 (3.3%) and 113 (1.0%) acres, respectively, of potential greater sage grouse nesting habitat would be affected by short-term and long-term disturbances associated with the production activities. Considering the vast amount of potential nesting habitat available, the 113-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 LOP-200-acre disturbance associated with the Proposed Action of the nine pods, provided the implementation of interim drilling guidelines, seasonal restrictions, reclamation, and mitigation measures provided are followed.

Raptors. Although no active raptor nests were located on the nine pods during 2001 aerial surveys, implementation of protection measures identified in Chapter 2, Section 4.7.1.1.4, and the IDP are expected to protect the raptor populations within the 9-pod interim drilling area. Therefore, only minimal cumulative impacts to raptors within Muddy Creek Watershed are likely to occur.

Black-footed Ferrets. Acreages and burrow densities that are adequate to support black-footed ferrets (200 or more acres with 8 or more burrows per acre) occur on three of the pods on the project area (Cow Creek, Sun Dog and Blue Sky). Black-footed ferret surveys have been conducted on two of these pods and no ferrets or ferret sign were found. The Sun Dog pod was surveyed in October of 2000 and September of 2001. Blue Sky pod was surveyed in August of 2001. Because of the fact that black-footed ferret surveys are required (per interim drilling guidelines) on all prairie dog towns to be disturbed that can support a ferret, no impacts to this species are expected as the result of the proposed 200 well interim drilling activities.

Fish. Four sensitive fish species have the potential to occur downstream in the Muddy Creek

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watershed seasonally for spawning and/or rearing, and the Little Snake River. Three of the four sensitive species (roundtail chub, bluehead sucker, and flannelmouth sucker) are documented to occur within the Muddy Creek watershed, approximately seven miles downstream from the project area. Additionally, Colorado River cutthroat trout are known to occur farther downstream in the Little Snake River. Four endangered species (Colorado pikeminnow, bonytail chub, humpback chub, and razorback sucker) may also potentially occur downstream in the Little Snake River, but it is highly unlikely. Thus, suitable habitat for spawning, age-0, juveniles, and adults of each of these species may be present in both the Muddy Creek watershed and the Little Snake River, both of which are within the zone of downstream influence of waters produced on the CCPA.

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. Similar measures to prevent offsite movement of disturbed soils caused by construction activities (WDEQ 2001) and prevent organic fluid spills from entering water courses and reaching fish producing waters will ensure implementation of the proposed action is not likely to adversely effect sensitive fish species in Dry Cow Creek, farther downstream in Muddy Creek, or in the Little Snake River. Crossings of any streams having potential to support sensitive fish species will be designed to allow migratory passage following methods identified by Watts (1974). In addition, any stream crossings of the downstream section of Muddy Creek, constructed to access the project area, would be located and constructed to ensure passage for upstream spawning migrations of these sensitive native fishes. All crossing construction would be limited to no-flow periods for ephemeral or intermittent drainages. Additionally, crossing designs would be approved by a BLM fishery biologist prior to installation.

Water used in drilling and construction activities would be obtained from deep 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. Thus, "contact" between the surface springs and deep water aquifers planned for use during this project is not anticipated. Therefore, no surface water depletions that would affect sensitive, threatened, or endangered fish species would occur. If the Proposed Action leads to surface water depletion in either Muddy Creek or the Little Snake River (perennial tributaries to the Colorado River falling under the Colorado River Compact), adverse impacts to the sensitive species may occur, and potential impacts to the four downstream Endangered species would require the initiation of consultation with the FWS.

The proposed development in the pod is not expected to result in reductions in sensitive, threatened, or endangered adult fish numbers, nor their exclusion from, or degradation to their spawning areas within the Muddy Creek watershed or in downstream waters of the Little Snake River. 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. Similar measures are anticipated to avoid onsite organic compound spills and to prevent them from entering ephemeral drainages and being carried downstream to fish producing waters.

Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may provide some new long-term habitat for fish species within the CCPA. To avoid impacts to downstream fisheries, no downstream discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dam's outlet structure and is a pre-

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existing, localized condition. This site will be closely monitored to identify any seepage increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the POC. All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on fish species of concern (sensitive, threatened, or endangered) found downstream from the CCPA, since all CBM produced water would be contained in the LSRCD reservoir.

Overall, impacts upon sensitive, threatened, or endangered adult fish numbers are expected to be minimal, provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented. Additionally, 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 sensitive, threatened, endangered, and special status species.

4.15.8 Recreation

BLM does not have statistics on historical use of the project area by recreation category which could be used to determine trends in cumulative impacts on recreation use and displacement. 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 non-consumptive users may occur, and there may be reduced levels of satisfaction for those who might continue to use the area. Some long-term benefits for recreation may be realized within the CCPA as well, since the LSRCD reservoir is planned to provide a long-term recreational fishery.

4.15.9 Visual Resources

As discussed in Chapter 3, existing visual qualities in the CCPA 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 3 designation with implementation of mitigation measures proposed by Double Eagle in Chapter 2.

4.15.10 Cultural Resources

Cultural resources on public lands, including archaeological sites and historic properties, are protected by federal law and regulations. Current CBM operations must comply with these protective regulations, and BLM has required the completion of cultural resource inventories prior to surface-disturbing activities. These inventories have been used to identify sites potentially

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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 have been completed on the CCPA, the potential for increased impacts on cultural artifacts would be minimized. By avoiding known cultural and historical sites during the layout of drill sites, access roads, and pipeline corridors, the potential for incremental increases in cumulative impacts would be avoided. Completion of cultural resource inventories would have a beneficial, cumulative impact on the level of cultural information about the project area. Some unintentional damage to subsurface resources could occur during grading or excavation activities. However, implementation of resource protection and mitigation measures described in Chapter 2, Section 2.1.8.2.15 would protect such resources upon discovery.

4.15.11 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 CCPA 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, 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 1980's and have infrastructure and housing to accommodate some population growth. Smaller communities near the CCPA, such as Wamsutter, 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 or 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.

4.15.12 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 described in Chapter 3, 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 project-related revenues generated, which are described in Section 4.11.

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4.15.13 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. Occasional traffic and activity associated with oil and gas exploration activities would generate small increases in risks to project workers and the public. Cumulative impacts to health and safety conditions are anticipated to be similar to those described for the Proposed Action.

4.15.14 Noise

Noise would result from on-going construction, drilling, and CBM operations during the life of the project. Increased traffic on existing transportation system roads within the project area would occur, thus adding to existing traffic noise. Given the current and anticipated low traffic volumes, and dispersed nature of traffic and CBM operations within the CCPA, the projected additions to cumulative, traffic-related noise impacts would be minimal.

CHAPTER 5

CONSULTATION AND COORDINATION

5.0 CONSULTATION AND COORDINATION

An EA must be prepared when a federal government agency considers approving an action within its jurisdiction that may impact the human environment. An EA aids federal officials in making decisions by presenting information on the physical, biological, and social environment of a proposed project and its alternatives. The first step in preparing an EA 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 EA should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis in the EA and to eliminate insignificant issues and alternatives from detailed analysis.

The Cow Creek CBM project EA was prepared by a third party contractor working under the direction of and in cooperation with the lead agency for the project, which is the BLM, Rawlins Field Office, Rawlins, Wyoming.

5.1 PUBLIC PARTICIPATION

A scoping notice was prepared and submitted to the public by the BLM on June 14, 2001, requesting input into 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 Double Eagle 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 IDT 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 drilling action. 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

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STATE AGENCIES

Governor Jim Geringer
State Engineer's Office
State Senators
Wyoming Department of Environmental
Quality

Wyoming Game and Fish Department
State Representatives
Wyoming State Planning Coordinator
Wyoming Department of Transportation
Wyoming Oil and Gas Conservation
Commission

COUNTY GOVERNMENT

Carbon County Commissioners

Carbon County Planning Commission

MUNICIPALITIES

Mayor-Baggs
Mayor-Rawlins

Mayor-Wamsutter

NATIVE AMERICAN TRIBES

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

Shoshone Tribal Council
Ute Tribal Council
Uinta-Ouray Tribal Council

GRAZING PERMITTEES

Weber Ranch
Salisbury Livestock Company
Three Forks Ranch Corporation
Mike Sheehan
H.B. Lee
Espy Livestock
PH Livestock Company

Montgomery Livestock Company
Stratton Sheep Company
Sam Morgan
Robert Orchard
Matt Weber
Jack Creek Land and Cattle Company

LEASE AND ROW HOLDERS

Stone & Wolf, LLC
Merit Energy Company
Benson-Montin-Greer

North Finn, LLC
P&M Petroleum Management
KCS Mountain Resources, Inc.

LANDOWNERS

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

LOCAL MEDIA

Casper Star-Tribune
Rock Springs Rocket Miner
Wyoming State Tribune/Eagle
KRAI - Craig, Colorado
KRKK - Rock Springs
KTWO - Casper
KUWR - University of Wyoming

Rawlins Daily Times
Wyoming State Journal
Gillette News-Record
KRAL - Rawlins
KSIT - Rock Springs
KTWO TV - Casper
Northwest Colorado Daily News

OTHER AGENCIES, INDUSTRY REPRESENTATIVES, INDIVIDUALS, AND ORGANIZATIONS

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Audubon Society
 Wilderness Society
 The Nature Conservancy
 Field Museum of Natural History
 Department of Geology
 Montana Oil Journal
 Murie Audubon Society
 Petroleum Association of Wyoming
 Sierra Club
 Wyoming Outdoor Council
 Wyoming Stockgrowers Association
 Wyoming Woolgrowers Association
 Ivan Herold

National Wildlife Federation
 Carbon County Stockgrowers
 Wyoming Association of Professional
 Archaeologists
 Independent Petroleum Association
 of Mountain States
 The Nature Conservancy
 Rocky Mountain Oil & Gas Association
 Wyoming Farm Bureau Federation
 Wyoming Public Lands Council
 Wyoming Wildlife Federation
 Vern Brodsho
 Little Snake River Conservation District

5.2 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 with preparing this EA.

Table 5-1. List of BLM Interdisciplinary Reviewers.

Name	Responsibility
RAWLINS FIELD OFFICE	
Brenda Vosika Neuman	BLM IDT Lead
John Spehar	Planning and Environmental Coordinator
Mary Apple	Public Affairs
Krystal Clair	Visual Resources/Recreation
Sandra Meyers	Cultural Resources
Kip Purington	Petroleum Engineer
Andy Warren	Vegetation/Range Issues
Mark Newman	Paleontology/Geology
Susan Foley	Soils/Pipeline Construction/Reclamation
Ken Peacock	Hydrology/Water Quality
Frank Blomquist	Riparian/Wetland; Wildlife/T & E Issues
Mike Bower	Fisheries Biologist
Janelle Wrigley	Realty Specialist
Tom Williams	Natural Resource Specialist
BUFFALO FIELD OFFICE	
Alan Schlutz	Hydrologic Technician
WYOMING STATE OFFICE	

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Name	Responsibility
Susan Caplan	Air Quality

Table 5-2. List of Consultant Interdisciplinary Team EA Preparers.

Principal Interdisciplinary Team		
Name	Affiliation	Responsibility
Gary Holsan	Gary Holsan Environmental Planning	Interdisciplinary Team Leader, Project Manager, Recreation, Visual Resources
Carleton Babb	CS Babb Consulting, LLC	Water Resources
Larry Hayden-Wing	Hayden-Wing Associates	Wildlife/Fisheries; Special Status Plants, Animals and Fish; Vegetation and Wetlands
Brenda Schladweiler	BKS Environmental Associates	Soils
George Blankenship	Planning Information Corporation	Socioeconomics, Transportation, Range, Other Land Use
Jim Zapert, Susan Eatinger	TRC Environmental Corporation	Air Quality
John Albanese	Pronghorn Archeological	Cultural Resources
Gustav Winterfeld	Erathem-Vanir Geological Consultants	Geology/Paleontology, Mineral Resources
Technical Support Team		
Travis Olson	Hayden-Wing Associates	Wildlife, Vegetation & Wetlands
Jeffrey Winstead	Hayden-Wing Associates	Wildlife Biologist, Cartographer
Scott Mullner	Hayden-Wing Associates	Fisheries Biologist
Connie Hedley	Hayden-Wing Associates	Document Editing and Production
Sarah Hamilton	Hayden-Wing Associates	Document Production

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LIST OF ACRONYMS/ABBREVIATIONS

ac-ft	acre-feet
ADT	average daily traffic
AO	Authorized Officer
APD	Application for Permit to Drill
AQRV	Air Quality Related Values
ARPA	Atlantic Rim Project Area
BLM	Bureau of Land Management
BMP	best management practices
bpd	barrels per day
CBM	coalbed methane
CCPA	Cow Creek Project Area
CCR 608	Carbon County Road 608
CDP	central delivery point
CDPHE-APCD	Colorado Department of Public Health and Environment - Air Pollution Control Division
CEQ	Council for Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Cumulative Impacts Analysis
CO	carbon monoxide
COE	U.S. Corps of Engineers
CREG	Consensus Revenue Estimating Group
CRM	Coordinated Resource Management
CWA	Clean Water Act
CWR	crucial winter range
DE	Double Eagle Petroleum & Mining Company
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMT	emergency medical technicians
EO	Executive Order
ESA	Endangered Species Act of 1973
FY	fiscal year
FWS	U.S. Fish and Wildlife Service
GAP	Gap Analysis Program
GDRA	Great Divide Resource Area
g/hp-hr	grams per horsepower-hour
GRB	Green River Basin
gpm	gallons per minute
HWA	Hayden-Wing Associates
I-80	Interstate 80
IDP	Interim Drilling Policy
IDT	interdisciplinary team
IMPROVE	Interagency Monitoring of PROtected Visual Environments
LOP	life of project
LSRCD	Little Snake River Conservation District
MCF	million cubic feet
MDP	Master Drilling Plan
mi	mile
MMCFD	million cubic feet per day
MSDS	Material Safety Data Sheet
MSUP	Master Surface Use Plan
NCR	nonselective catalytic reduction
NEPA	National Environmental Policy Act
NO ₂	nitrogen dioxide
NOS	Notice of Staking
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NO _x	oxides of nitrogen

LIST OF ACRONYMS/ABBREVIATIONS

OSHA	Occupational Safety and Health Administration
PA	physician's assistant
PEDCO	Petroleum Development Corporation
POC	point of compliance
POD	Plan of Development
PPP	pollution prevention plan
PM ₁₀	Particulate Matter less than 10 microns
PRB	Powder River Basin
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
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
SAR	sodium absorption ratio
SARA	Superfund Amendments and Reauthorization Act
SCR	selective catalytic reduction
SEO	State Engineer's Office
SH 789	Wyoming State Highway 789
SO ₂	Sulfur Dioxide
SPCC	Spill Prevention Control and Countermeasures
sq	square
SSC	species of special concern
TD	total well depth
TDS	total dissolved solid
TPQ	threshold planning quantity
USDI	United States Department of the Interior
USGS	United States Geological Survey
UW	University of Wyoming
WDEQ-AQD	Wyoming Department of Environmental Quality, Air Quality Division
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission
WOS	Wildlife Observation System
WYDOT	Wyoming Department of Transportation

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 BLM's authority to allow drilling on the federal mineral estate is limited. The CEQ Regulations and 40 CFR 1506.1, *limitations on actions during NEPA process* to comply with the 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 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 EA, including a detailed Water Management Plan will be prepared and approved for each individual pod. Because of the current BLM workload,

APPENDIX A: INTERIM DRILLING POLICY

and in order to expedite the completion of the EA's, 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 WDEQ for a 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 in "Design of Culvert Fishways" by F.J. Watts, Water Resources Research Institute, University of Idaho, Moscow, Idaho, May 1974.

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 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 EIS's and EA's for protection of resource values may be considered in the assessment. Any action proposed must be in conformance with the Great Divide 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.

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
U.S. Army Corps of Engineers	Issues (Section 404) permit(s) for placement of dredged or fill material in or excavation of waters of the U. S. and their adjacent wetlands.
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY	
Water Quality Division	<p>Administers Storm Water Pollution Prevention Plan.</p> <p>Approves Surface Discharge.</p> <p>Issue NPDES permits for discharging produced water and storm water runoff.</p> <p>Approves wastewater and sewage disposal.</p> <p>Permits to construct settling ponds an wastewater systems, including ground water injection and disposal wells.</p> <p>Administrative approval for discharge of hydrostatic test water.</p>
Air Quality Division	Permits to construct and permits to operate.
Land Quality Division	Mine permits, impoundments, and drill hole plugging on state lands.
Solid Waste Division	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations.
WYOMING STATE ENGINEER'S OFFICE	
	<p>Issues permits to appropriate groundwater and surface water.</p> <p>Issues temporary water rights for construction permits to appropriate surface water.</p>
WYOMING STATE HISTORIC PRESERVATION OFFICE	

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
	<p>Provides consultation concerning inventory of, and impacts to, cultural resources.</p> <p>Programmatic agreements, consultation.</p>
WYOMING DEPARTMENT OF TRANSPORTATION	
	<p>Permits for oversize, overlength, and overweight loads.</p> <p>Access permits to state highways</p>
CARBON COUNTY	
	<p>Grants small wastewater system permits, where applicable.</p> <p>Issues driveway access permits where new roads intersect with county roads.</p> <p>Prepares road use agreements and/or oversize trip permits when traffic on county road exceeds established size and weight limits or where the potential for excessive road damage exists.</p> <p>Issues construction and conditional use permits for all new structures.</p> <p>Administers zoning changes where applicable.</p>

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
WYOMING OIL AND GAS CONSERVATION COMMISSION	
	<p>Acts as primary authority for drilling on state and privately held mineral resources, and secondary authority for drilling on federal lands.</p> <p>Holds authority to allow or prohibit flaring or venting of gas on private or state owned minerals.</p> <p>Regulates drilling and plugging of wells on private or state owned minerals.</p> <p>Issues Aquifer Exemption Permit</p> <p>Approves directional drilling.</p> <p>Administers rules and regulations governing drilling units.</p> <p>Grants gas injection well permits.</p> <p>Administers drainage protection and protection of correlative rights on private/state mineral estate.</p>

APPENDIX C-1: Master Surface Use Plan

June 15, 2001

Double Eagle Petroleum Company

P.O. Box 766

Casper, Wyoming 82602

(307) 237-9330

Cow Creek Area of Pod #6

Carbon County, Wyoming

Double Eagle Petroleum Company is proposing the drilling of eight(8) exploratory coalbed methane (CBM) wells near and in the Cow Creek Unit or Pod #6 of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming.

The Atlantic Rim Environmental Impact Study will commence in 2001 and cover approximately 300,000 acres. The EIS is expected to take 18-24 months to complete. During the interim period before the EIS completion, the Bureau of Land Management will allow the drilling of up to 200 exploratory wells. Currently oil and gas operators have identified 9 areas or "Pods" where these exploratory wells will be located.

The Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Statement allows for the drilling of 24 CBM wells, 1 aquifer recharge well and 1 disposal well in Pod #6 located in portions of Sections 12 of Township 16 North, Range 92 West and Sections 7, 17 & 18 of Township 16 North, Range 91 West, Carbon County, Wyoming. 10 CBM wells and the disposal well located in Sections 8 and 17 of Township 16 North, Range 91 West will be operated by PEDCO/Warren Resources. The remaining 14 CBM wells and 1 aquifer recharge well in Pod #6 will be operated by Double Eagle Petroleum. This Master Surface Use Plan also serves as Double Eagle's right of way application for operations proposed herein. **This Master Surface Use Plan focuses solely on the wells to be operated by Double Eagle Petroleum.**

The 14 CBM wells Double Eagle will operate in Pod #6 currently consist of 2 existing CBM wells, 4 existing and approved Permits to Drill, and 8 proposed locations. Of this total 14 wells/locations, 9 will be within the Cow Creek Federal Unit on federal leases C-07345B and C-075345A and WYW-48862. The remaining 5 proposed wells will be on federal lease #WYW-131275.

For purposes of this Master Surface Use Plan, Double Eagle has combined the surface use methods employed in its 2 existing CBM wells and 4 approved CBM locations with the proposed eight(8) new CBM locations and aquifer recharge well. This Master Surface Use Plan is not intended to modify the surface uses approved for its existing wells or locations, rather it is to compliment and coordinate the two plans. A topographic map showing the wells, approved APDs, proposed locations, access routes and pipelines is attached to this Plan as Exhibit "A".

APPENDIX C-1: MASTER SURFACE USE PLAN

Following is a list of the CBM wells and aquifer recharge well located within Pod #6 for which Double Eagle will operate:

<u>Well Name</u>	<u>Location</u>	<u>Lease</u>	<u>Status</u>
CCU #1X-12	NW $\frac{1}{4}$ SE $\frac{1}{4}$ (12, T16N-R92W)	C-075345B	Producing
CCU #34-12	SW $\frac{1}{4}$ SE $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Shut-in
CCU #32-12	SW $\frac{1}{4}$ NE $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Approved APD
CCU #42-12	SE $\frac{1}{4}$ NE $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Approved APD
CCU #43-12	NE $\frac{1}{4}$ SE $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Approved APD
CCU #44-12	SE $\frac{1}{4}$ SE $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Approved APD
CCU #12-7	Lot 6 (SW $\frac{1}{4}$ NW $\frac{1}{4}$) (7, T16N-R91W)	W-48862	Application
CCU #13-7	Lot 7 (NW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	W-48862	Application
CCU #14-7	Lot 8 (SW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	W-48862	Application
DBLE #24-7	SE $\frac{1}{4}$ SW $\frac{1}{4}$ (7, T16N-R91W)	W-131275	Application
DBLE #33-7	NW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	W-131275	Application
DBLE #34-7	SW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	W-131275	Application
DBLE #43-7	NE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	W-131275	Application
DBLE #44-7	SE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	W-131275	Application
ARW #1	SE $\frac{1}{4}$ NW $\frac{1}{4}$ (12, T16N-R92W)	C-075345A	Application

The wells operated by Double Eagle are located on federal oil and gas leases C-07345B, C-075345A, W-48862 and W-131275. Lease WYW-131275 has a time stipulation from February 1st to July 31st for sage grouse and raptor nesting. All locations are covered within the area of wildlife analysis completed by Hayden-Wing and Associates for PEDCO/Warren Resources in Spring 2001. From that study, the only wildlife concern in the immediate area are a 2-mile buffer from a sage grouse lek and prairie dog town. The sage grouse lek will be addressed with a timing stipulation and the prairie dog town was addressed by moving locations and access routes a sufficient distance from the site. Block cultural surveys have been conducted on each location and applicable right-of-ways. All of these concerns identified by these studies can be easily be addressed without mitigation while staking the locations.

The drilling of the above locations will determine whether coalbed methane gas production is possible and economic. The coal seams targeted in the Cow Creek Area and Pod #6 will be the Mesaverde formation coals. Drilling locations are spaced on 40 acre spacing. This spacing is viewed by Double Eagle initially as the most warranted spacing since this area has only one (1) producing CBM well and therefore no reliable reservoir data exists to date. BLM's Reservoir Management Group identified The Cow Creek Pod or Pod #6 as having the only well testing coalbed methane in the proposed EIS area and "having the best economic coalbed methane potential due to its structural location".

These comments and others lead BLM to specify this area as the only one which would be allowed to discharge production water onto the surface. This discharge would be under a National Pollution Discharge Elimination System (NPDES) permit issue by the Wyoming Department of Environmental Quality (DEQ). Double Eagle is currently applying for a NPDES permit from the Wyoming Department of Environmental Quality which is designed to not increase impacts to the drainage

APPENDIX C-1: MASTER SURFACE USE PLAN

basin and to explore alternative methods of containment and disposal of produced water. The NPDES permit will be discussed further in this Plan and is attached to the Water Management Plan which accompanies the APDs for each well.

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 connection or for authorization from the Wyoming DEQ for temporary or permanent surface water discharge permits and/or approval of sundry notices by the BLM for production activities and facilities.

All gas production and water production from Double Eagle operated wells will flow in underground pipelines to a Central Delivery Point (CDP) facility. The CDP will be located at the CCU #1X-12 wellsite in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 12, Township 16 North, Range 92 West. Once gas production enters the CDP it will be metered, compressed and sold into an existing third party gas sales lying beneath the CDP. Production water will enter the CDP and flow into an existing settling pond. From the pond, the water will be addressed in several ways as defined and approved by the Wyoming DEQ under the NPDES permit.

1. Existing Roads

- A. Access to the Cow Creek Area wellsites is obtained by road traveling approximately 38 miles South of Creston Junction, Wyoming. From the intersection of Interstate 80 and Highway 789 (Creston Junction Exit), proceed south toward Baggs, Wyoming on Highway 789 for approximately 31 miles to Dad, Wyoming. Turn left (east) at Dad and follow the main road for approximately 3 miles where the road forks. Take the left fork and continue on for 2 miles to the Cow Creek 1X-12 wellsite and Battery. This site will become the Central Delivery Point (CDP) of all Double Eagle wells discussed under the Master Surface Use Plan. For further reference, please see the area and topographic maps in the individual well Application for Permit to Drill (APDs) for the location of each well, access route and location of nearby roads.
- B. The existing roads are shown on an enclosed map. Existing roads will be maintained in as good or better condition than they now exist. All equipment and vehicles will be confined to these travel corridors and other areas specified in the plan of development.

2. Proposed Access Roads to be Constructed

- A. No new main roads will be needed to access wells in this program as existing two-track roads are already present and will represent the main corridors for access to the wellsites. However, new ancillary roads branching off these main roads to each location for access and utility trenches will require construction and are discussed later in the Plan. Each roadway access route will be 16 feet in width and be a dirt road which is crowned and ditched following the general terrain. Drainage crossings

APPENDIX C-1: MASTER SURFACE USE PLAN

on the access routes will be constructed as low water crossings or with installation of culverts. Low water crossings will be employed in gentle sloping terrain as opposed to culverts which will be used in steeper terrain. Drainage structures will be designed to pass all naturally occurring mean flows.

- B. After wells are completed and equipment is installed, travel to wells will normally be limited to one visit per day. A light truck or utility vehicle will be used to check on operations, read meters, and provide light service during the life of the project. The integrity of all discharge facilities would be checked during these wellsite visits in addition to monitoring compliance with the NPDES permit, and ensure that all discharges occur only as planned and authorized. Well service trips could be rescheduled or postponed during periods of wet weather when vehicle travel could cause rutting.
- C. If wells are productive, the portions of access routes that provide access to the CDP facility will be upgraded to an all weather road to provide year around service. Road up-grading will consist of graveling the road way with scoria material that is acceptable to the surface owner. Culverts and other road drainage control structures will be installed at specific locations as specified by the landowner.
- D. All equipment and vehicles will be confined to these travel corridors and other areas specified in the plan of development.

3. Location of Existing Wells

All existing wells or locations known within one mile of the proposed Double Eagle locations are shown on the area and topographic maps in the individual well Application for Permit to Drill (APDs) for the location of each well.

- A. Water Wells: One, Non Producing
- B. Abandoned Wells: Eleven
- C. Temporarily Abandoned Wells: None
- D. Disposal Wells: None
- E. Drilling Wells: None
- F. Producing Wells: Two
- G. Completing Wells: None
- H. Shut In Wells: Three

APPENDIX C-1: MASTER SURFACE USE PLAN

I. Injection Wells: None

J. Monitoring or Observation Wells: None

K. Proposed or Permitted Wells: 25

4. Existing and/or Proposed Facilities if Well is Successful

- A. There are no existing facilities on the wellsite locations.
- B. A graded wellpad with the dimensions of 180 feet by 200 feet will be constructed at the wellsite. A portion of these areas will be reclaimed and reseeded after drilling and completion operations are completed. All areas will be reclaimed and reseeded after operations are completed
- C. During operations, surface facilities at the wellsite will consist of a wellhead and insulated wellhead cover in an area approximately 10 feet by 10 feet. An area with the dimensions of 100 feet by 100 feet will not be reclaimed as such is needed for servicing the well. Each wellbore will have a pump installed to pump water from the coal formation thereby allowing for the release and production of natural gas. Exposed surface facilities will be painted Carlsbad Cavern colors approved by BLM.
- D. Two buried pipelines and one buried power cable, each appropriate in length to travel the distance from each wellsite on the defined access routes to the CDP will be installed between the well location and the CDP as shown on the enclosed map. The pipelines and power cable will be installed in the same trench. Each trench will 4 feet deep to prevent freezing of pipelines. The pipelines will be constructed of HDPE or steel pipe. One pipeline will transport the produced water and the other will transport the gas. A backhoe or small trencher will be utilized to dig the trench(s) thus, surface disturbance will be minimized.

5. Location and Type of Water Supply

Water for drilling, completing and dust control of the proposed wells will be obtained from the settling pond at the CDP located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 12, T16N, R92W. The water in the settling pond is production water from the CCU #1X-12 well. Water will be hauled by truck to the well locations over existing roads. Water volumes used in the operations is dependent upon the depth of the well and the losses that might occur during the operation.

APPENDIX C-1: MASTER SURFACE USE PLAN

6. Construction Materials

No construction material will be needed for drilling purposes. There are no plans to use any federally owned material, but should that become necessary, the required approvals will be obtained prior to use. Construction and drilling activity will not be conducted using frozen or saturated soil material or during periods when watershed damage or excessive rutting is likely to occur. If production is established, gravel will be purchased from a local supplier and the material will be spread on the roadway for it to maintain all weather travel to the CDP facility.

7. Methods of Handling Waste Disposal

- A. All wastes that accumulate during the drilling operations will be contained in a trash cage that is fenced and completely enclosed with a fine wire mesh, and will be removed from the location and deposited in an approved sanitary landfill. Immediately after removal of the drilling rig, all garbage and debris on the site will be removed from the site. The reserve pit will not be utilized for trash disposal. All state laws and regulations pertaining to containment and disposal of human waste will be complied with.
- B. Double Eagle and its contractors shall ensure that all use, production, storage, transport and disposal of hazardous and extremely hazardous materials associated with the drilling, completion and production of wells, and project operations will be in accordance with all applicable existing or hereafter promulgated federal, state and local government rules, regulations and guidelines.
- C. For the protection of livestock and wildlife, all pits will be fenced “stock tight” and any pits containing toxic liquids will be netted with 2" mesh netting.
- D. Cuttings and drilling fluids shall be put in the reserve pit during drilling. A wire fence will be installed around the pit during drilling and after the drilling rig leaves. There will be no oil, salt water or other noxious fluids produced during drilling and completion operations.

8. Ancillary Facilities

It is anticipated that there will be a maximum of three (3) trailers on location during drilling and completion operations. Upon conclusion of the operations, the trailers or other facilities will be removed from the site.

APPENDIX C-1: MASTER SURFACE USE PLAN

9. Wellsite Layout

- A. Please refer to the diagrams attached to the individual APDs or the Master Drilling Plan that shows each drill pad orientation with cuts and fills. Location dimensions are surveyed as 200' by 180' maximum area. However, the amount of area actually used for the drillsite will be dependent on the drilling rig used. The only grading of the wellsite will be the part of the location where the drilling rig and ancillary facilities are positioned. Within the location dimension, a temporary pit will be excavated measuring 15 feet wide and 15 feet long and 12 feet deep. The estimated life of the pit will be 2-3 weeks to allow for evaporation of pit fluids and will be reclaimed after completion operations. The pit will be fenced "stock tight" to prohibit livestock and wildlife from falling into it.
- B. Where grading occurs, the top 6 inches of soil material will be removed from the location, including areas of cuts, fill and subsoil storage areas, and will be stockpiled at the site. If ground frost prevents the segregation and removal of the topsoil material from the less desirable subsoil material, cross-ripping to the depth of the topsoil material will be completed as necessary.
- C. Care will be exercised to make certain that soil material and overburden will not be pushed over side-slopes or into drainages. All soil material disturbed will be placed in an area where it can be retrieved.
- D. If there is snow on the ground when construction begins, it will be removed before the soil is disturbed, and it will be piled downhill from the topsoil stockpile location.
- E. The backslope and foreslope will be constructed no steeper than 1.5:1. The reserve pit will be constructed with a minimum of one-half ($\frac{1}{2}$) the total depth below the original ground surface on the lowest point within the pit.
- F. The reserve pit will be fenced stock-tight on all sides when the well is suspended, completed or abandoned.
- G. The reserve pit will be oriented to prevent collection of surface runoff. The pad will be constructed in such a manner as to prevent water from draining across the pad.
- H. Block cultural surveys have been conducted on all locations and utility right-of-way corridors and have identified no negative impact from the proposed operations. However, if in connection with construction operations, the lessee/operator, his contractors, subcontractors, or the employees of any of them discover, encounter or become aware of any objects or sites of cultural value on the affected area, such as historical or prehistorical ruins, graves or grave markers, fossils, or artifacts, the lessee/operator shall immediately suspend all operations in the vicinity of the cultural value and notify the BLM Authorized Officer of the findings. Operations may

APPENDIX C-1: MASTER SURFACE USE PLAN

resume at the discovery site upon receipt of written instruction and authorizations by the Authorized Officer, Bureau of Land Management.

10. Plans For Reclamation of the Surface

A. Reclamation procedures whether the well is completed as a successful production well or as a dry hole:

1. Rat and mouse holes if present will be filled immediately upon release of the drilling rig from the location.
2. All garbage, trash and debris will be removed and properly disposed of in accordance with paragraph number 7 of this Plan entitled Methods of Handling Waste Disposal.
3. The liquid contents of the reserve pit may be hauled to the next well to be immediately drilled or will be allowed to dry before backfilling, or pit fluids will be removed and disposed of in a manner approved by the Authorized Officer of the BLM before the reserve pit is backfilled.
4. All rehabilitation work, including seeding, will be completed within one(1) year of completion of the operation. The areas not needed for production purposes will be recontoured, top soil respread and seeded utilizing the seed mixture provided by the surface management agency.
5. All pits will be closed within 90 days after completion of operations or when the pit has dried out sufficiently to permit reclamation, but no case longer than one year after completion of operations without an extension approved by BLM.

B. Additional reclamation procedures if the well is completed as a dry hole:

1. A Notice of Intent to Abandon and Subsequent Report of Abandonment will be submitted to BLM for approval. A Final Abandonment Notice will be submitted when the rehabilitation is complete and the new vegetation is established.
2. An above-ground tubular metal dry-hole marker will be erected over the drill-hole location upon cessation of drilling and/or testing operations. The marker will be inscribed with the operator's name, well number, well location (¼ ¼, section, township, range, etc.) and federal lease number. Upon request of the surface management agency, the casing may be cut-off-three (3) feet below

APPENDIX C-1: MASTER SURFACE USE PLAN

reclaimed ground surface (or below plow depth) with a metal plate affixed to the top providing the same well information as stated above. This monument will consist of a piece of pipe not less than four inches in diameter and ten feet in length, of which four feet shall be above the general ground level and the remainder being imbedded in cement. The top of the pipe will be closed by a welded or screw cap, cement or other means.

3. All disturbed areas will be restored as nearly as possible to resemble the surrounding terrain. Topsoil will be respread and reseeding will be done according to the directions of the surface management agency. Care will be taken to prevent erosion.

C. Additional reclamation procedures if the well is completed as a producing well:

1. Those disturbed areas not required for production operations will be recontoured to resemble surrounding terrain. No depressions will be left that trap water or form ponds.
2. The backslope and foreslope will be reduced to 2.5:1 by pulling fill material up from the foreslope and placing it into the toe of cut slopes.
3. If warranted, water bars at least one (1) foot deep will be constructed on the contour with approximately two (2) feet of drop per 100 feet of water bar to ensure drainage, and will be extended into established vegetation. All water bars will be constructed with a berm on the downhill side to prevent the soft material from silting in the trench. Water bar spacing on the location will be midway between the top and bottom of the backslope, and midway between the top and bottom of the foreslope.
4. Topsoil will be distributed evenly over those areas not required for production, and will be reseeded as recommended by the surface management agency.
5. To maintain quality and purity, certified seed with a minimum germination rate of 80% and a minimum purity of 90% will be used, in a mix directed by the surface management agency.

11. Surface Ownership

The surface estate of the access roads, drillsites and pipeline routes covered by this Plan are managed by the BLM.

APPENDIX C-1: MASTER SURFACE USE PLAN

12. Other Information

An Environmental Assessment (EA) of the area covered by this Master Surface Plan is being prepared by Mr. Gary Holsan, P. O. Box 275, Thayne, Wyoming 83127. Once the document is completed it will be forwarded to BLM's office in Rawlins, Wyoming.

An in depth wildlife analysis has been conducted by Hayden-Wing Associates, P.O. Box 1689, Laramie, Wyoming 82073 in conjunction with the Atlantic Rim Environmental Impact Study. BLM has received a copy of this analysis.

All drillsite locations have been surveyed by a registered professional land surveyor.

Block cultural surveys for each quarter-quarter section where a wellsite, access road or pipeline route is located have been conducted by a BLM approved archeologist and is on file with BLM who will forward a copy of same to the State Historical Preservation Office (SHPO).

A Water Management Plan is attached to the Master Surface Use Plan that addresses how produced water will be handled during the testing and production of the CBM wells.

General factors on the area are described as follows:

- A. Topography – The wellsites located on generally flat terrain broken by small drainages. One (1) wellsite is situated on an abandoned wellsite. The main wellsite access route and one ancillary road are existing two-track roads.
- B. Soils – Soils in the area are sandy loam.
- C. Wildlife – Species present in the area include mule deer, antelope, rabbits, coyotes, fox, badgers, rodents and various birds.
- D. Vegetation – Species occurring within the area include mixed short grasses, low sagebrush, prickly pear cactus, phlox and creosote bush.
- E. Closest Residence – The closest residence to the proposed wellsite is approximately 4.6 miles to the southwest.
- F. Land use – The primary use of the subject land is livestock grazing and mineral production.

APPENDIX C-1: MASTER SURFACE USE PLAN

13. Lessee or Operator's Certification

Double Eagle Petroleum Company, hereby certifies that said company is authorized to conduct operations on the above described land under the terms and conditions of Federal Oil And Gas Leases C-075345A, C-075345B, W-48862, WYW-131275 and Unit W-109471X. Bond coverage pursuant to 43 CFR 3104 is provided by Double Eagle Petroleum Company. The applicable bond number is on file in the Wyoming State Office, BLM Bond No. WY3224, a statewide oil and gas lease bond in the amount of \$25,000.00.

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drillsites and access routes; that I am familiar with the conditions which presently 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 Double Eagle Petroleum Company and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved.

Double Eagle Petroleum Company

Name: _____
Stephen H. Hollis, President

Date: _____

APPENDIX C-2: Master Drilling Plan

Double Eagle Petroleum Company

P.O. Box 766
Casper, Wyoming 82602
(307) 237-9330

Cow Creek Area of Pod #6

Carbon County, Wyoming
June 15, 2001
Amended February 5, 2002

Double Eagle Petroleum Company is proposing the drilling of eight(8) exploratory coalbed methane (CBM) wells near and in the Cow Creek Unit or Pod #6 of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming.

The Atlantic Rim Environmental Impact Study will commence in 2001 and cover approximately 300,000 acres. The EIS is expected to take 18-24 months to complete. During the interim period before the EIS completion, the Bureau of Land Management will allow the drilling of up to 200 exploratory wells. Currently oil and gas operators have identified 9 areas or "Pods" where these exploratory wells will located.

The Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Statement allows for the drilling of 24 CBM wells in Pod #6 located in portions of Sections 12 of Township 16 North, Range 92 West and Sections 7, 17 & 18 of Township 16 North, Range 91 West, Carbon County, Wyoming. 10 wells located in Sections 8 and 17 of Township 16 North, Range 91 West will be operated by PEDCO/Warren Resources. The remaining 14 wells in Pod #6 will be operated by Double Eagle Petroleum. Of this total 14 wells, Double Eagle has two (2) existing wellbores, four(4) approved permits to drill and is proposing eight (8) additional locations. **This Master Drilling Plan focuses solely on those new proposed eight (8) locations to be operated by Double Eagle Petroleum.**

1. Wells to be covered by The Master Drilling Plan

<u>Well Name</u>	<u>Location</u>	<u>Survey</u>
CCU #12-7	Lot 6 (SW $\frac{1}{4}$ NW $\frac{1}{4}$) (7, T16N-R91W)	300 FWL/1,750 FNL
CCU #13-7	Lot 7 (NW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	500 FWL/2,400 FSL
CCU #14-7	Lot 8 (SW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	500 FWL/660 FEL
DBLE #24-7	SE $\frac{1}{4}$ SW $\frac{1}{4}$ (7, T16N-R91W)	660 FSL/1,650 FWL
DBLE #33-7	NW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	1,980 FSL/1,980 FEL
DBLE #34-7	SW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	660 FSL/1,980 FEL
DBLE #43-7	NE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	660 FEL/1,980 FSL
DBLE #44-7	SE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	600 FEL/660 FSL

APPENDIX C-2: MASTER DRILLING PLAN

2. Estimated Important Geological Markers

<u>Horizon</u>	<u>Drilling Depth</u>
Lewis Shale	Surface
Mesaverde	910'
Total Depth	1,500'

3. Estimated Depth of Anticipated Water, Oil, Gas or Minerals

<u>Formation</u>	<u>Drilling Depth</u>	<u>Remarks</u>
Mesaverde	910'	Oil, Gas or Water

4. Operator's Minimum Specifications for Pressure Control

- A. A BOP schematic of the blowout preventer equipment which will consist of 2000 psi W.P. Double Ram, Hydraulic Preventer is enclosed. All fill, kill lines will be 2000 psi W.P. 0-160' no pressure control. 160'-1,500' 2,000# system. Note: This well is proposed as a "Coal Bed Methane" (CBM) well. A number of CBM wells drilled in the area indicate that the maximum anticipated surface pressure will not exceed 250 psi thus the BOP will only be tested to 1,000 psi.
- B. Testing Procedures
1. Ram type preventers and associated equipment shall be tested to 1,000 psi. Pressure shall be maintained for at least 10 minutes, or until requirements of test are met, whichever is longer.
 2. Tests will be run at the time of installation, prior to drilling out of casing shoe, whenever any seal subject to test pressure is broken, and at least every 30 days.
 3. All casing strings will be pressure tested to 0.22 psi/ft or 1,500 psi (whichever is greater) prior to drilling the plug after cementing. Test pressure will not exceed 70% of the minimum internal yield of the casing.
- C. Accessories to BOP's include upper and lower Kelly cock valves with handles and floor safety valve, drill string BOP.
- D. An accumulator unit will be used that has sufficient capacity to close all the equipment on the stack. The accumulator unit will be located at the master accumulator and on the rig floor. Hydraulic controls will be located at the master accumulator and on the rig floor. Manual controls (hand wheels) will also be installed on the blind and pipe rams. Refer to the enclosed exhibit for the diagram of the "Accumulator System and Hydraulic Controls".

5. Casing and Cementing Program

APPENDIX C-2: MASTER DRILLING PLAN

- A. All new casing.
- B. Surface casing: 160' of 9-5/8", 36#/ft, J-55 STNC and cement to surface with 90 sacks of cement. Centralizers will be placed 5' off bottom of surface hole, and then one per joint. Cementing will consist of 90 sacks of Class G with 2% Calcium Chloride and 1/4 lb per sack of Flowcele with a weight of 15 lbs per gallon and a yield of 1.15 cubic feet per sack.
- C. Production casing: 1,500' of 7", 23#/ft, J-55, STNC, cemented with 225 sacks of cement. First Stage will consist of 125 sacks of Midcon 2 premium cement with a weight of 13 lbs per gallon and a yield of 2.0 cubic feet per sack. Second stage will consist of 100 sacks of Midcon 2 premium cement with a weight of 14.2 lbs per gallon and a yield of 1.59 cubic feet per sack. Anticipated top of cement is 400'.

6. Auxiliary Equipment

- A. A float will not be used.
- B. The pit will be monitored on a regular basis by a member of the drilling crew during the drilling of this well.

7. Mud Program

The mud system will consist of fresh water with appropriate weighting agents.

0' – 160' Fresh Water

160' – TD Fresh Water with weighting agents (9.0-12.0 lb fluids as dictated by hole conditions).

Note: An adequate supply of weighting agents will be on hand for the purpose of assuring well control.

8. Testing Logging and Coring Program

- A. The primary objective in this well is the Mesaverde Formation.
- B. No Drilling Stem Tests will be run.
- C. Logging: The following electrical logs will be run:
DIL/FDC/CNL – TD to surface casing
- D. Coring: the decision to collect cores will be determined based on drilling samples.

APPENDIX C-2: MASTER DRILLING PLAN

- E. Well completion and stimulation procedures will be determined following the evaluation of drilling results and open hole logs. A “Sundry Notice” will be submitted outlining the planned completion procedure at that time.

9. Abnormal Pressures or Temperatures

- A. No abnormal temperatures have been noted or reported in wells drilled in the immediate area, nor at the depths anticipated in this well. The estimated static surface pressure is 250 psi or less. Anticipated Mesaverde Coals and Water Sands to be slightly over pressured.
- B. No H₂S is anticipated.

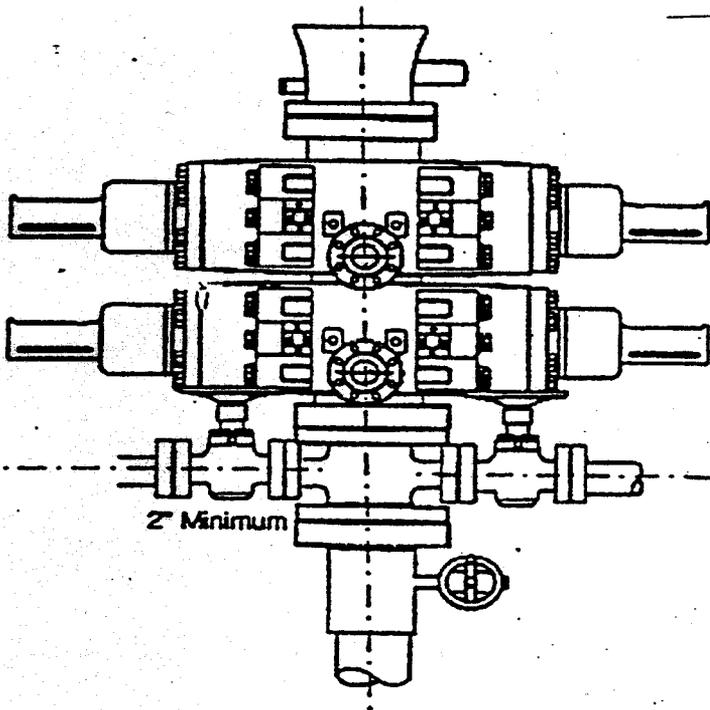
10. Starting Date and Duration of Operations

The anticipated starting date is approximately August 1, 2001. Each drilling and completion operation should be completed in 45 days after spudding the well.

APPENDIX C-2: MASTER DRILLING PLAN

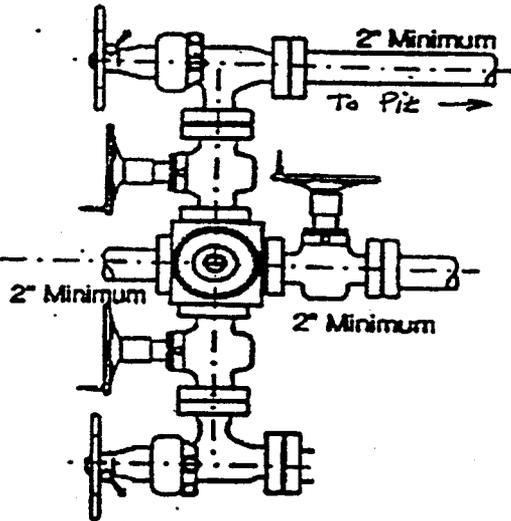
Double Eagle Petroleum Co.
Application for Permit to Drill
Cow Creek Unit Wells: 12-7, 13-7, 14-7, 24-7, 33-7, 34-7, 43-7, 44-7
Carbon County, Wyoming

BOP Schematic Diagram



2000 psi System

SIMPLE CHOKE SYSTEM



TYPICAL CHOKE MANIFOLD ASSEMBLY

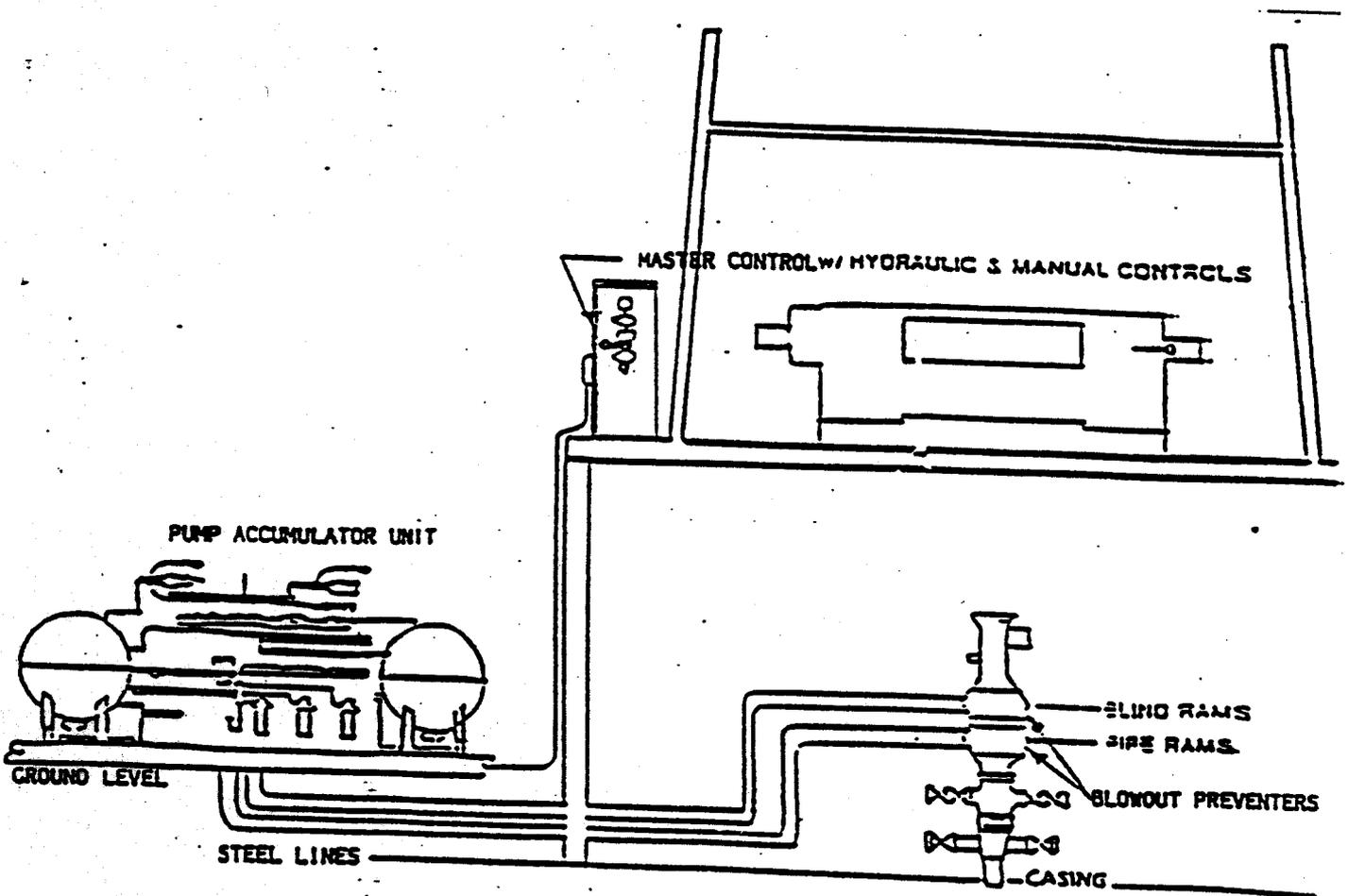
(Threaded or Flanged Connectors)

NOTE: COAL BED METHANE / WATER (CBM) WELL
Test Pressures will be limited to 1000 psi

APPENDIX C-2: MASTER DRILLING PLAN

Double Eagle Petroleum Co.
Application for Permit to Drill
Cow Creek Unit Wells: 12-7, 13-7, 14-7, 24-7, 33-7, 34-7, 43-7, 44-7
Carbon County, Wyoming

BOP ACCUMULATOR SYSTEM & HYDRAULIC CONTROLS



APPENDIX C-3: WATER MANAGEMENT PLAN

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WATER MANAGEMENT PLAN

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**DOUBLE EAGLE PETROLEUM AND
MINING COMPANY**

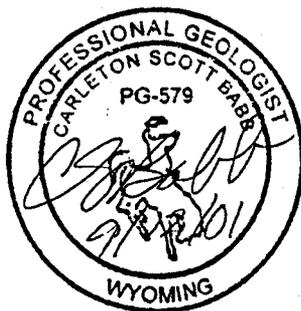
COW CREEK CBM PROJECT

**SECTIONS 12 & 13, T16N-R92W
SECTION 7, T16N-R91W
CARBON COUNTY, WYOMING**

WATER MANAGEMENT PLAN

Prepared for Double Eagle Petroleum & Mining Company

**Prepared by Carleton S. Babb, PG
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307:234-7376
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September 12, 2001**



DOUBLE EAGLE PETROLEUM & MINING COMPANY

COW CREEK CBM PROJECT T16N-R91& 92W Carbon County, Wyoming

WATER MANAGEMENT PLAN

Well Locations – Geographic Setting

Double Eagle Petroleum & Mining Company (DE) has proposed the development of their Cow Creek Unit and Pod #6 tracts of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming for Coal Bed Methane. The project will consist of 14 producing wells located in Sections 12 & 13, T16N-R92W and Section 7, T16N-R91W, Carbon County, Wyoming. The wells are initially on 40-acre spacing. There are two existing wells, four wells presently being drilled and eight proposed wells. Well details are presented in Table 2. The wells are also posted on Map 1. There will be one well at each surface location, each completed in the Mesaverde Coals. Six wells are permitted to discharge up to 125 gpm (4300 bpd, 0.28 cfs) of produced water into a Class 4 tributary to Dry Cow Creek, thence to the Little Snake River Conservation District (LSRCD) reservoir in Section 13, T16N-R92W. The balance of the produced water will be diverted to a new, off-channel reservoir and an aquifer recharge well. Estimated initial water production is 29 gpm per well. The total initial production from 14 wells will be approximately 409 gpm (0.91 cfs, 14,000 bpd). The water will be totally contained within the project area. A NPDES discharge permit has been obtained from the Wyoming Department of Environmental Quality utilizing DEQ Guideline Option 2 with one discharge point and one point of compliance.

The terrain consists of semi-arid to arid, relatively flat rangeland with occasional ridges composed of sandstone outcrops. Existing drainages are generally entrenched, but stable. The project tributaries discharge to Dry Cow Creek (Class 4), which, in turn, joins Cow Creek (Class 4), which joins Muddy Creek (Class 3), thence, the Little Snake River (Class 2). The project is approximately 40.5 stream miles from the Little Snake River.

The Cow Creek CBM project is a pilot project designed to test the economic and operational feasibility of methane recovery from the Mesaverde coals in the Green River basin. The project also presents the opportunity to test different options for handling the associated produced water. The project will generate valuable, site-specific data for use in planning and evaluating future development in the area. DE's 1X-12 well is the only CBM well presently producing to sales within the 310,000 acre Atlantic Rim EIS.

APPENDIX C-3: WATER MANAGEMENT PLAN

Watershed Delineation

The watershed impacted by this project is the unnamed tributary to Dry Cow Creek, referenced to the outlet of the LSRCD Reservoir in section 13. This drainage basin covers an area of 4.3 square miles. The watershed is shown on Map 1. The basin slope calculated for this watershed is 467 ft/mi.

Produced Water – Project Related

The project wells are expected to initially produce CBM water at the rate of 29 gpm (0.065 cfs, 1000 bpd) each. The total production for the 14 wells will be approximately 409 gpm (0.91 cfs, 14,000 bpd). The water production is expected to decline at an annual rate of 30 to 50% per year. Decline rates of 30 to 70% have been observed in the Powder River Basin CBM wells.

Table 1 presents the water quality analysis dated 7/27/00 for the 34-12 well completed in the Mesaverde Coals. The project wells are expected to produce water of similar quality. A summary of the produced water quality is as follows:

Total dissolved solids @ 180°C	1740 mg/l
Specific conductance @ 25°C	2770 umhos/cm
pH	8.33 su
Sulfate	<1.0 mg/l
Chloride	102 mg/l
Sodium adsorption ratio	60.7
Total radium 226	1.6 pCi/l
Total petroleum hydrocarbons	<1.0 mg/l
Dissolved iron	<30 ug/l
Total barium	920 ug/l
Total manganese	<10.0 ug/l
Total arsenic	0.50 ug/l

Table 2 lists the project well locations, discharge point and point of compliance. Existing wells are noted with an * and wells now being drilled with **. The Water Management Map (Map 1) also shows the locations of the proposed wells, discharge point and point of compliance.

Produced Water – Non-Project Related

Existing Wells

There are currently no non-project, producing CBM wells within the project watershed. There are two stock-water wells in the immediate vicinity of the project. The Cow Creek Unit 3-12 is located in the NW SE Section 12, T16N-

APPENDIX C-3: WATER MANAGEMENT PLAN

R92W. The well is owned by the BLM. It is plugged back to water zones at 934' to 1063'. The well is presently shut in. The second well is the J.O. Well 1 located in the NW NW Section 22, T16N-R91W; this is three miles east of the nearest DE proposed well. The well is owned by the BLM and is plugged back to 3000'. Water production is from an unknown interval. This is a flowing well, with water running into a low-lying area and reservoir, thence directly into Cow Creek.

The first well is completed in a zone above the Mesaverde coals and below the Lewis sands. Sufficient sealing facies should exist to isolate the producing zone in the water well from CBM activities. Given that the second well is located three miles east of the project area and regional geologic dips are westerly, it should not suffer any adverse impact from CBM production.

Potential Development

It is anticipated that additional leases within the project watershed will be developed in the future. A maximum development scenario for the drainage basin is 34 wells on 80-acre spacing with one well per location. This includes the 14 project wells. The total produced water discharged into this drainage at full development would be approximately 993 gpm or 2.2 cfs (34,000 bpd). This is a worst case scenario, assuming instantaneous full development, no production decline and no storage or conveyance loss. The actual development of this watershed will include all of these factors, which will result in a lower value for the actual full development water discharge rate.

Discharge Point Siting

The proposed pilot project will use one discharge point and one point of compliance (POC). These locations are listed in Table 2 and shown on Map 1. The discharge point is located in an established, ephemeral tributary of Dry Cow Creek. Up to 125 gpm (4300 bpd, 0.28 cfs) of produced water will be discharged to the unnamed tributary into the existing LSRCD Reservoir. The balance of the produced water will be diverted to a new, off-channel reservoir and an aquifer recharge well. The discharge point location has been developed in cooperation with the landowner and grazing lessee in the project area. Figure 1 is a diagram of the existing outfall.

No existing headcuts have been observed in drainages that will receive CBM water.

APPENDIX C-3: WATER MANAGEMENT PLAN

Mean Annual Flows

Mean annual flows were estimated for the project watershed above the LSRCD Reservoir (Table 3). These estimates were made using the Basin Characteristics Method and both area and channel widths (Lowham 1988). The input data are also shown in Table 3. The mean annual flows range from 0.07 to 0.12 cfs for this watershed. For comparison, the maximum initial project CBM flow will be approximately 0.91 cfs from 14 wells. However, the approved NPDES permit only allows 125 gpm (4300 bpd, 0.28 cfs) of discharge to the unnamed tributary into the existing LSRCD Reservoir.

Peak Flows

Peak flows were computed for the project watershed. Estimates were made using Lowham's Basin Characteristics Method. Peak flow estimates and input data are presented in Table 3. Peak flows range from $P_2 = 68.4$ cfs to $P_{500} = 1350$ cfs. The respective P_{10} and P_{25} values are 272 and 448 cfs. The P_{10} and P_{25} values were converted to 63.3 cfs/sq mi and 104 cfs/sq mi, respectively for use in culvert sizing. The maximum initial CBM flow for the 14 project wells is expected to be approximately 0.91 cfs and 2.2 cfs for full development of the watershed. If the P_{25} peak flow of 448 cfs is sustained for one hour, it will generate a water volume of 37 ac-ft. Expected CBM flows are much less than estimated natural peak flows for this watershed.

Channel Capacity

Channel capacity and respective velocity were estimated for this project at the discharge point using the Manning Equation. Input and results are presented in Table 3. Estimates were made for maximum channel capacity and water depth for the maximum discharge for the project. Bank full channel width and depth are 8 feet and 5 feet, respectively. When bank full, this channel has a capacity of 169 cfs at a velocity of 4.2 ft/sec. The estimated maximum project CBM flow of 0.9 cfs will result in a water depth of 0.25 feet and a velocity of 0.9 ft/sec.

Colorado River Issues

Due to the interstate agreements limiting salt loading to the Colorado River watershed, the following limits have been placed on the Cow Creek CBM project by the Wyoming Department of Environmental Quality:

- DE is being given credit for previous permitted discharge and will be allowed to discharge up to 125 gpm (4300 bpd, 0.28 cfs) to the unnamed tributary into the existing LSRCD Reservoir; the actual water rate will be dependent on the

APPENDIX C-3: WATER MANAGEMENT PLAN

salt load – the NPDES permit allows the total discharge of up to 1.34 tons of salt per day

- DE must maintain a freeboard of 2.5 ft in the LSRCD reservoir to accommodate the runoff from a 25-year precipitation event (37.8 Ac-ft)
- A point of compliance (POC) must be established below the LSRCD Reservoir
- NPDES permit standards must be met at the POC
- In effect, all CBM water must be totally contained within the project area
- DE will utilize a new, off-channel reservoir and a permitted aquifer recharge well to store and dispose of the water in excess of the LSRCD Reservoir allowable.

Due to the westward geologic dips and hydrologic gradients in the project area, the depths of the Mesaverde coals at the project site and the presence of aquitards above the producing zones, there should be no adverse impacts to ground-water zones contributing flow to tributaries of the Colorado River. In fact, the policy of total containment will result in most of the produced water reentering the local hydrologic system via the processes of infiltration, evaporation and transpiration.

Facility Design

Road Crossings

Project roads will utilize existing roads and trails and also include some new trails. These roads are shown on Map 1 as dashed black and red lines. The terrain at the project site is generally low relief, and will only require 18-inch culverts.

Head Cuts

No head cuts have been observed in the drainage that will receive CBM water from the Cow Creek project. The one tributary receiving surface discharge will be monitored regularly for erosion. Any adverse impacts will be promptly mitigated by DE using best management practices.

Culverts

The locations for 17 new and existing culverts are posted on Map 1. An 18-inch culvert will be installed at each of the new locations.

Reservoirs

There is one existing reservoir within the project area (LSRCD). One new, off-channel reservoir will also be constructed. Table 4 lists the reservoirs, their

APPENDIX C-3: WATER MANAGEMENT PLAN

locations and specific reservoir data, including capacities. The reservoirs are also shown on Map 1. The new reservoir is documented in Figure 2 and will be permitted with the Wyoming State Engineer prior to commencing any construction activities. Total water losses for the two reservoirs are estimated at 400 and 200 gpm, respectively.

Aquifer Recharge Well

An aquifer recharge well will be installed at the aquifer recharge facility shown on Map 1. The recharge well will be drilled to approximately 400 ft and completed in the Lewis sands (Figure 3). The well diameter will be 5.5 inches. 200 ft of injection head should be available, which will allow the well to gravity-inject CBM water into the Lewis sands. Table 5 presents various injection rates for different transmissivities (T) and times (t). The maximum rate of 276 gpm (9464 bpd) would occur with $T = 3000$ gpd/ft and $t = 1$ day. A minimum rate of 36 gpm (1234 bpd) would occur with $T = 500$ gpd/ft and $t = 1460$ days (4 years). This well has been permitted with WDEQ and is being installed to gather site-specific data. The westward geologic dips and hydrologic gradients in the project area should carry the recharge water deeper into the basin.

Water Balance

Tables 6 & 7 are water balances run for the project with the initial rate of 29 gpm per well and no decline. Table 6 assumes water losses from the LSRCD reservoir, one off-channel reservoir and one recharge well. The result is an excess capacity of 639 ac-ft/yr (more outflow than inflow). An injection rate of 200 gpm was used for the recharge well. Precipitation is accounted for with the freeboard buffer in the LSRCD reservoir; the off-channel reservoir and recharge well are really not affected by precipitation.

The water balance in Table 7 demonstrates the effect of the limit on produced water being discharged to the LSRCD reservoir. This reduces the water loss available to the project, but still results in a net annual excess capacity of 193 ac-ft and total containment is still achieved.

If additional loss capacity is required, options include, but are not limited to:

- Installation of additional recharge wells
- Installation of additional off-channel reservoirs
- Evaporation enhancement using spray nozzles
- Recomplete an abandoned wellbore as either a recharge or disposal well.

APPENDIX C-3: WATER MANAGEMENT PLAN

Stock "Tanks"

No new stock watering stations will be installed at this project.

Erosion Control Plan

If any head cuts should develop due to CBM surface flow, the head cuts will be mitigated by cutting the profile slope back to 5:1 to 10:1, as appropriate. Side slopes will be 3:1. The active channel will be rip-rapped with coarse, crushed or native rock. Geofabric will be laid beneath the rock, if necessary. The area will then be reseeded.

Downstream Impacts

There are no downstream concerns that need to be addressed by DE. The CBM water discharged from this project will be contained within the project area. Since produced water will not leave the project area, there will be no downstream impacts. There is no irrigation from Dry Cow Creek or Cow Creek, both Class 4 waters downstream of the project. If produced water from this project should affect downstream areas, DE will work with the respective surface owners to mitigate any problems.

Monitoring

Each discharge point will be monitored monthly for the first year of operation. Inspectors will note the condition of the discharge point, check for evidence of erosion and schedule any remedial work, if required.

All dam outlets (spillways and pipes) will be checked quarterly, or after major storm events for the first year of operation. Inspectors will note the condition of the outlets, check for evidence of erosion and schedule any remedial work, if required.

Any stabilized head cuts will be inspected for signs of erosion or structural failure. Inspectors will note the condition and schedule remedial work, if required.

The channel and crossings on Dry Cow Creek, immediately below the project, will be inspected for signs of accelerated erosion due to the continuous flow of produced CBM water, if it occurs.

APPENDIX C-3: WATER MANAGEMENT PLAN

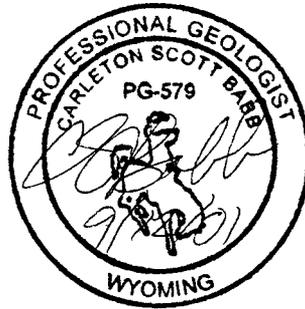
After the first year of operation, inspections will only occur annually, unless specific sites have required remedial action.

LESSEE'S OR OPERATOR'S REPRESENTATIVE AND CERTIFICATION

I hereby certify that I, or persons under my direct supervision, have inspected the watershed area(s) affected by our coal bed methane drilling and production plans; that I am familiar with the conditions that 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 operations proposed herein will be performed by Double Eagle Petroleum & Mining Company 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.

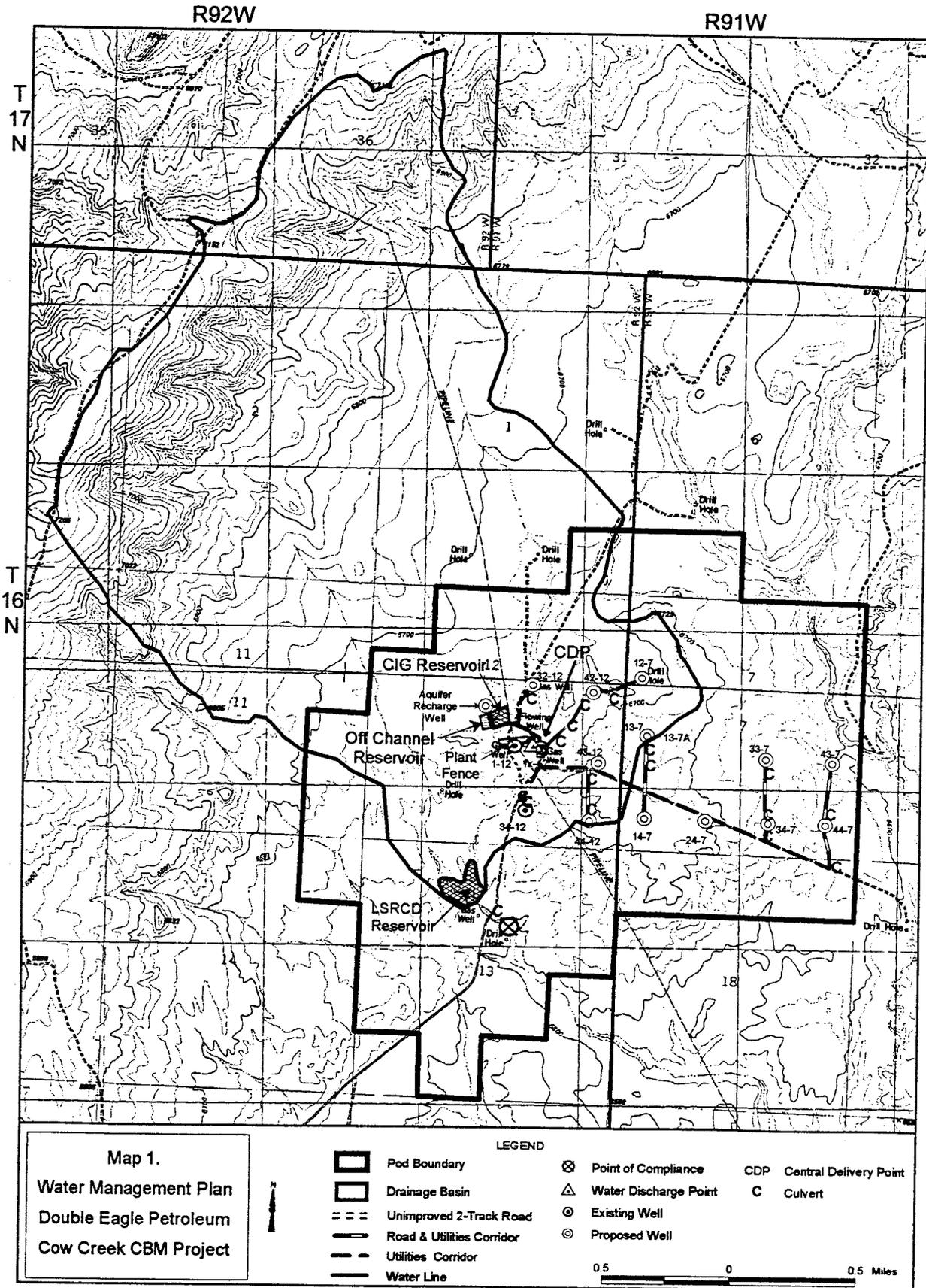
Date September 12, 2001

Name and Title Carleton S. Barb
Hydrogeologist



Double Eagle/cc wmp

APPENDIX C-3: WATER MANAGEMENT PLAN



OUTFALL TO LSRCD RESERVOIR

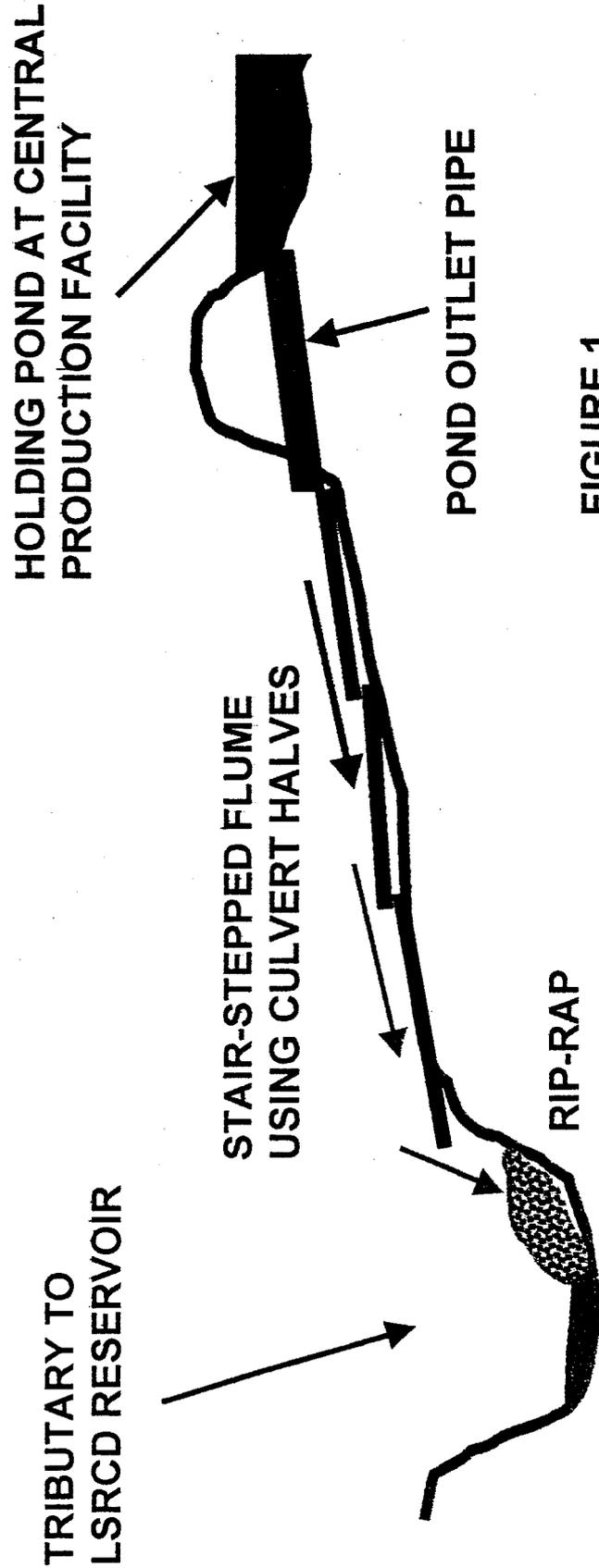


FIGURE 1

Double Eagle Petroleum
and Mining Company

Cow Creek CBM Project

DIAGRAMMATIC CROSS-SECTION
NOT TO SCALE

CSB 8/23/01

APPENDIX C-3: WATER MANAGEMENT PLAN

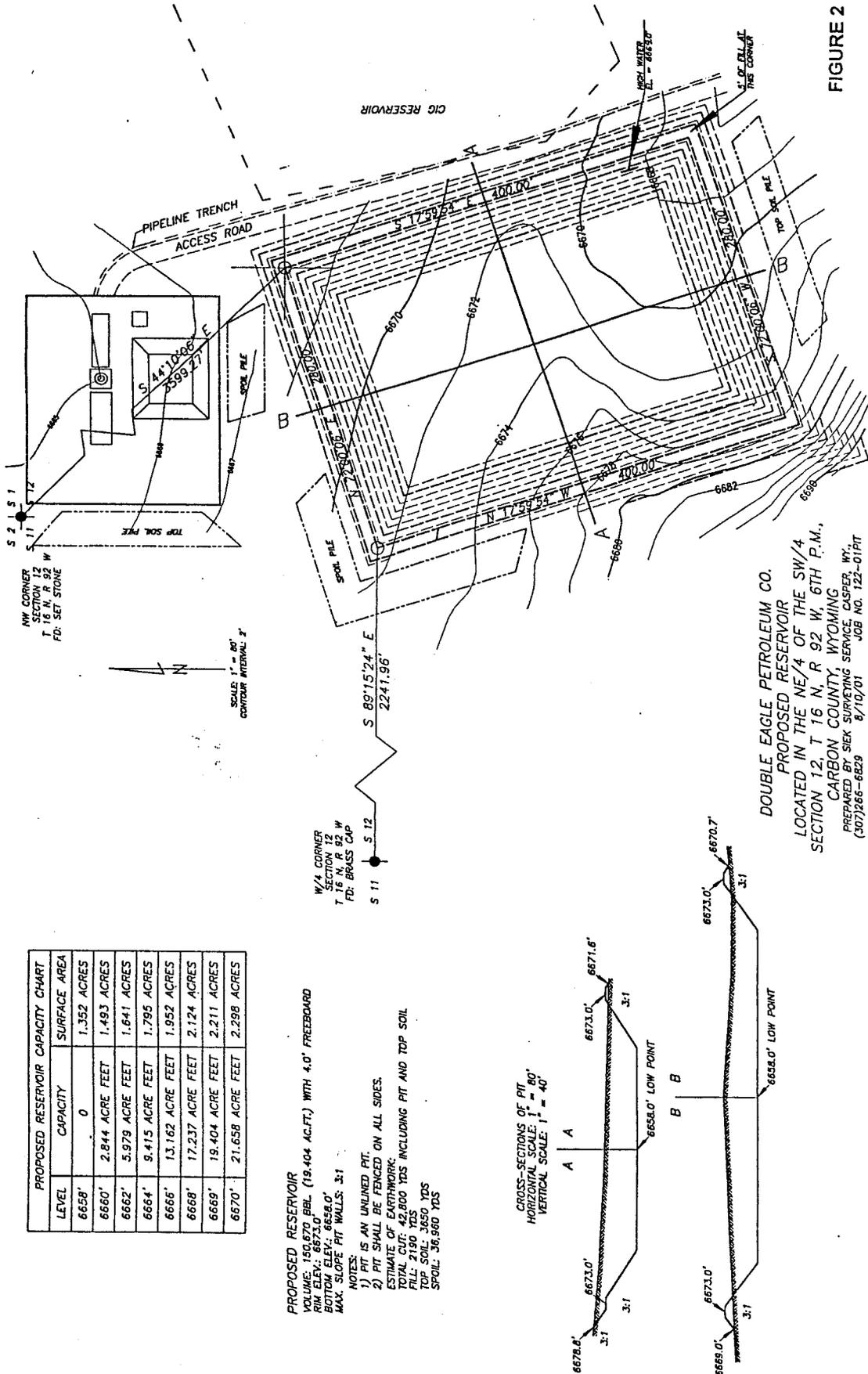


FIGURE 2

AQUIFER RECHARGE WELLS

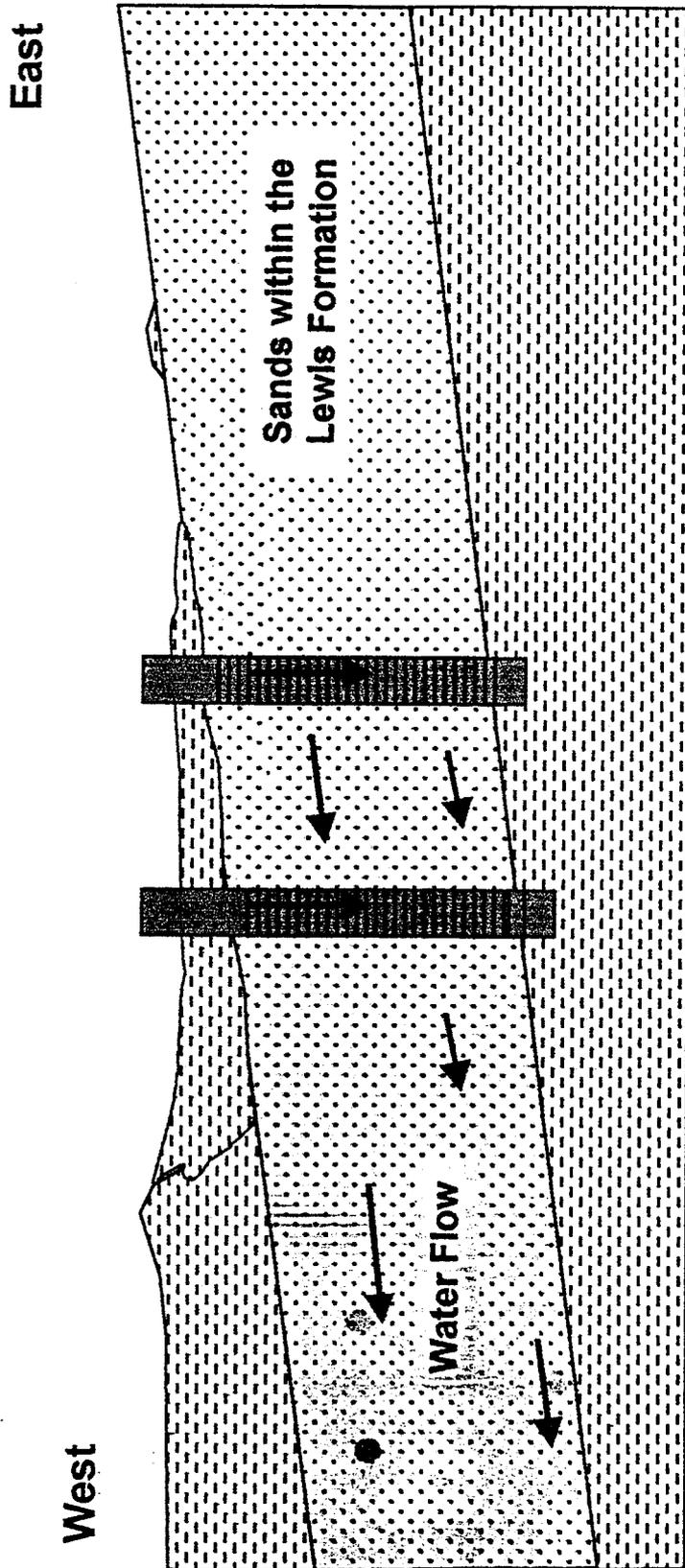


FIGURE 3
Double Eagle Petroleum
Cow Creek CBM Project

Not to Scale

CSB 8/23/01

HEAD CUT MITIGATION

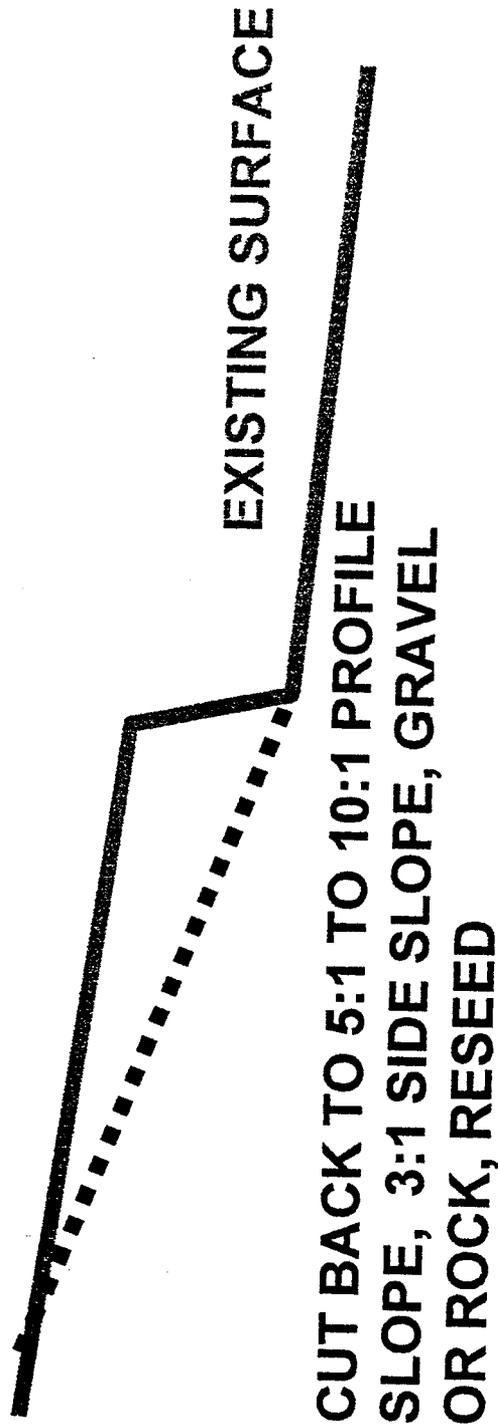
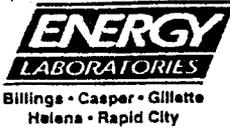


FIGURE 4

NOT TO SCALE

APPENDIX C-3: WATER MANAGEMENT PLAN



ENERGY LABORATORIES, INC.

SHIPPING: 2393 SALT CREEK HIGHWAY • CASPER, WY 82601
 MAILING: P.O. BOX 3258 • CASPER, WY 82602
 E-mail: energy@trib.com • FAX: (307) 234-1639
 PHONE: (307) 235-0515 • TOLL FREE: (888) 235-0515

TABLE 1

LABORATORY ANALYSIS REPORT	
Client: DOUBLE EAGLE PETROLEUM & MINING COMPANY Attention: Steve Degenfelder Project: CCU IX-12 Sample Matrix: Liquid, Water Sample ID: 34-12 Laboratory ID: 002-00-34698 Sample Date/Time: 07/27/2000 10:00 Date/Time Received: 07/27/2000 16:18 Report Date: August 16, 2000	Sampling Information Sample Type: DOUBLE EAGLE PETROLEUM & MINING COMPANY Company: Sampler: Steve Degenfelder NPDES Permit / Outfall #: Quarter Section: Section: Township: Range: CBM Database: Total Depth, ft. Well Elevation, ft.

Major Ions	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Calcium	4.8	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Magnesium	2.0	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Sodium	630	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Potassium	7.8	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Chloride	102	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Bicarbonate	1670	mg/L	1.0	SM 2320-B	08/03/00	14:49	lm
Sulfate	< 1.0	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal

Non-Metals	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Cyanide, total	< 5.0	ug/L	5.0	EPA 335.3	07/28/00	17:09	eli-b
Hardness as CaCO ₃	20.2	mg/L	10.0	EPA 200.7	08/03/00	9:07	jal
pH	8.33	std. units	0.01	SM 4500-H-B	08/03/00	14:49	lm
Phenol, total	40.0	ug/L	10.0	EPA 420.1	08/02/00		jl
Sodium Adsorption Ratio	60.7	mg/L	1.0	EPA 200.7	08/03/00	9:07	jal
Specific Conductance @ 25°C	2770	umhos/cm	1.0	SM 2510-C	08/01/00	10:56	jr
Total Dissolved Solids @ 180°C	1740	mg/L	1.0	SM 2540-C	08/01/00	13:48	jr
Total Petroleum Hydrocarbons	< 1.0	mg/L	1.0	EPA 418.1	07/25/00	10:43	mm

Trace Metals	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Aluminum, total	< 50.0	ug/L	50.0	EPA 200.7	08/03/00	9:07	jal
Antimony, total	< 5.0	ug/L	5.0	EPA 200.8	08/10/00	10:35	ts
Arsenic, total	0.50	ug/L	0.10*	EPA 200.8	08/07/00	17:10	eli-b
Barium, total	920	ug/L	100	EPA 200.7	08/03/00	9:07	jal
Beryllium, total	< 0.10	ug/L	0.10	EPA 200.8	08/07/00	17:10	eli-b
Boron, total	1070	ug/L	100	EPA 200.7	08/03/00	9:07	jal
Cadmium, total	< 0.10	ug/L	0.10	EPA 200.8	08/10/00	10:35	ts
Chromium, total	1.0	ug/L	1.0	EPA 200.8	08/10/00	10:35	ts
Copper, total	3.0	ug/L	1.0	EPA 200.8	08/03/00	9:07	jal
Iron, dissolved	< 30	ug/L	30.0	EPA 200.7	08/09/00	12:01	jal
Iron, total	310	ug/L	30.0	EPA 200.7	08/03/00	9:07	jal
Lead, total	< 2.0	ug/L	2.0	EPA 200.8	08/10/00	10:35	ts
Manganese, dissolved	< 10.0	ug/L	10.0	EPA 200.7	08/09/00	12:01	jal
Manganese, total	< 10.0	ug/L	10.0	EPA 200.7	08/03/00	9:07	jal
Mercury, total	< 0.10	ug/L	0.10	EPA 245.1 Mod.	08/07/00	17:10	eli-b
Nickel, total	< 10.0	ug/L	10.0	EPA 200.8	08/10/00	10:35	ts
Selenium, total	< 5.0	ug/L	5.0	EPA 200.8	08/10/00	10:35	ts
Silver, total	< 3.0	ug/L	3.0	EPA 200.8	08/10/00	10:35	ts
Thallium, total	< 10.0	ug/L	10.0	EPA 200.8	08/10/00	10:35	ts
Zinc, total	130	ug/L	10.0	EPA 200.7	08/03/00	9:07	jal

Radiochemical	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Radium 226	1.6	pCi/L	0.2	EPA 903.0	08/09/00		rs
Precision ±	0.2	pCi/L					

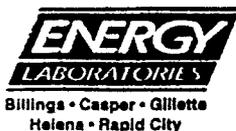
Quality Assurance Data	Target Range
Anion	meq
Cation	meq
SM A/C Balance	%
Cate TDS	mg/L
TDS A/C Balance	dec. %

* 0.10 ug/L is currently the lowest available detection limit for Arsenic.
 File: F:\wp\mchenna\2000\double_eagle_juvanimon\00ml\34498-2.xls

COMPLETE ANALYTICAL SERVICES

TRACKING NO. PAGE NO.
34698R00002

APPENDIX C-3: WATER MANAGEMENT PLAN



ENERGY LABORATORIES, INC.

SHIPPING: 2393 SALT CREEK HIGHWAY • CASPER, WY 82601
 MAILING: P.O. BOX 3258 • CASPER, WY 82602
 E-mail: energy@trib.com • FAX: (307) 234-1639
 PHONE: (307) 235-0515 • TOLL FREE: (888) 235-0515

LABORATORY ANALYSIS REPORT, TPH USING EPA 418.1 ANALYTICAL RESULTS

Client: Double Eagle Petroleum & Mining Co.
Project: CCU 1X-12
Matrix: Liquid - WATER

Date Sampled: 07-27-00
Time Sampled: 10:00
Date Received: 07-27-00
Date Reported: July 28, 2000

ANALYTE CONCENTRATION

Laboratory ID	Sample ID	Volume, mL	Absorbance	Dilution Factor	TPH Result, mg/L	Date, Time Analyzed
00-34698-2	34-12	975	0.008	1	< 1.0	07-28-00 10:44

Quality Assurance Report

Instrument Calibration 07/28/00:

Concentration, mg/L in Freon
 Concentration, mg/L if 1 liter sample
 Absorbance:
 Correlation Coefficient:
 Slope:
 Intercept:
 Analyst:

0	10	25	50	75	100
0	1.0	2.5	5.0	7.5	10.0
0.000	0.076	0.202	0.400	0.604	0.760

0.9991
 129
 -0.609
 mmc

QCS Sample Analysis (spike) 07/28/00 10:40:

Sample Number	Sample ID	Absorbance	Response	Expected Response	%	Date, Time Analyzed
QCS0728	QCS	0.372	4.74	5.00	94.8%	07-28-00 10:40
Acceptance Range:					75 - 125 %	

Method Blank:

Sample ID	Volume, mL	Absorbance	Dilution Factor	Result, mg/L	Date, Time Analyzed
MB0728A	1000	0.000	1	< 1.0	07-28-00 10:33

ND - Analyte not detected at stated limit of detection

METHODS USED IN THIS ANALYSIS:

EPA 418.1

ec: r:\reports\clients2000\double_eagle_petroleum\casper_org\34698-1-3_4181_l-w.xls

Analyst: mmc

COMPLETE ANALYTICAL SERVICES

TRACKING NO. PAGE NO.
 34698R00006

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 2

**DOUBLE EAGLE PETROLEUM & MINING COMPANY
COW CREEK CBM PROJECT**

WELL, DISCHARGE POINT, & POINT OF COMPLIANCE LOCATIONS

<u>Well</u>	<u>STR</u>	<u>Well Location</u> <u>Qtr/Qtr</u> <u>Lat-Long</u>	<u>API</u>	<u>Discharge</u> <u>Point</u>	<u>Receiving</u> <u>Stream</u>
CCU 1X-12 *	12-T16N-92W	NW SE 41.37107, 107.69301	49-007-05094	001	Tributary to Dry Cow Creek
CCU 34-12 *	12-T16N-92W	SW SE 41.36722, 107.69444	49-007-21601	001	Tributary to Dry Cow Creek
CCU 32-12 **	12-T16N-92W	SW NE 41.37467, 107.69493	49-007-21921	001	Tributary to Dry Cow Creek
CCU 42-12 **	12-T16N-92W	SE NE 41.37446, 107.69021	49-007-21919	001	Tributary to Dry Cow Creek
CCU 43-12 **	12-T16N-92W	NE SE 41.37107, 107.69070	49-007-21918	001	Tributary to Dry Cow Creek
CCU 44-12 **	12-T16N-92W	SE SE 41.36703, 107.69025	49-007-21920	001	Tributary to Dry Cow Creek
CCU 12-7	7-T16N-R91W	SW NW (Lot 6)		001	Tributary to Dry Cow Creek
CCU 13-7	7-T16N-R91W	NW SW (Lot 7)		001	Tributary to Dry Cow Creek

APPENDIX C-3: WATER MANAGEMENT PLAN

				Table 3
DOUBLE EAGLE PETROLEUM & MINING COMPANY				
COW CREEK CBM PROJECT				
BELOW COW CREEK RESERVOIR				
Sec. 12 & 13, T16N-R92W, Carbon County, Wyoming				
PEAK FLOWS (Lowham, 1988; Basin characteristics method - High Desert Region)				
Drainage Basin Area, sq mi		4.3		
Geographic Factor		1.1		
Basin Slope, ft/mi		467		
Average Annual Precipitation, inches		10.5		
P ₂	68.4	cfs		
P ₅	171	cfs		
P ₁₀	272	cfs	P ₁₀ = 63.3 cfs/sq mi	
P ₂₅	448	cfs	P ₂₅ = 104.2 cfs/sq mi	
P ₅₀	606	cfs		
P ₁₀₀	797	cfs		
P ₂₀₀	999	cfs		
P ₅₀₀	1350	cfs		
MEAN ANNUAL FLOW (Lowham, 1988)				
Location: POC				
Drainage Area, sq mi		4.3		
Avg. Annual Precipitation, in.		10.5		
Channel width, ft		8		
Mean Annual Flow, cfs (A&P)		0.12		
Mean Annual Flow, cfs (W)		0.07		
CBM FLOW				
Project: 14 wells @ 29 gpm/well = 406 gpm = 0.91 cfs				
CHANNEL CAPACITY (Manning Equation)				
		<u>Maximum</u>	<u>Project CBM only</u>	
width	ft	8	4	
depth	ft	5	0.25	
slope	ft/ft	0.0025	0.0025	
roughness		0.03	0.03	
velocity	ft/sec	4.2	0.9	
discharge	cfs	169.2	0.9	
cow ck hydro A				
			CSB	
			8/23/01	

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 4

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

RESERVOIR DATA

<u>RESERVOIR</u>	<u>HW AREA</u> acres	<u>MAX WTR</u> <u>DEPTH</u> feet	<u>AVG WTR</u> <u>DEPTH</u> feet	<u>CAPACITY</u> ac-ft
LSRCD	15.8	23	7.7	121
Recharge Facility	2.2	11	8.8	20

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 5

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

INJECTION RATES

SINGLE WELL GRAVITY INJECTION INTO LEWIS SANDS
200 FT MAXIMUM INJECTION HEAD (400 FT HOLE, 5 1/2 INCH DIAMETER)

SUMMARY OF MAXIMUM RATES, GPM/BPD
USING DIFFERENT TRANSMISSIVITIES & TIMES

TIME, DAYS	TRANSMISSIVITY, GPD/FT		
	3000	1000	500
1	276	98	51
365	9464	3360	1749
1460	211	73	38
	7235	2503	1303
	200	69	36
	6858	2366	1234

t and T summary A

CSB
8/6/01

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 6

**DOUBLE EAGLE PETROLEUM & MINING COMPANY
COW CREEK CBM PROJECT**

WATER BALANCE

AT LSRCD RESERVOIR

INFLOW excluding precipitation

<u># of wells</u>	<u>Formation</u>	<u>gpm/well</u>	<u>cfs/well</u>	<u>Total project flow (cfs)</u>	<u>Annual flow volume (cu feet)</u>	<u>Annual flow volume (acre-feet)</u>
6	Kmv coal	29	0.065	0.390	12291471	282
8	Kmv coal	29	0.065	0.520	16388628	376
14				0.909		658

OUTFLOW

<u>Reservoir</u>	<u>Capacity (acre-feet)</u>	<u>Estimated combined evaporation and seepage rate (gpm)</u>	<u>(cfs)</u>	<u>Estimated annual losses due to evaporation and seepage (acre-feet)</u>
LSRCD	120	400	0.896	649
Rechg. Reservoir	20	200	0.448	324
Subtotal	140			973
<u>Recharge Well</u>		200	0.448	324
Total Outflow				1297

OUTFLOW (acre-feet)	-	INFLOW (acre-feet)	=	EXCESS CAPACITY (acre-feet)
1297		658		639

cc wtr bal

CSB
8/23/01

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 7

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WATER BALANCE

AT LSRCD RESERVOIR

INFLOW excluding precipitation

<u># of wells</u>	<u>Formation</u>	<u>gpm/well</u>	<u>cfs/well</u>	<u>Total project flow (cfs)</u>	<u>Annual flow volume (cu feet)</u>	<u>Annual flow volume (acre-feet)</u>
6	Kmv coal	29	0.065	0.390	12291471	282
8	Kmv coal	29	0.065	0.520	16388628	376
14				0.909		658

OUTFLOW

<u>Reservoir</u>	<u>Capacity (acre-feet)</u>	<u>Estimated combined evaporation and seepage rate</u>	<u>Estimated annual losses due to evaporation and seepage (acre-feet)</u>
		<u>gpm</u> <u>(cfs)</u>	
Rechg. Reservoir	20	200 0.448	324
<u>Flow to LSRCD Res.</u>		125 0.28	203
<u>Recharge Well</u>		200 0.448	324
Total Outflow			851

OUTFLOW (acre-feet) 851	-	INFLOW (acre-feet) 658	=	EXCESS CAPACITY (acre-feet) 193
--------------------------------------	---	-------------------------------------	---	--

cc wtr bal

CSB
8/23/01

Appendix D

Plant and Wildlife Species of Concern that may potentially occur on or near the Cow Creek Pod.

Plant Species of Concern ¹					
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	G5T4?/ S1	moderate potential to occur along wet draws and riparian areas	moist clay soils; spring draws; associated with dense gramonoids and shrubs
Wolf's orache (<i>Atriplex wolfii</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>Descurania pinnata</i> ssp. <i>paysonii</i>)	Carbon, Laramie, Sweetwater	Regional Endemic	G5T3?/ S2	potential to occur within the vicinity of the 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, G5T1T 2/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

APPENDIX D: PLANT AND WILDLIFE SPECIES OF CONCERN

Plant Species of Concern ¹					
Species	Counties of Distribution	Wyoming Range	Status ²	Probability of Occurrence	Habitat
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 Cow Creek pod	stabilized sand dunes

APPENDIX D: PLANT AND WILDLIFE SPECIES OF CONCERN

Wildlife Species of Concern ¹		
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</i>	R4
Snowy plover	<i>Charadrius alexandrius</i>	R2, G4/S1B, S2?N
Burrowing owl	<i>Athene cunicularia</i>	R2, G4/S3B, SZN, SSC4
White-faced ibis	<i>Plegadis chihi</i>	R2, G5/S3B, SZN, NSS3
Long-billed curlew	<i>Numenius americanus</i>	R2, G5/S1B, SZN, NSS3
Brewer's sparrow	<i>Spizella breweri</i>	G5/S3B, SZN
Sage sparrow	<i>Amphispiza belli</i>	G5/S3B, SZN
Reptiles		
Smooth green snake	<i>Liochlorophis vernalis</i>	G5/S2
Amphibians		
Northern leopard frog	<i>Rana pipiens</i>	R2, G5/S3, NSS4
Great Basin spadefoot	<i>Spea intermontana</i>	G5/S4, NSS4
Boreal toad	<i>Bufo boreas boreas</i>	R2/R4, G4T4/S2, NSS2
Columbia spotted frog	<i>Rana pretiosa</i>	R2/R4, G4/S2S3, NSS4
Fish		
Roundtail chub	<i>Gila robusta</i>	G2G3/S2?, NSS1
Bluehead sucker	<i>Catostomus discobolus</i>	G4/S2S3, NSS1
Flannelmouth sucker	<i>Catostomus latipinnis</i>	G3G4/S3, NSS1
Colorado River cutthroat trout	<i>Oncorhynchus clarki pleuriticus</i>	G4T2T3/S2, NSS2, FSR2/R4

1 - Sources: Dorn 1992, Fertig and Beauvais 1999, WYNDD 2000 and 2001

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

APPENDIX D: PLANT AND WILDLIFE SPECIES OF CONCERN

- S1 Critically imperiled 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 Imperiled 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 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.
- BLM BLM-identified Special Status plants in the Great Divide Resource Area, Rawlins District.