FINDING OF NO SIGNIFICANT IMPACT & DECISION RECORD
FOR
Anadarko/Lance Oil & Gas
Rose Draw Unit Beta
ENVIRONMENTAL ASSESSMENT –WY-070-EA08-186

DECISION: Is to approve Alternative C as described in the attached Environmental Assessment (EA) and authorize Anadarko/Lance Oil & Gas's Rose Draw Unit Beta Coal Bed Natural Gas (CBNG) POD comprised of the following 30 Applications for Permit to Drill (APDs):

***Note:** The 34-22 and 33-23 APDs are pending a 30-day public posting period ending October 9, 2008.

	Well Name	Well #	Qtr/Qtr.	Sec	Twn	Rng	Lease #
1	RDU BETA LAWRENCE	14-13*	SWSW	13	52N	78W	WYW146355
2	RDU BETA LAWRENCE	34-14	SWSE	14	52N	78W	WYW146355
3	RDU BETA LAWRENCE	43-14	NESW	14	52N	78W	WYW146355
4	RDU BETA HEPP	23-19	NESW	19	52N	78W	WYW146356
5	RDU BETA HEPP	12-20	SWNW	20	52N	78W	WYW146356
6	RDU BETA LAWRENCE	14-21	SWSW	21	52N	78W	WYW146356
7	RDU BETA LAWRENCE	12-22	SWNW	22	52N	78W	WYW146356
8	RDU BETA LAWRENCE	14-22	SWSW	22	52N	78W	WYW146356
9	RDU BETA LAWRENCE	23-22	NESW	22	52N	78W	WYW146356
10	RDU BETA LAWRENCE	33-22	NWSE	22	52N	78W	WYW146356
11	RDU BETA LAWRENCE	34-22	SWSE	22	52N	78W	WYW146356
12	RDU BETA	14-23	SWSW	23	52N	78W	WYW146356
13	RDU BETA	23-23	NESW	23	52N	78W	WYW146356
14	RDU BETA	33-23	NWSE	23	52N	78W	WYW146356
15	RDU BETA	41-23	NENE	23	52N	78W	WYW146356
16	RDU BETA	43-23	NESE	23	52N	78W	WYW146356
17	RDU BETA	12-24	SWNW	24	52N	78W	WYW146356
18	RDU BETA LAWRENCE	14-24	SWSW	24	52N	78W	WYW146356
19	RDU BETA	21-24	NENW	24	52N	78W	WYW146356
20	RDU BETA	23-24	NESW	24	52N	78W	WYW146356
21	RDU BETA KNUDSON	32-24	SWNE	24	52N	78W	WYW146356
22	RDU BETA	34-24	SWSE	24	52N	78W	WYW146356
23	RDU BETA	43-24	NESE	24	52N	78W	WYW146356
24	RDU BETA LAWRENCE	44-30	SESE	30	52N	78W	WYW146360
25	RDU BETA HEPP	21-31	NENW	31	52N	78W	WYW146360
26	RDU BETA HEPP	23-31	NESW	31	52N	78W	WYW146360
27	RDU BETA FED	24-31	SESW	31	52N	78W	WYW146360
28	RDU BETA HEPP	32-31	SWNE	31	52N	78W	WYW146360
29	RDU BETA HEPP	33-31	NWSE	31	52N	78W	WYW146360
30	RDU BETA HEPP	41-31	NENE	31	52N	78W	WYW146360

The following impoundment locations were inspected and approved for use in association with the water management strategy for the POD.

	IMPOUNDMENT Name / Number	Qtr/Qtr	Sec	TWP	RNG	Capacity (Acre Feet)	Surface Disturbance (Acres)	Lease #
1	41-23-5278	NENE	23	52	78	14.9	2.5	WYW146319
2	42-23-5248	SENE	23	52	78	15	2.5	WYW146319
3	Pit 13-24-5278	NWSW	24	52	78	45	5.0	WYW146319
4	Pit 32-24-5278	SWNE	24	52	78	45	5.0	WYW146319

This approval is subject to adherence with all of the operating plans and mitigation measures contained in the Master Surface Use Plan of Operations, Drilling Plan, Water Management Plan, and information in individual APDs. This approval is also subject to operator compliance with all mitigation and monitoring requirements contained within the Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS) approved April 30, 2003.

RATIONALE: The decision to authorize Alternative C, as described in the attached Environmental Assessment (EA), is based on the following:

1. The Operator, in their POD, has committed to:
    - Comply with all applicable Federal, State and Local laws and regulations.
    - Obtain the necessary permits from other agencies for the drilling, completion and production of these wells including water rights appropriations, the installation of water management facilities, water discharge permits, and relevant air quality permits.
    - Offer water well agreements to the owners of record for permitted water wells within ½ mile of a federal CBNG producing well in the POD.
    - Provide water analysis from a designated reference well in each coal zone.
2. The Operator has certified that a Surface Use Agreement has been reached with the Landowner(s).
3. Alternative C will not result in any undue or unnecessary environmental degradation.
4. It is in the public interest to approve these wells, as the leases are being drained of federal gas, resulting in a loss of revenue for the government.
5. Mitigation measures applied by the BLM will alleviate or minimize environmental impacts.
6. Alternative C is the environmentally-preferred Alternative.
7. The proposed action is in conformance with the PRB FEIS and the Approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management (BLM), Buffalo Field Office, April 2001.

FINDING OF NO SIGNIFICANT IMPACT: Based on the analysis of the potential environmental impacts, I have determined that NO significant impacts are expected from the implementation of Alternative C and, therefore, an environmental impact statement is not required.

ADMINISTRATIVE REVIEW AND APPEAL: Under BLM regulations, this decision is subject to administrative review in accordance with 43 CFR 3165. Any request for administrative review of this decision must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this Decision Record is received or considered to have been received.

Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager:_____ Date: _____

BUREAU OF LAND MANAGEMENT
BUFFALO FIELD OFFICE
ENVIRONMENTAL ASSESSMENT (EA)
FOR
Anadarko/Lance Oil & Gas
Rose Draw Unit Beta
PLAN OF DEVELOPMENT
WY-070-EA08-186

INTRODUCTION

This site-specific analysis tiers into and incorporates by reference the information and analysis contained in the Powder River Basin Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS), #WY-070-02-065 (approved April 30, 2003), pursuant to 40 CFR 1508.28 and 1502.21. This document is available for review at the Buffalo Field Office. This project EA addresses site-specific resources and impacts that were not covered within the PRB FEIS.

1. PURPOSE AND NEED

The purpose for the proposal is to produce coal bed natural gas (CBNG) on 7 federal oil and gas mineral leases issued to the applicant by the BLM.

1.1. Conformance with Applicable Land Use Plan and Other Environmental Assessments:

The proposed action is in conformance with the terms and the conditions of the Approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Buffalo Field Office (BFO), April 2001 and the PRB FEIS, as required by 43 CFR 1610.5

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1. Alternative A - No Action

A No Action Alternative was considered in the PRB FEIS, Volume 1, pages 2-54 through 2-62. This alternative would consist of no new federal wells. 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 lease lands, "subject to the terms and conditions incorporated in the lease." Thus, under this alternative, the operator's proposal would be denied.

2.2. Alternative B Proposed Action

Proposed Action Title/Type: Anadarko/Lance Oil & Gas's Rose Draw Unit Beta Plan of Development (POD) for 32 coal bed natural gas well APD`s and associated infrastructure.

Proposed Well Information: There were 32 wells proposed within this POD; the wells are vertical bores proposed on an 80 acre spacing pattern with 1 well per location. Each well will produce from 1 coal seam. Proposed well house dimensions are 4 ft wide x 4 ft length x 4 ft height. Well house color is Covert Green, selected to blend with the surrounding vegetation. Proposed wells are located as follows:

***Note:** The 34-22 and 33-23 APDs are pending a 30-day public posting period ending October 9, 2008.

	Well Name	Well #	Qtr/Qtr.	Sec	Twn	Rng	Lease #
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3	RDU BETA LAWRENCE	43-14	NESW	14	52N	78W	WYW146355
4	RDU BETA HEPP	23-19	NESW	19	52N	78W	WYW146356
5	RDU BETA HEPP	12-20	SWNW	20	52N	78W	WYW146356
6	RDU BETA HEPP	12-21	SWNW	21	52N	78W	WYW153570
7	RDU BETA LAWRENCE	14-21	SWSW	21	52N	78W	WYW146356
8	RDU BETA LAWRENCE	12-22	SWNW	22	52N	78W	WYW146356
9	RDU BETA LAWRENCE	14-22	SWSW	22	52N	78W	WYW146356
10	RDU BETA LAWRENCE	23-22	NESW	22	52N	78W	WYW146356
11	RDU BETA LAWRENCE	24-22	SESW	22	52N	78W	WYW146356
12	RDU BETA LAWRENCE	33-22	NWSE	22	52N	78W	WYW146356
13	RDU BETA	14-23	SWSW	23	52N	78W	WYW146356
14	RDU BETA	23-23	NESW	23	52N	78W	WYW146356
15	RDU BETA	24-23	SESW	23	52N	78W	WYW146356
16	RDU BETA	32-23	SWNE	23	52N	78W	WYW146356
17	RDU BETA	41-23	NENE	23	52N	78W	WYW146356
18	RDU BETA	43-23	NESE	23	52N	78W	WYW146356
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22	RDU BETA	23-24	NESW	24	52N	78W	WYW146356
23	RDU BETA KNUDSON	32-24	SWNE	24	52N	78W	WYW146356
24	RDU BETA	34-24	SWSE	24	52N	78W	WYW146356
25	RDU BETA	43-24	NESE	24	52N	78W	WYW146356
26	RDU BETA LAWRENCE	44-30	SESE	30	52N	78W	WYW146360
27	RDU BETA HEPP	21-31	NENW	31	52N	78W	WYW146360
28	RDU BETA HEPP	23-31	NESW	31	52N	78W	WYW146360
29	RDU BETA FED	24-31	SESW	31	52N	78W	WYW146360
30	RDU BETA HEPP	32-31	SWNE	31	52N	78W	WYW146360
31	RDU BETA HEPP	33-31	NWSE	31	52N	78W	WYW146360
32	RDU BETA HEPP	41-31	NENE	31	52N	78W	WYW146360

Water Management Proposal: The following impoundments were proposed for use in association with the water management strategy for the POD.

	IMPOUNDMENT Name / Number	Qtr/Qtr	Sec	TWP	RNG	Capacity (Acre Feet)	Surface Disturbance (Acres)	Lease #
1	41-23-5278	NENE	23	52	78	14.9	2.5	WYW146319
2	42-23-5248	SENE	23	52	78	15	2.5	WYW146319
3	Pit 13-24-5278	NWSW	24	52	78	45	5.0	WYW146319

	IMPOUNDMENT Name / Number	Qtr/Qtr	Sec	TWP	RNG	Capacity (Acre Feet)	Surface Disturbance (Acres)	Lease #
4	Pit 32-24-5278	SWNE	24	52	78	45	5.0	WYW146319

County: Johnson

Applicant: Anadarko/Lance Oil & Gas

Surface Owners: Charles Lawrence, Eddie Knudson, Charles Hepp, BLM, State of Wyoming

Project Description:
The proposed action involves the following:

- Drilling of 32 total federal CBM wells in the Wall Coal zone to depths of approximately 2300 feet.

- Drilling and construction activities are anticipated to be completed within two years, the term of an APD. Drilling and construction occurs year-round in the PRB. Weather may cause delays lasting several days but rarely do delays last multiple weeks. Timing limitations in the form of COAs and/or agreements with surface owners may impose longer temporal restrictions on portions of this POD, but rarely do these restrictions affect an entire POD.

- Well metering shall be accomplished by telemetry. Metering would entail 2-3 visits per week during summer, 4 per week during winter to each well.

- A Water Management Plan (WMP) that involves the following infrastructure and strategy: initially will use 4 discharge points and 4 stock water reservoirs within the Crazy Woman Creek watershed and will later to shift water management to deep well injection at the Salt Creek field as the area develops.

- An unimproved and improved road network.

- Construction of overhead power is not required for this project. An underground power network will be constructed by Anadarko Petroleum Corporation. If this network is not completed before wells are producing, temporary diesel generators will be placed at the power drops.

- A storage tank of approximately 500 gallon capacity shall be located with each diesel generator. Generators are projected to be in operation for approximately 24 months. Fuel deliveries are anticipated to be 3 times per week. Noise level is expected to be 100.5 decibels at 1 meter distance.

- A buried gas, water and power line network, with no new central gathering/metering facilities or compression facilities.

For a detailed description of design features, construction practices and water management strategies associated with the proposed action, refer to the Master Surface Use Plan (MSUP), Drilling Plan and WMP in the POD and individual APDs. Also see the subject POD and/or APDs for maps showing the proposed well locations and associated facilities described above. More information on CBNG well drilling, production and standard practices is also available in the PRB FEIS, Volume 1, pages 2-9 through 2-40 (January 2003).

Implementation of committed mitigation measures contained in the MSUP, Drilling Program and WMP, in addition to the Standard COA contained in the PRB FEIS Record of Decision Appendix A, are incorporated and analyzed in this alternative.

Additionally, the Operator, in their POD, has committed to:

1. Comply with all applicable Federal, State and Local laws and regulations.
2. Obtain the necessary permits for the drilling, completion and production of these wells including water rights appropriations, the installation of water management facilities, water discharge permits, and relevant air quality permits.
3. Offer water well agreements to the owners of record for permitted water wells within ½ mile of a federal CBNG producing well in the POD
4. Provide water analysis from a designated reference well in each coal zone.

The Operator has certified that a Surface Use Agreement has been reached with the Landowners.

2.3. Alternative C – Environmentally Preferred

Alternative C represents a modification of Alternative B based on the operator and BLM working cooperatively to reduce environmental impacts. The description of Alternative C is the same as Alternative B with the addition of the project modifications identified by BLM and the operator following the initial project proposal (Alternative B). At the on-sites, all areas of proposed surface disturbance were inspected to insure that the project would meet BLM multiple use objectives to conserve natural resources while allowing for the extraction of Federal minerals. In some cases, access roads were re-routed, and well locations, pipelines, discharge points and other water management control structures were moved, modified, mitigated or dropped from further consideration to alleviate environmental impacts. Alternatives to the different aspects of the proposed action are always considered and applied as pre-approval changes, site specific mitigation and/or Conditions of Approval (COAs), if they will alleviate environmental effects of the operator's proposal. The specific changes identified for the Rose Draw Unit Beta POD are listed below under 2.3.1:

2.3.1. Changes as a result of the on-sites

1. 23-13 well: Well was moved slightly to avoid a drainage, and this move made it a fee/fee well, so it is no longer included in this project.
2. 14-22 well: Moved approx 70' E to preserve southern knob on location.
3. 24-22 well (Now the 34-22): Moved approx. 200' N to get well out of line of sight of a raptor nest and to avoid highly erosive soils in a sandy blowout area.
4. 33-22 well: Access road will be moved to the west side of the ridgeline to follow better terrain, and engineered road surface will be kept to 12' wide.
5. 23-23 well: Moved well 350' NW to a better work location with more room.
6. 24-23 well: Original access was very steep in sandy soils. Well was moved almost .25 miles to the west to a more stable location, and is now the 33-23 well.
7. 32-23 well: Dropped due to highly erosive, fragile soils on access road and pad location.
8. 21-24: Moved 45' E to create an eyebrow-type pad to avoid hill to NE of road. Pad will be redesigned to stay out of sandy hillside to the east, and well stake will be located appropriately. Landowner requests stock tank at this location.

9. 32-24 well: Moved well approx. 60' closer to access road to make a drive-through pad. Pad will be 150' x 170' with rounded corners.
10. 34-24 well: This well is at the end of a road, so the pad will be redesigned to be 150' x 200' to provide a turn-around at this location. Landowner requests a stock tank at "y" intersection between this and the 23-24 well.
11. 43-24 well: Well was moved 40'N, 10'W to avoid a drainage.
12. 44-30 well: Location changed from a pad to a slot that will accommodate the engineered access road as it comes into the location.
13. 33-31 well: SW corner of pad will be moved in approx 25', and pad rotated slightly, to stay out of slump area on the hillside, which will reduce erosion concerns. Pad will be 150' x 200'
14. 41-31 well: Moved approx. 50' E. New pad design will avoid sandy ridge/blowout area.
15. Changed the low water crossing through a main drainage off of Crazy Woman Creek. This LWC was part of the original plan for a new road which starts at the fee well # 21-23, and ties in to the access road for the P41-23 reservoir. In light of the fact that this is a major drainage and a LWC would require excessive amounts of cut and fill in fragile soils, the LWC was ruled out. Instead, two 12' box culverts will be used in the bottom of the draw to create a bridge.
16. Access road to the east side of the POD will now come through sections 15 and 16 (State surface). This was done to prevent use of the original existing road that passes within 25' of a cottonwood with a bald eagle nest.
17. Access road to the 32-31 well was changed to stay down low in the drainage, in order to keep as much road as possible out of line-of-sight of a bald eagle nest.

2.3.2. Programmatic mitigation measures identified in the PRB FEIS ROD

Programmatic mitigation measures are those, determined through analysis, which may be appropriate to apply at the time of APD approval if site specific conditions warrant. These mitigation measures can be applied by BLM, as determined necessary at the site-specific NEPA APD stage, as COAs and will be in addition to stipulations applied at the time of lease issuance and any standard COA.

2.3.2.1. Groundwater

1. In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed a guidance document, "Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments" which was approved September, 2006. For WYPDES permits received by DEQ after the August 1st effective date, the BLM requires that operators comply with the current approved DEQ compliance monitoring guidance document prior to discharge of federally-produced water into newly constructed or upgraded impoundments.

2.3.2.2. Surface Water

1. Channel Crossings:
   a) Channel crossings by road and pipelines will be constructed perpendicular to flow. Culverts will be installed at appropriate locations for streams and channels crossed by roads as specified in the BLM Manual 9112-Bridges and Major Culverts and Manual 9113-Roads. Streams will be crossed perpendicular to flow, where possible, and all stream crossing structures will be designed to carry the 25-year discharge event or other capacities as directed by the BLM.
   b) Channel crossings by pipelines will be constructed so that the pipe is buried at least four feet below the channel bottom.
2. Low water crossings will be constructed at original streambed elevation in a manner that will prevent any blockage or restriction of the existing channel. Material removed will be stockpiled for use in

reclamation of the crossings.

3. Concerns regarding the quality of the discharged CBNG water on downstream irrigation use may require operators to increase the amount of storage of CBNG water during the irrigation months and allow more surface discharge during the non-irrigation months.

4. The operator will supply a copy of the complete approved SW-4, SW-3, or SW-CBNG permits to BLM as they are issued by WSEO for impoundments.

5. The operator will supply to the BLM copies of the WYPDES permits for this POD as soon as they available from WDEQ and before discharging CBNG production water from this POD.

2.3.2.3. Soils

1. The Companies, on a case by case basis depending upon water and soil characteristics, will test sediments deposited in impoundments before reclaiming the impoundments. Tests will include the standard suite of cations, ions, and nutrients that will be monitored in surface water testing and any trace metals found in the CBNG discharges at concentrations exceeding detectable limits.

2.3.2.4. Wetland/Riparian

1. Wetland areas will be disturbed only during dry conditions (that is, during late summer or fall), or when the ground is frozen during the winter.

2. No waste material will be deposited in riparian areas, flood plains, or in natural drainage ways.

3. Soil or other material stockpiles will be located outside the active floodplain.

4. Disturbed channels will be re-shaped to their approximate original configuration or stable geomorphological configuration and properly stabilized.

5. Reclamation of disturbed wetland/riparian areas will begin immediately after project activities are complete.

2.3.2.5. Wildlife

1. For any surface-disturbing activities proposed in sagebrush shrublands, the Companies will conduct clearance surveys for sage grouse breeding activity during the sage grouse's breeding season before initiating the activities. The surveys must encompass all sagebrush shrublands within 0.5 mile of the proposed activities.

2. All stock tanks shall include a ramp to enable trapped small birds and mammals to escape. See Idaho BLM Technical Bulletin 89-4 entitled Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations.

2.3.2.6. Threatened, Endangered, or Sensitive Species

2.3.2.6.1. Bald Eagle

1. Special habitats for raptors, including wintering bald eagles, will be identified and considered during the review of the APD/POD or Sundry Notices.

2. Surveys for active bald eagle nests and winter roost sites will be conducted within suitable habitat by a BLM approved biologist. Surface disturbing activities will not be permitted within one mile of suitable habitat prior to survey completion.

3. A disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round for all bald eagle nest sites. A seasonal minimal disturbance buffer zone of one mile will be established for all bald eagle nest sites (February 1 – August 15).

4. A disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round for all bald eagle winter roost sites. A seasonal minimal disturbance buffer zone of 1 mile will be established for all bald eagle winter roost sites (November 1 – April 1). These buffer zones and timing may be adjusted based on site-specific information through coordination with, and written approval from, the USFWS.

5. Within ½ mile of bald eagle winter roost sites additional measures such as remote monitoring and restricting maintenance visitation to between 9:00 and 3:00 may be necessary to prevent disturbance (November 1 – April 1).

2.3.2.6.2. Black-footed Ferret

1. If any black-footed ferrets are located, the USFWS will be consulted. Absolutely no disturbance will be allowed within prairie dog colonies inhabited by black-footed ferrets.

2.3.2.7. Visual Resources

1. The Companies will mount lights at compressor stations and other facilities on a pole or building and direct them downward to illuminate key areas within the facility while minimizing the amount of light projected outside the facility.

2.3.2.8. Noise

1. Noise mufflers will be installed on the exhaust of compressor engines to reduce the exhaust noise.

2. Where noise impacts to existing sensitive receptors are an issue, noise levels will be required to be no greater than 55 decibels measured at a distance of one-quarter mile from the appropriate booster (field) compressor. When background noise exceeds 55dBA, noise levels will be no greater than 5dBA above background. This may require the installation of electrical compressor motors at these locations.

2.3.2.9. Air Quality

1. During construction, emissions of particulate matter from well pad and resource road construction will be minimized by application of water, or other dust suppressants, with at least 50 percent control efficiency. Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced or otherwise stabilized to reduce the amount of fugitive dust generated by traffic or other activities, and dust inhibitors (surfacing materials, non-saline dust suppressants, and water) could be used as necessary on unpaved collector, local and resource roads that present a fugitive dust problem. The use of chemical dust suppressants on BLM surface will require prior approval from the BLM authorized officer.

2.3.3. Site specific mitigation measures

All changes made at the onsite will be followed. They have all been incorporated into the operator's POD.

Surface Use

1. All well locations that aren't constructed pads will have a work area staked out; surface and vegetation disturbance will be limited to the staked area. Widths vary from 150' x 150' to 150' x 200' depending on terrain and the need for a turnaround.
2. A pre-construction field meeting shall be conducted prior to beginning any dirt work approved under

this POD. The operator shall contact the BLM Authorized Officer Melanie Hunter @ 307 684-1138 at least 4-days prior to beginning operations so that the meeting can be scheduled. The operator is responsible for having all contractors present (dirt contractors, drilling contractor, pipeline contractor, project oversight personnel, etc.) including the overall field operations superintendent, and for providing all contractors copies of the approved POD, project map and BLM Conditions of Approval pertinent to the work that each will be doing.

3. All permanent above-ground structures (e.g., production equipment, tanks, etc.) not subject to safety requirements will be painted to blend with the natural color of the landscape. The paint used will be a color which simulates "Standard Environmental Colors." The color selected for the Rose Draw Beta POD is Covert Green.
4. The operator will drill seed on the contour to a depth of 0.5 inch, followed by cultipaction to compact the seedbed, preventing soil and seed losses. To maintain quality and purity, the current years tested, certified seed with a minimum germination rate of 80% and a minimum purity of 90% will be used. ON BLM surface or in lieu of different specific mix desired by the surface owner, use the following:

Loamy Ecological Site Seed Mix		
Species	**% in Mix**	**Lbs PLS***
Western Wheatgrass (Pascopyrum smithii)/or ***Thickspike Wheatgrass*** (Elymus lanceolatus ssp. lanceolatus)	30	3.6
Bluebunch Wheatgrass (Pseudoroegneria spicata ssp. Spicata)	10	1.2
Green needlegrass (Nassella viridula)	25	3.0
Slender Wheatgrass (Elymus trachycaulus ssp. trachycaulus)	20	2.4
Prairie coneflower (Ratibida columnifera)	5	0.6
White or purple prairie clover (Dalea candidum, purpureum)	5	0.6
Rocky Mountain beeplant (Cleome serrulata)	5	0.6
Totals	**100%**	**12 lbs/acre**

Regarding the Railroad Car bridge in Section 25, T52N R78W

The following need to be completed before the bridge will be approved for use:

1. PE Certification:
   The report was a very comprehensive load test and rating of the steel railroad car superstructure - but, as noted in the report - "no visual inspection was conducted nor was there and effort to assess the condition or capacity of the abutments". A Professional Engineer still needs to certify the safety and adequacy of the bridge as a whole (hydraulic capacity, abutments, concrete supports, and steel). PE certification will be submitted after modifications have been made and visually inspected by the authorized officer.

2. Inspection/Maintenance Plan:

The operator should submit an inspection and maintenance plan addendum for the bridge, covering the time after first use by heavier equipment when the abutments, approach, and the structure get a real life test. Subsequent annual visual exams, and periodic 6-year formal exams (and possibly re-certification) will be performed based on anticipated future heavy drilling traffic. Surface the approaches to maintain the elevation of the abutments at the ends of the bridge (so there is not an abrupt "bump" up to the bridge) and to allow drivers to drive slowly onto the bridge from the south.

3. Completion of Report Recommendations:
   Recommendations from the report (replacement of missing/damaged struts, measures to center traffic on the bridge) summarized on page 30, must be performed. Additionally, the recommended maximum speed for the bridge will be 5 mph.

Wildlife

All conservation measures and terms and conditions identified in the Powder River Basin Oil and Gas Project Biological Opinion (WY07F0075) shall be complied with.

The following conditions will alleviate impacts to fish:

1) Any infrastructure crossing a drainage should be constructed in a manner that fish passage will not be impeded and channel and bank stability are not compromised. Maintaining fish passage will require that no plunging flow, or a drop from the crossing to the channel immediately below the crossing, occur over a crossing during low flow events.
2) Crossing should be located to avoid existing high banks and high gradient stream areas.
3) Monitoring of low water crossings after each high-water event and after spring high flows will be required to maintain a stream profile that does not inhibit fish passage.
4) If low water crossings create a fish passage problem, they will be repaired as quickly as possible.

The following conditions will alleviate impacts to bald eagles:

1. No project related actions shall occur within one mile of Crazy Woman Creek annually from November 1 through April 1 (CM9), prior to a winter roost survey or from February 1 through August 15 (CM8) prior to a nesting survey. This timing limitation will be in effect unless surveys determine the nest/roost to be inactive. This affects the following wells and infrastructure:

Township/Range	Section	Wells and Infrastructure
48/76	33	14-33, 34-33
	34	44-34, 23-34
47/76	3	12-3, 41-3, 43-3
	4	12-4, 21-4, 32-4

   a. If a roost is identified and construction has not been completed, a year-round disturbance-free buffer zone of 0.5 mile will be established for all bald eagle winter roost sites. A seasonal minimum disturbance buffer zone of 1 mile will be established for all bald eagle roost sites (November 1 - April 1). Additional measures such as remote monitoring and restricting maintenance visitation to between 9:00 AM and 3:00 PM may be necessary to prevent disturbance.
   b. If a nest is identified and construction has not been completed, a disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) would be established year round for all bald eagle nests. A seasonal minimum disturbance buffer zone of 1 mile will be established for all bald eagle nest sites (February 1 - August 15).
2. Additional mitigation measures may be necessary if the site-specific project is determined by a Bureau biologist to have an adverse affect to bald eagles or their habitat.

Burrowing Owls

1. The following conditions will alleviate impacts to burrowing owls:
   A burrowing owl survey will be required in suitable burrowing owl habitat (i.e. active and inactive prairie dog colonies) between April 15 and June 15. If a burrowing owl nest if identified, a 0.25 mile buffer will be applied to the nest and no surface disturbing activity shall occur within 0.25 miles of all identified prairie dog colonies from April 15 to August 31, annually, prior to a burrowing owl nest occupancy survey for the current breeding season. This condition will be implemented on an annual basis for the duration of surface disturbing activities within the prairie dog town(s). This timing limitation will then be in effect, annually, unless surveys determine the nest(s) to be inactive.

Raptors

1. The following conditions will alleviate impacts to raptors:
   a. No surface disturbing activity shall occur within 0.5 mile of all identified raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season. This timing limitation will affect all infrastructure depicted on the 2008 Rose Draw Unit Beta POD Wildlife COAs map.

      1) Surveys to document nest occupancy shall be conducted by a biologist following BLM protocol, between April 15 and June 30. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a 0.5 mile timing buffer will be implemented. The timing buffer restricts surface disturbing activities within 0.5 mile of occupied raptor nests from February 1 to July 31.
      2) Nest productivity checks shall be completed annually and continue for the first five years following project completion. The productivity checks shall be conducted no earlier than June 1 or later than June 30 and any evidence of nesting success or production shall be recorded. Survey results will be submitted to a Buffalo BLM biologist in writing no later than July 31 of each survey year. This applies to all nest(s) within 0.5 miles of the project area.

   b. If an undocumented raptor nest is located during project construction or operation, the Buffalo Field Office (307-684-1100) shall be notified within 24 hours.
   c. Well metering, maintenance and other site visits within 0.5 miles of raptor nests should be minimized as much as possible during the breeding season (February 1 – July 31).

Sage Grouse

1. The following conditions will alleviate impacts to sage-grouse:
   a. No surface disturbing activities are permitted within 2 miles of the active sage-grouse lek(s) between March 1 and June 15, prior to completion of a greater sage grouse lek survey. This condition will affect those infrastructure depicted on the 2008 Rose Draw Unit Beta POD Wildlife COAs map.
   b. If an active lek is identified during the survey, the 2 mile timing restriction (March 1-June 15) will be applied and surface disturbing activities will not be permitted until after the nesting season. If surveys indicate that the identified lek is inactive during the current breeding season, surface disturbing activities may be permitted within the 2 mile buffer until the following breeding season (March 1). The required sage grouse survey will be conducted by a biologist following the most current WGFD protocol. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities.
   c. Well metering, maintenance and other site visits within 2.0 miles of documented sage grouse lek sites should be minimized as much as possible during the breeding season (March 1– June 15).

Water Management

1. Locate the CKL#7 Spring and collect a flow rate and water quality sample in the Fall of 2008 and submit for analysis using the list of analytes identified in WDEQ WYPDES permit. Forward the lab analysis results and flow rate to the BLM hydrology staff for insertion into the WMP. Collect yearly Spring and Fall samples and submit for analysis when the spring is flowing.

2.4. Alternatives considered but not analyzed in detail

Direct Discharge

Direct discharge to tributaries of Crazy Woman Creek is not feasible as the sole water management strategy because of steep dissected topography, landowner concerns and stringent WDEQ discharge standards in the Crazy Woman Creek drainage basin.

Re-injection

Re-injection of produced water was considered, and will likely play a major water management role in the future for this area. A review of the well logs on file with the Wyoming Oil and Gas Conservation Commission and available geologic information suggests that there are no aquifers within the immediate area that have sufficient storage capacity to accept the volume of CBNG water that would be produced.

Land Application

Land application of produced water was considered. Land application would involve applying the water to cropland at agronomic rates through an irrigation system. Land application is at best a seasonal approach and would require the construction of several reservoirs to store produced water during the non-irrigation season. Due to the high construction and operating costs, the lack of landowner interest, and the lack of suitable sites, land application was ruled out.

Total Containment

Total containment within existing and proposed reservoirs was assessed and quickly discounted due to the number of reservoirs necessary to contain the overall volume of CBNG production water associated with this POD. Landowner concerns coupled with the large number of new reservoirs required under this alternative resulted in poor economics and high surface disturbance prompting the selection of other alternatives.

Treatment of Produced Water

Treatment of produced water with subsequent discharge into Crazy Woman Creek was extensively researched to examine the full range of possibilities. The following potential treatment technologies were considered: Sulfur burners, constructed wetlands, rapid spray distillation, electrodialysis reversal, electronic water purification, reverse osmosis, ion exchange with resins, ion exchange with zeolites and cation exchange and cation removal. Sulfur burner technologies were rejected since they will not address sodium concentrations in the produced water. Use of constructed wetlands was determined to not be a reasonable alternative since they have limited utility in removing total dissolved solids and salts. Given the short growing season in Antelope Creek, substantial reservoir storage would still be needed. Rapid spray distillation and electronic water purification are emerging technologies that are unproven and have not been demonstrated to effectively treat CBNG water. Electrodialysis reversal has not been cost effectively applied the treatment of CBNG water. Both electrodialysis reversal and reverse osmosis would generate a brine reject stream of up to 20 percent of the design flow of the treatment system. With ion exchange technologies, it is possible to substantially reduce the volume of brine reject water however the resulting reject stream would be more concentrated. The concentrated brine from these treatment systems would need to be appropriately managed to address potential environmental concerns. The brine waters could potentially be trucked off-site for disposal, which given the volumes associated with

electrodialysis reversal and reverse osmosis, would render those options uneconomic. Other options for managing the brine reject streams include evaporation in a lined pit; or dilution to stock water standards and discharge to total containment reservoirs.

2.5. Summary of Alternatives

A summary of the infrastructure currently existing within the POD area (Alternative A), the infrastructure originally proposed by the operator (Alternative B), and the infrastructure within the BLM/operator modified proposal (Alternative C) are presented in Table 2.5.

Table 2.5 Summary of the Alternatives

Facility	Alternative A (No Action) Existing Number or Miles	Alternative B (Original Proposal) Proposed Number or Miles	Alternative C (Environmental Alt.) Revised Number or Miles
Total CBNG Wells	74 (approx. 0.3 acres/ea)	36	30
Well Locations			
Nonconstructed		11	11
Constructed		25	19
Slotted			
Conventional Wells	2(+-0.5 acres)		
Gather/Metering Facilities	0	0	0
Compressors	0	0	0
Ancillary (Staging/Storage Areas)			
Template/Spot Upgrade Roads			
No Corridor			
With Corridor	39710’	62000’	44190’
Engineered Roads			
No Corridor			
With Corridor		30500’	26970’
Primitive Roads		0	0
No Corridor	19680’		
With Corridor	40235’		
Buried Utilities			
No Corridor	8400’	190’	2291
With Corridor			
Overhead Powerlines	13095’	0	0
Communication Sites			
Monitor Wells	0	0	0
LAD	0	0	0
SDI	0	0	0
Treatment Facilities	0	0	0

Facility	Alternative A (No Action) Existing Number or Miles	Alternative B (Original Proposal) Proposed Number or Miles	Alternative C (Environmental Alt.) Revised Number or Miles
Impoundments			
On-channel	0	2 (5 ac)	2 (5 ac)
Off-channel	0	2 (10 ac)	2 (10 ac)
Lined	0		
Unlined			
Water Discharge Points	0	4 (0.04 ac)	4 (0.04 ac)
Channel Disturbance			
Headcut Mitigation	0	0	0
Channel Modification	0	0	0
TOTAL ACRES DISTURBANCE	**127.05**	**160.26**	**118.1**

3. DESCRIPTION OF AFFECTED ENVIRONMENT

Applications to drill were received on 12/21/2007. Field inspections of the proposed Rose Draw Unit Beta CBNG project were conducted on 4/21, 4/22, 4/30, 8/29/2008 by

DATE	NAME	TITLE	AGENCY
4/21, 22	Tammi Hitt	Permitting Agent	Anadarko Petroleum Company
8/29	Ethan Jahnke	Permitting Agent	Anadarko Petroleum Company
4/21	Jeff Maddox	Landman	Anadarko Petroleum Company
8/29	Jerry Geer	Landman	Anadarko Petroleum Company
4/21,22	Colt Rodeman	Drilling Supervisor	Anadarko Petroleum Company
4/21	Dan L (?)	Construction Foreman	Anadarko Petroleum Company
4/21	Shane Gasvoda	Water Management Specialist	Anadarko Petroleum Company
4/21	Randy Hepp	Landowner	
8/29	Chuck Hepp	Landowner	
4/22	Charles Lawrence	Landowner	
4/21	Nathan Raeger	Hydrologist	WWC Engineering
4/21,22	Brent Bennet	Civil Engineer	Grizzly Engineering
4/22	Aaron Money		Grizzly Engineering
4/21,22	Craig Knight	Civil Engineer	Knight Technologies, Inc.
4/22	Naomi Knight	CE	KTI
4/21,22	Bill Hildreth		KTI
8/29	Royce Robinson		KTI
8/29	Corey Nestor		KTI
4/21	Brad Rogers	Wildlife Biologist	USFWS
7/9	Arnie Irwin	Soil Scientist	BLM
4/30	Ted Hamersma	Civil Engineer Tech.	BLM
4/21	Chris Williams	Hydrologist	BLM
9/17	J Bunderson	Civil Engineer	BLM
4/21,22	Bill Ostheimer	Wildlife Biologist	BLM
4/21, 22	Leigh Grench	Archaeologist	BLM

DATE	NAME	TITLE	AGENCY
8/29	Wendy Sutton	Archaeologist	BLM
7/9	Casey Freise	Sup. Nat. Res. Spc.	BLM
All days	Melanie Hunter	Natural Resource Specialist	BLM

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This section describes the environment that would be affected by implementation of the Alternatives described in Section 2. Aspects of the affected environment described in this section focus on the relevant major issues. Certain critical environmental components require analysis under BLM policy. These items are presented below in Table 3.1.

Table 3.1 - Critical elements requiring mandatory evaluation are presented below.

Mandatory Item	Potentially Impacted	No Impact	Not Present On Site	BLM Evaluator
Threatened and Endangered Species	X			Bill Ostheimer
Floodplains		X		Chris Williams
Wilderness Values			X	Melanie Hunter
ACECs			X	Melanie Hunter
Water Resources	X			Chris Williams
Air Quality	X			Melanie Hunter
Cultural or Historical Values	X			Wendy Sutton
Prime or Unique Farmlands			X	Melanie Hunter
Wild & Scenic Rivers			X	Melanie Hunter
Wetland/Riparian		X		Chris Williams
Native American Religious Concerns			X	Wendy Sutton
Hazardous Wastes or Solids		X		Melanie Hunter
Invasive, Nonnative Species	X			Melanie Hunter
Environmental Justice		X		Melanie Hunter

3.1. Topographic Characteristics of Project Area

The Rose Draw project area is located primarily south of Tipperary Road, approximately 30 miles northeast of Buffalo, Wyoming. The northern portion of the project area, closer to Crazy Woman Creek, is open grasslands, with relatively flat topography and some gently rolling hills. The 23-30, 23-19, 12-20, 12-21, 12-22, 34-14, 43-14, and 14-13 wells are located in this area. The remainder of the project area is located in steeper, “breaks” type sagebrush country. Narrow ridgelines are cut with deep ephemeral drainages, with limited flat ground in the narrow valleys between ridgelines. Occasional rocky or sandy outcroppings are also found in steeper areas.

3.2. Vegetation & Soils

Species typical of short grass prairie comprise the project area flora. Specific species observed throughout the project area include cheatgrass, western wheatgrass, and crested wheatgrass. Differences in dominant species within the project area vary with soil type, aspect and topography. The bottomlands near Crazy Woman Creek, including the 12-20, 14-13, 34-14, and 43-13 wells, had either been grazed off, making vegetation difficult to identify, or were covered with grasses such as crested wheatgrass; cheatgrass has also become a major component. Plant diversity is low. This plant community is relatively stable, with the rhizomatous wheatgrasses being somewhat resistant to overgrazing, and the cheatgrass effectively competing against the establishment of perennial cool-season grasses.

An increase in bare ground reduces water infiltration and increases soil erosion. The watershed is functioning. The biotic integrity is reduced by the lack of diversity in the plant community.

The remaining wells in the project area are in a Mixed Sagebrush/Grass Plant Community.
Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush control. Big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grasses, and miscellaneous forbs.

Dominant grasses include rhizomatous wheatgrasses, and green needlegrass, although cheatgrass has invaded most of these sites. Forbs commonly found in this plant community include Louisiana sagewort (cudweed), plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Plains pricklypear is also present. The overstory of sagebrush and understory of grass and forbs provide a diverse plant community, which will support domestic livestock and wildlife such as mule deer and antelope.

This state is stable and protected from excessive erosion. The biotic integrity of this plant community is intact, but can be at risk depending on how far a shift has occurred in plant composition toward blue grama, big sagebrush, and/or cheatgrass. The watershed is functioning, but it could become at risk if blue grama sod and/or bare ground increases.

The soils in the project area vary from loamy bottomland soils to clayey soils with sandy outcrops in the sagebrush, breaks country. Topsoil depths to be salvaged for reclamation range from 6-8 inches on ridges to greater than 10 inches in bottomland. Erosion potential varies from to depending on the soil type, vegetative cover and slope, but is severe for the most of the project area, excluding the above-mentioned wells in the bottomlands. The erosion potential for the soils where this well is located is slight. The reclamation potential of soils in the project area varies from fair, including these bottomland wells, to poor, which includes the remainder of the wells in the project.

3.2.1. Wetlands/Riparian

Wetland areas within the POD are restricted to the margins of Crazy Woman Creek, riparian vegetation may be found along the channels in the larger tributaries within the POD and along Crazy Woman Creek. Large stands of cottonwoods are present in the floodplain of Crazy Woman Creek.

3.2.2. Invasive Species

The following state-listed noxious weeds and/or weed species of concern infestations in the project area were discovered by a search of inventory databases on the Wyoming Energy Resource Information Clearinghouse (WERIC) web site (www.weric.info):

- Russian knapweed
- saltcedar
- leafy spurge
- Scotch thistle
- Canada thistle
- common cocklebur
- buffalo bur

The WERIC database was created cooperatively by the University of Wyoming, BLM and county Weed and Pest offices. Additionally, the operator or BLM confirmed the following WRIC identified infestations during subsequent field investigations:

- saltcedar

- leafy spurge
- Scotch thistle
- Canada thistle
- buffalo bur

These species were found primarily in the bottomlands near Crazy Woman Creek. At the onsite it was noted that hawkmoth caterpillars are actively feeding on the leafy spurge infestation on the banks of Crazy Woman Creek.

The state-listed noxious weeds are listed in PRB FEIS Table 3-21 (p. 3-104) and the Weed Species of Concern are listed in Table 3-22 (p. 3-105.

3.3. Wildlife

Several resources were consulted to identify wildlife species that may occur in the proposed project area. Resources that were consulted include the POD wildlife reports, wildlife database compiled and managed by the BLM Buffalo Field Office (BFO) wildlife biologists, the PRB FEIS, the Wyoming Game and Fish Department (WGFD) big game and sage-grouse maps, and the Wyoming Natural Diversity Database (WYNDD).

A habitat assessment and wildlife inventory surveys were performed by Big Horn Environmental Consultants (BHEC 2008). The consultant performed surveys for bald eagles, mountain plover, sharp-tailed grouse, greater sage-grouse, raptor nests, and prairie dog colonies according to Powder River Basin Interagency Working Group (PRBIWG) accepted protocol in 2008. Habitat surveys were conducted for Ute ladies'-tresses orchid. PRB IWG accepted protocol is available on the CBM Clearinghouse website (www.cbmclearinghouse.info).

A BLM biologist conducted field visits April 21 and 22 of 2008. During this time, the biologist reviewed the wildlife survey information for accuracy, evaluated impacts to wildlife resources, and provided project modification recommendations where wildlife issues arose.

Wildlife species common to the habitat types present are identified in the PRB FEIS (pg. 3-114). Species identified in the project area or noted as being of special importance are described below.

3.3.1. Big Game

Big game species expected to be within the project area include pronghorn antelope, mule deer, and white-tailed deer. The WGFD has determined the entire project area to be Winter Yearlong range for antelope and mule deer. For white-tailed deer, Crazy Woman Creek represents Yearlong range.

Yearlong use is when a substantial portion of a population makes general use of the habitat on a year-round basis. Winter/Yearlong use is when a population of animals makes general use of suitable habitat sites within a range on a year-round basis. During the winter months there is a significant influx of additional animals into the area from other seasonal ranges. Big game range maps are available in the PRB FEIS (3-119-143), the project file, and from the WGFD. The project area is part of the Powder River deer herds, and the Ucross pronghorn herd. The Wyoming Game and Fish summaries for these herds set a 2007 Post-season Objective of 2,500 with a 2007 Post-season Population Estimate of 10,000 for pronghorn and a 2007 population objective of 52,000 and a population estimate of 56,200. White tailed deer had a 2007 population objective of 8,000 and an estimated population of 8,200.

3.3.2. Aquatics

The project area is drained by Crazy Woman Creek, a perennial tributary of the Powder River. Powder River fishes use Crazy Woman Creek for various stages of their life cycles. Fish that have been identified in the Powder River watershed are listed in the PRB FEIS (3-156-159).

Wyoming Game and Fish data for fish sampled in the Powder River and Crazy Woman Creek are presented below (WYGFD website http://gf.state.wy.us/fish/AAC/CurrentProjects/Powder/index.asp).

Table. Fish species and numbers captured during 5 sample periods (June-October) at sites on the Powder River and Crazy Woman Creek in 2004.

Species	Powder River	Crazy Woman Creek
Sand shiner	37,682	11,810
Flathead chub	13,622	984
Plains minnow	6,511	137
Plains killifish – Exotic	6,417	6
Longnose dace	696	1,635
Mountain sucker	599	12
Channel catfish	39	254
River carpsucker	186	21
Fathead minnow	156	529
Stonecat	72	316
Goldeye	33	7
Shorthead redhorse	24	38
White sucker	23	511
Shovelnose sturgeon	18	2
Creek chub	18	3
Common carp – Exotic	11	146
Green sunfish – Exotic	1	0
Smallmouth bass – Exotic	1	9
Sturgeon chub	1	0
Black bullhead	0	34
Sauger	0	0
Totals	**63,420**	**16,454**

The Powder River Basin is one of the last free-flowing prairie stream ecosystems left in the United States, with existing flows, turbidity, and water quality within historic ranges. The Powder River supports an intact native fish community including several rare or declining species. These species have evolved life history strategies that allow them to survive in extreme conditions (Hubert 1993). Native fish species include sauger, shovelnose sturgeon, goldeye, plains minnow, sand shiner, flathead chub, river carpsucker, sturgeon chub, western silvery minnow, channel catfish, fathead minnow, longnose dace, mountain sucker, shorthead redhorse, longnose sucker, stonecat, white sucker and others. Six of these are designated by the WGFD as either Native Species Status (NSS) 1, 2, or 3 species. Species in these designations are considered to be species of concern, in need of more immediate management attention, and more likely to be petitioned for listing under the Endangered Species Act.

NSS1 species (sturgeon chub and western silvery minnow) are those that are physically isolated and/or exist at extremely low densities throughout their range, and habitat conditions are declining or vulnerable. NSS2 species (goldeye, shovelnose sturgeon, and sauger) are physically isolated and/or exist at extremely low densities throughout their range, and habitat conditions appear to be stable. NSS3 species (plains minnow) are widely distributed throughout their native range and appear stable; however, habitats are

declining or vulnerable. For these species, the WGFD has been directed by the Wyoming Game and Fish Commission to recommend that no loss of habitat function occur. Some modification of the habitat may occur, provided that habitat function is maintained (i.e., the location, essential features, and species supported are unchanged).

The sturgeon chub was petitioned for listing under the Endangered Species Act in 2000. The sturgeon chub is a small minnow native to WY and is known to occur only in the Powder River and in one location on Crazy Woman Creek. The sturgeon chub requires large, free-flowing rivers characterized by swift flows, high variable flow regimes, braided channels, high turbidity, and sand/gravel substrates. On April 18, 2001, the U.S. Fish and Wildlife Service determined that the listing was not warranted, due to the sturgeon chub population being more abundant and better distributed throughout their range than previously believed.

Amphibian and reptile species occur throughout the Basin, but there is little recorded baseline information available about them. Confluence Consulting, Inc. identified the following species present within the Clear Creek and Powder River watersheds: Woodhouse's toad, Northern leopard frog, gopher snake, and garter snake (2004). Because sampling at the upper two sites on Clear Creek occurred late in the season, seasonality may have influenced the lack of reptiles and amphibians observed at these sites.

3.3.3. Migratory Birds

A wide variety of migratory birds may be found in the proposed project area at some point throughout the year. Migratory birds are those that migrate for the purpose of breeding and foraging at some point in the calendar year. Many species that are of high management concern use shrub-steppe and shortgrass prairie areas for their primary breeding habitats (Saab and Rich 1997). Migratory bird species of management concern that may occur in the project area are listed in the PRB FEIS (3-151).

3.3.4. Raptors

Raptors species expected to occur in suitable habitats within the Powder River Basin include northern harrier, golden eagle, red-tailed hawk, Swainson's hawk, ferruginous hawk, American kestrel, prairie falcon, short-eared owl, great horned owl, bald eagle, rough-legged hawk, merlin, Cooper's hawk, northern goshawk, long-eared owl, and burrowing owl. Most raptor species nest in a variety of habitats including but not limited to; native and non-native grasslands, agricultural lands, live and dead trees, cliff faces, rock outcrops, and tree cavities.

Twenty six raptor nest sites were identified within 0.5 mile of the project area. Of these, eight nests were active in 2008 (BHEC 2008). The nest locations and 2008 status is reflected on the project work map dated September 17, 2008 and in the table below:

Table 4. Documented raptor nests within the project area in 2008.

	Nest ID	UTM_E	UTM_N	QQ	Section	T_N	R_W	Species	Substrate	Status	Condition
1	3012	406941	4923948	SWSE	19	52	77	UNRA	CTL	INAC	POOR
2	3047	398039	4923712	NWNW	29	52	78	GHOW	CTL	**ACTI**	GOOD
3	3048	400202	4923097	SENW	28	52	78	N/A	JUN	INDE	GONE
4	3051	399210	4924828	SENE	20	52	78	GOEA	CTL	ACTI	GOOD
5	3052	406950	4923948	SWSE	19	52	77	UNRA	CTL	INAC	POOR
6	3444	397717	4923702	NENE	30	52	78	RTHA	CTL	**ACTI**	GOOD

	Nest ID	UTM_E	UTM_N	QQ	Section	T_N	R_W	Species	Substrate	Status	Condition
7	3449	395446	4922653	NWSW	25	52	79	N/A	CTL	GONE	GONE
8	3451	395879	4922705	NESW	25	52	79	RTHA	CTL	INAC	FAIR
9	4955	401783	4923933	SWNW	23	52	78	LEOW	JUN	**ACTI**	POOR
10	4956	403046	4924706	SENW	27	52	78	UNRA	JUN	INAC	FAIR
11	509	402456	4925100	NENE	22	52	78	GOEA	CTL	INAC	GOOD
12	510	402456	4925100	NENE	22	52	78	GOEA	CTL	INAC	FAIR
13	5774	399125	4923075	SWNE	29	52	78	N/A	RHS	GONE	GONE
14	5775	402392	4925545	NWNE	22	52	78	UNRA	CTL	INAC	POOR
15	5776	397473	4923268	SWNE	30	52	78	UNRA	CTL	INAC	UNK
16	5777	398484	4923899	SESW	29	52	78	UNRA	CTL	INAC	UNK
17	new	403908	4926817	NWNE	14	52	78	N/A	CTL	GONE	GONE
18	new	403392	4926004	NESW	14	52	78	RTHA	CTL	**ACTI**	GOOD
20	new	402405	4925037	NWNE	22	52	78	GOEA	CTL	**ACTI**	GOOD
21	new	403314	4926007	NESW	14	52	78	CANG	CTL	INAC	GOOD
22	new	403576	4926515	NWNW	14	52	78	GOEA	CTL	ACTF	GOOD
23	new	396749	4922380	SWSW	30	52	78	GOEA	CTL	**ACTI**	GOOD
24	new	397896	4921523	SENE	32	52	78	UNRA	CLF	INAC	GOOD
25	new	397822	4921529	SENE	32	52	78	RTHA	CLF	**ACTI**	GOOD
26	new	402378	4925577	SWSE	15	52	78	GHOW	CTD	**ACTI**	UNK

UNRA; Unknown. RTHA; Red-tailed hawk. AMKE; American Kestrel. GOEA; Golden Eagle. BAEA Bald Eagle. GHOW; Great-horned owl. CANG; Canada Goose

CTL; live cottonwood, CLD; dead cottonwood, CLF; cliff, JUN; juniper,

INACT; inactive. ACT; Active

3.3.5. Threatened and Endangered and Sensitive Species

3.3.5.1. Threatened and Endangered Species

Within the BLM Buffalo Field Office there are two species that are Threatened or Endangered under the Endangered Species Act.

3.3.5.1.1. Black-footed ferret

The USFWS listed the black-footed ferret as Endangered on March 11, 1967. Active reintroduction efforts have reestablished populations in Mexico, Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming. In 2004, the WGFD identified six prairie dog complexes (Arvada, Sheridan, Pleasantdale, Four Corners, Linch, Kaycee, and, Thunder Basin National Grasslands) partially or wholly within the BLM Buffalo Field Office administrative area as potential black-footed ferret reintroduction sites (Grenier et al. 2004). The north-east corner of project area (POD boundary) clips the border of the Arvada complex.

This nocturnal predator is closely associated with prairie dogs, depending almost entirely upon them for its food. The ferret also uses old prairie dog burrows for dens. Current science indicates that a black-footed ferret population requires at least 1000 acres of black-tailed prairie dog colonies, separated by no more than 1.5km, for survival (USFWS 1989).

The WGFD believes the combined effects of poisoning and Sylvatic plague on black-tailed prairie dogs have greatly reduced the likelihood of a black-footed ferret population persisting east of the Big Horn

Mountains (Grenier 2003). The U.S. Fish and Wildlife Service has also concluded that black-tailed prairie dog colonies within Wyoming are unlikely to be inhabited by black-footed ferrets (Kelly 2004).

Thirty two black-tailed prairie dog colonies were identified within or adjacent to the project area totaling approximately 1,500 acres (WLS 2008). Potential black-footed ferret habitat is present within the project area. Thirty two black-tailed prairie dog colonies were identified within or adjacent to the project area totaling approximately 1,500 acres (WLS 2008). Within one mile of the POD boundary, there are over 3,000 acres of prairie dog colonies mapped on the BLM database. The prairie dog colonies within the project area are part of the Arvada potential reintroduction complex. Potential black-footed ferret habitat is present within the project area.

3.3.5.1.2. Ute Ladies'-Tresses Orchid

This orchid is listed as Threatened under the Endangered Species Act. It is extremely rare and occurs in moist, sub-irrigated or seasonally flooded soils at elevations between 1,780 and 6,800 feet above sea level. Habitat includes wet meadows, abandoned stream channels, valley bottoms, gravel bars, and near lakes or perennial streams that become inundated during large precipitation events. Wyoming Natural Diversity Database model predicts undocumented populations may be present particularly within southern Campbell and northern Converse Counties.

Prior to 2005, only four orchid populations had been documented within Wyoming. Five additional sites were located in 2005 and one in 2006 (Heidel pers. Comm.). The new locations were in the same drainages as the original populations, with two on the same tributary and within a few miles of an original location. Drainages with documented orchid populations include Antelope Creek in northern Converse County, Bear Creek in northern Laramie and southern Goshen Counties, Horse Creek in Laramie County, and Niobrara River in Niobrara County. In Wyoming, *Spiranthes diluvialis* blooms from early August to early September, with fruits produced in mid August to September (Fertig 2000).

Suitable orchid habitat was assessed (BHEC 2008). Marginal habitat is present within the project area along Crazy Woman Creek with the steep transition between creek and uplands combined with clayey soils reducing the habitat suitability.

3.3.5.2. Sensitive Species

The USDI Bureau of Land Management (BLM) Wyoming has prepared a list of sensitive species to focus species management efforts towards maintaining habitats under a multiple use mandate. Two habitat types, prairie dog colonies and sagebrush ecosystems, specifically, are the most common among habitat types within the Powder River Basin and contain habitat components required in the life cycle of several sensitive species. These are described below in general terms. Those species within the Powder River Basin that were once listed or candidates for listing under the Endangered Species Act of 1973 and remain BLM Wyoming sensitive species are described in more detail. The authority for this policy and guidance comes from the Endangered Species Act of 1973, as amended; Title II of the Sikes Act, as amended; the Federal Land Policy and Management Act (FLPMA) of 1976; and the Department Manual 235.1.1A.

3.3.5.2.1. Sagebrush obligates

Sagebrush ecosystems support a variety of species. Sagebrush obligates are animals that cannot survive without sagebrush and its associated perennial grasses and forbs; in other words, species requiring sagebrush for some part of their life cycle. Sagebrush obligates within the Powder River Basin, listed as sensitive species by BLM Wyoming include greater sage-grouse, Brewer's sparrow, and sage thrasher. Brewer's sparrows and sage thrashers require sagebrush for nesting, with nests typically located within or under the sagebrush canopy. Sage thrashers usually nest in tall dense clumps of sagebrush within areas having some bare ground for foraging. Brewer's sparrows are associated closely with sagebrush habitats

having abundant scattered shrubs and short grass (Paige and Ritter 1999). Other sagebrush obligate species include sagebrush vole, pronghorn antelope, and sagebrush lizard.

3.3.5.2.2. Bald eagle

On February 14, 1978, the bald eagle was federally listed as Endangered. On August 8, 2007, the bald eagle was removed from the Endangered Species list. The bald eagle remains under the protection of the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In order to avoid violation of these laws and uphold the BLM's commitment to avoid any future listing of this species, all conservation measures and terms and conditions identified in the Powder River Basin Oil and Gas Project Biological Opinion (WY07F0075) (USFWS 2007) shall continue to be complied with.

Bald eagle nesting habitat is generally found in areas that support large mature trees. Eagles typically will build their nests in the crown of mature trees that are close to a reliable prey source. This species feeds primarily on fish, waterfowl, and carrion. In more arid environments, such as the Powder River Basin, prairie dogs, ground squirrels, and lagomorphs (hares and rabbits) can make up the primary prey base. The diets of wintering bald eagles are often more varied. In addition to prairie dogs, ground squirrels, and lagomorphs, carcasses of domestic sheep and big game may provide a significant food source in some areas. Historically, sheep carcasses from large domestic sheep ranches provided a reliable winter food source within the Powder River Basin (Patterson and Anderson 1985). Today, few large sheep operations remain in the Powder River Basin. Wintering bald eagles may congregate in roosting areas generally made up of several large trees clumped together in stands of large ponderosa pine, along wooded riparian corridors, or in isolated groups. Bald eagles often share these roost sites with golden eagles as well.

There is suitable nesting and roosting habitat within one mile of proposed activities. Mature cottonwoods along Crazy Woman Creek and a consistent food supply from the prairie dog colonies and fish bearing waters (Crazy Woman Creek and the Powder River) attract bald eagles to the project area. The BLM database indicates consistent bald eagle winter use along Crazy Woman Creek.

The BLM database indicates wintering eagles are frequently seen along Crazy Woman Creek and the Powder River. A summary of the documented wintering bald eagles along Crazy Woman Creek in the project area is presented below:

Observer	Date	Bald eagles	UTME	UTMN
ARCADIS	2/7/2008	1	396873	4922890
Big Horn Environmental	12/18/2006	1	397499	4923235
BLM	1/6/2004	1	396966	4923300
Big Horn Environmental	12/6/2006	1	396870	4923340
Big Horn Environmental	12/13/2006	2	396952	4923399
ARCADIS	1/14/2008	1	397551	4923443
ARCADIS	1/14/2008	1	398399	4923940
ARCADIS	12/28/2007	2	398641	4923999
Big Horn Environmental	12/13/2006	1	399916	4925066
BLM	1/6/2004	1	399626	4925094
ARCADIS	2/7/2008	2	400268	4925264
BLM	1/21/2005	2	401615	4925378
BLM	2/10/2005	1	401542	4925405
BLM	1/6/2006	2	401481	4925465
BLM	1/14/2006	1	402310	4925941

BLM	1/18/2002	1	402900	4926280
Jones and Stokes	1/16/2008	1	405083	4926303
Big Horn Environmental	12/6/2006	1	403361	4926318
ARCADIS	2/7/2008	2	403108	4926324
BLM	1/6/2004	2	403495	4926539

A bald eagle nest was discovered in the spring of 2008 in the project area. The nest failed for unknown reasons sometime around April 6, 2008 and the pair was not seen in the area subsequently. The nest tree was located approximately 100 meters from Tipperary Road, a busy county road used for oil and gas.

3.3.5.2.3. Black-tailed prairie dog

The black-tailed prairie dog was added to the list of Candidate species for federal listing on February 4, 2000 (USFWS 2000). On August 12, 2004, the U.S. Fish and Wildlife Service removed the black-tailed prairie dog's Candidate status. BLM Wyoming, considers prairie dogs as a sensitive species and continues to afford this species the protections described in the PRB FEIS. The black-tailed prairie dog is a diurnal rodent inhabiting prairie and desert grasslands of the Great Plains.

Thirty three black-tailed prairie dog colonies were identified within the project area totaling approximately 1,500 acres (WLS 2008). Within one mile of the POD boundary, there are over 3,000 acres of prairie dog colonies mapped on the BLM database. The alluvial terraces above Crazy Woman creek provide ideal habitat for prairie dogs.

3.3.5.2.4. Burrowing owl

The burrowing owl is a small, long-legged owl found throughout open landscapes of North and South America. Burrowing owls can be found in grasslands, rangelands, agricultural areas, deserts, or any dry open area with low vegetation where abandoned burrows dug by mammals such as ground squirrels (*Spermophilus spp*.), prairie dogs (*Cynomys spp.),* and badgers (*Taxidea taxus*) are available. Black-tailed prairie dog colonies provide the primary habitat for burrowing owls (Klute et al. 2003).

The western burrowing owl has declined significantly throughout its North American range. Current population estimates for the United States are not well known but trend data suggest significant declines (McDonald et al. 2004). The last official population estimate placed them at less than 10,000 breeding pairs. The majority of the states within the owl's range have recognized that western burrowing owl populations are declining. It is listed as a sensitive species by the BLM throughout the west and by the USDAFS. Primary threats across the North American range of the burrowing owl are habitat loss and fragmentation primarily due to intensive agricultural and urban development, and habitat degradation due to declines in populations of colonial burrowing mammals (Klute et al. 2003).

Burrowing owl nesting habitat consists of open areas with mammal burrows. Individual burrowing owls have moderate to high site fidelity to breeding areas and even to particular nest burrows (Klute et al. 2003). Burrow and nest sites are reused at a higher rate if the bird has reproduced successfully during the previous year. Favored nest burrows are those in relatively sandy sites (possibly for ease of modification and drainage), areas with low vegetation around the burrows (to facilitate the owl's view and hunting success), holes at the bottom of vertical cuts with a slight downward slope from the entrance, and slightly elevated locations. In Wyoming, egg laying begins in mid-April. Incubation is assumed to begin at the mid-point of the laying period and lasts for 26 days (Olenick 1990). Young permanently leave the primary nest burrow around 44 days from hatch (Landry 1979). Juveniles will continue to hunt with and associate with parents until migration (early September through early November) (Haug 1985).

Habitat exists throughout the project area. The wildlife information provided by Bighorn Environmental

did not indicate any burrowing owl nests within, or within 0.25 mile, of the project area. Although it should be noted surveys were not conducted specifically for burrowing owls, primarily incidental observations would have been documented.

3.3.5.2.5. Grouse

3.3.5.2.5.1. Greater sage-grouse

The greater sage-grouse is listed as a sensitive species by BLM (Wyoming). In recent years, several petitions have been submitted to the USFWS to list greater sage-grouse as Threatened or Endangered. On January 12th, 2005, the USFWS issued a decision that the listing of the greater sage-grouse was "not warranted" following a Status Review. The decision document supporting this outcome noted the need to continue or expand all conservation efforts to conserve sage-grouse. In 2007, the U.S. District Court remanded that decision, stating that the USFWS' decision-making process was flawed and ordered the USFWS to conduct a new Status Review as a result of a lawsuit and questions surrounding the 2005 review (Winmill Decision Case No. CV-06-277-E-BLW, December 2007).

Greater sage-grouse are found in prairie, sagebrush shrublands, other shrublands, wet meadows, and agricultural areas; they depend upon substantial sagebrush stands for nesting and winter survival (BLM 2003).

Suitable sage-grouse nesting habitat is present throughout the project area. Moderately dense sagebrush is present in patches throughout the project area. Sage-grouse habitat models indicate that 95% of the project area contains high quality sage-grouse nesting habitat and/or high quality sage-grouse wintering habitat (Walker et al. 2007). BLM records identified eleven sage-grouse leks within 4 miles of the project area. The 4-mile distance was recommended by the State wildlife agencies' ad hoc committee for consideration of oil and gas development effects to nesting habitat (WGFD 2008). These eleven lek sites are identified below (Table 6).

Table 6. **Occupied Sage-grouse leks within 4 miles of the project area.**

LEK NAME	STATUS 2008	Last year of attendance	2008 Peak Males	Legal	UTMs
Alvaro	Inactive	1999	0	SWNE S26 T52 R80	394900E 4923200N
Arpan Draw	Inactive	2007	0	SENW S12 T52 R79	395800E 4927500N
Clear Creek Cutoff	Inactive	2006	0	NWNE S14 T52 R79	394470E 4927000N
Cook Draw	Active	2008	23	NENE S14 T52 R79	395063E 4926734N
Thompson Creek Rd I	Inactive	2004	0	SENW S13 T52 R79	395300E 4926200N
Thompson Creek Rd II	Inactive	2000	0	SESE S13 T52 R79	396600E 4925200N
Fleetwood Draw	Active	2008	12	SENE S23 T51 R79	394833E 4915051N
Jewell Draw	Active	2008	49	NWSE S34 T53 R78	402860E 4930957N
Kinney Draw	Active	2008	15	SESE S13 T51 R78	401223E 4919134N
Kinney Draw II	Active	2008	50	NWSW S10 T51 R78	401423E 4918361N
Nurse Draw	Active	2008	6	SWNW S3 T51 R78	401598E 4919511N

3.3.5.2.5.2. Sharp-tailed grouse

Sharp-tailed grouse inhabit short and mixed-grass prairie, sagebrush shrublands, woodland edges, and river canyons. In Wyoming, this species is found where grasslands are intermixed with shrublands, especially wooded draws, shrubby riparian area, and wet meadows.

The project area has the potential to support sharp-tailed grouse during most of the year. The mosaic of grasslands and sagebrush-grasslands could provide habitat from April through October. Cottonwoods and junipers could provide buds and berries, respectively, to sustain grouse through the winter.

3.3.5.2.6. Mountain plover

The mountain plover was proposed for listing in 1999 (USFWS). In 2003, the USFWS withdrew a proposal to list the Mountain Plover as a Threatened species, stating that the population was larger than had been thought and was no longer declining. Mountain plovers, which are a BLM sensitive species, are typically associated with high, dry, short grass prairies (BLM 2003). Mountain plover nesting habitat is often associated with heavily grazed areas such as prairie dog colonies and livestock pastures. Suitable mountain plover habitat is present within the project area due to prairie dog colonies.

3.4. West Nile Virus

West Nile virus (WNv) is a mosquito-borne disease that can cause encephalitis or brain infection. Mosquitoes spread this virus after they feed on infected birds and then bite people, other birds, and animals. WNv is not spread by person-to-person contact, and there is no evidence that people can get the virus by handling infected animals.

Since its discovery in 1999 in New York, WNv has become firmly established and spread across the United States. Birds are the natural vector host and serve not only to amplify the virus, but to spread it. Though less than 1% of mosquitoes are infected with WNv, they still are very effective in transmitting the virus to humans, horses, and wildlife. *Culex tarsalis* appears to be the most common mosquito to vector, WNv.

The human health issues related to WNv are well documented and continue to escalate. Historic data collected by the CDC and published by the USGS at www.westnilemaps.usgs.gov are summarized below. Reported data from the Powder River Basin (PRB) includes Campbell, Sheridan and Johnson counties.

Table 3.4 Historical West Nile Virus Information

Year	Total WY Human Cases	Human Cases PRB	Veterinary Cases PRB	Bird Cases PRB
2001	0	0	0	0
2002	2	0	15	3
2003	392	85	46	25
2004	10	3	3	5
2005	12	4	6	3
2006	65	0	2	2
2007*	155	22	Unk	1

*Wyoming Department of Health Records September 12, 2007.

Human cases of WNv in Wyoming occur primarily in the late summer or early fall. There is some evidence that the incidence of WNv tapers off over several years after a peak following initial outbreak (Litzel and Mooney, personal conversations). If this is the case, occurrences in Wyoming are likely to increase over the next few years, followed by a gradual decline in the number of reported cases.

Although most of the attention has been focused on human health issues, WNv has had an impact on vertebrate wildlife populations. At a recent conference at the Smithsonian Environmental Research Center, scientists disclosed WNv had been detected in 157 bird species, horses, 16 other mammals, and alligators (Marra et al 2003). In the eastern US, avian populations have incurred very high mortality, particularly crows, jays and related species. Raptor species also appear to be highly susceptible to WNv. During 2003, 36 raptors were documented to have died from WNv in Wyoming including golden eagle, red-tailed hawk, ferruginous hawk, American kestrel, Cooper's hawk, northern goshawk, great-horned owl, prairie falcon, and Swainson's hawk (Cornish et al. 2003). Actual mortality is likely to be greater. Population impacts of WNv on raptors are unknown at present. The Wyoming State Vet Lab determined 22 sage-grouse in one study project (90% of the study birds), succumbed to WNv in the PRB in 2003. While birds infected with WNv have many of the same symptoms as infected humans, they appear to be more sensitive to the virus (Rinkes 2003).

Mosquitoes can potentially breed in any standing water that lasts more than four days. In the Powder River Basin, there is generally increased surface water availability associated with CBNG development. This increase in potential mosquito breeding habitat provides opportunities for mosquito populations to increase. Preliminary research conducted in the Powder River Basin indicates WNv mosquito vectors were notably more abundant on a developed CBNG site than two similar undeveloped sites (Walker et al. 2003). Reducing the population of mosquitoes, especially species that are apparently involved with bird-to-bird transmission of WNv, such as *Culex tarsalis*, can help to reduce or eliminate the presence of virus in a given geographical area (APHIS 2002). The most important step any property owner can take to control such mosquito populations is to remove all potential man-made sources of standing water in which mosquitoes might breed (APHIS 2002).

The most common pesticide treatment is to place larvicidal briquettes in small standing water pools along drainages or every 100 feet along the shoreline of reservoirs and ponds. It is generally accepted that it is not necessary to place the briquettes in the main water body because wave action prevents this environment from being optimum mosquito breeding habitat. Follow-up treatment of adult mosquitoes with malathion may be needed every 3 to 4 days to control adults following application of larvicide (Mooney, personal conversation). These treatment methods seem to be effective when focused on specific target areas, especially near communities, however they have not been applied over large areas nor have they been used to treat a wide range of potential mosquito breeding habitat such as that associated with CBNG development.

The WDEQ and the Wyoming Department of Health sent a letter to CBNG operators on June 30, 2004. The letter encouraged people employed in occupations that require extended periods of outdoor labor, be provided educational material by their employers about WNv to reduce the risk of WNv transmission. The letter encouraged companies to contact either local Weed and Pest Districts or the Wyoming Department of Health for surface water treatment options.

3.5. Water Resources

The project area is within the Crazy Woman Creek drainage system.

3.5.1. Groundwater

WDEQ water quality parameters for groundwater classifications (Chapter 8 – Quality Standards for Wyoming Groundwater) define the following limits for TDS: 500 mg/l TDS for Drinking Water (Class I), 2000 mg/l for Agricultural Use (Class II) and 5000 mg/l for Livestock Use (Class III).

The ROD includes a Monitoring, Mitigation and Reporting Plan (MMRP). The objective of the plan is to monitor those elements of the analysis where there was limited information available during the preparation of the EIS. The MMRP called for the use of adaptive management where changes could be

made based on monitoring data collected during implementation.

Specifically relative to groundwater, the plan identified the following (PRB FEIS ROD page E-4):

- The effects of infiltrated waters on the water quality of existing shallow groundwater aquifers are not well documented at this time;
- Potential impacts will be highly variable depending upon local geologic and hydrologic conditions;
- It may be necessary to conduct investigations at representative sites around the basin to quantify these impacts;
- Provide site specific guidance on the placement and design of CBM impoundments, and;
- Shallow groundwater wells would be installed and monitored where necessary.

A search of the Wyoming State Engineer Office (WSEO) Ground Water Rights Database for this area showed 23 registered stock and domestic water wells within ½ mile of a federal CBNG producing well in the POD with depths ranging from 4 to 1,550 feet. For additional information on water, please refer to the PRB FEIS (January 2003), Chapter 3, Affected Environment pages 3-1 through 3-36 (groundwater).

3.5.2. Surface Water

The project area is within the Crazy Woman Creek primary watershed. The area is drained by small, steep tributaries to Crazy Woman that are mostly ephemeral (flowing only in response to a precipitation event, with a few short reaches that may display intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source – PRB FEIS Chapter 9 Glossary) during wetter years. The channels range from well vegetated grassy swales, without defined bed and bank in the headwater areas, to deeply incised drainages with floodplains and steep erodible inner hillslopes as the tributaries approach Crazy Woman Creek.

The PRB FEIS presents the historic mean Electrical Conductivity (EC, in μmhos/cm) and Sodium Adsorption Ratio (SAR) by watershed at selected United States Geological Survey (USGS) Gauging Stations in Table 3-11 (PRB FEIS page 3-49). These water quality parameters "illustrate the variability in ambient EC and SAR in streams within the Project Area. The representative stream water quality is used in the impact analysis presented in Chapter 4 as the baseline for evaluating potential impacts to water quality and existing uses from future discharges of CBM produced water of varying chemical composition to surface drainages within the Project Area" (PRB FEIS page 3-48). For the Crazy Woman Creek Watershed, the EC ranges from 1,066 at Maximum monthly flow to 1,937 at Low monthly flow and the SAR ranges from 1.29 at Maximum monthly flow to 2.26 at Low monthly flow. These values were determined at the USGS station located at Upper Station (06316400) near Arvada (PRB FEIS page 3-49).

The operator has identified a natural spring within this POD boundary at TN52, RW78, NENE of Sec 28. The flow and water quality of the spring has not been determined at the time of POD approval.

For more information regarding surface water, please refer to the PRB FEIS Chapter 3 Affected Environment pages 3-36 through 3-56.

3.6. Cultural Resources

Class III cultural resource inventories were conducted for the Rose Draw Beta POD project, following the Secretary of the Interior's Guidelines and Standards. A Class III inventory specifically for the project was conducted by North Platte Archaeological Services (BLM project no. 70080071). The inventory covered approximately 3203 acres; this inventory recorded, rerecorded, or revisited 10 sites and 12

isolates. One additional Class III inventory cover portions of the project (BLM # 70040150). The following cultural resources are located in or near the APE (area of potential effect).

Table 3.5 Cultural Resources Inventory Results

Site Number	Site Type	National Register Eligibility
48JO3681	Site	E
48JO3727	Site	NE
48JO3728	Site	NE
48JO4005	Site	NE
48JO4006	Site	NE
48JO4007	Site	NE
48JO4008	Site	NE
48JO4009	Site	NE
48JO4010	Site	NE
48JO4087	Site	E
48IR1	Isolate	NE
48IR2	Isolate	NE
48IR3	Isolate	NE
48IR4	Isolate	NE
48IR5	Isolate	NE
48IR6	Isolate	NE
48IR7	Isolate	NE
48IR8	Isolate	NE
48IR9	Isolate	NE
48IR10	Isolate	NE
48IR11	Isolate	NE
48IR12	Isolate	NE

E: Eligible
NE: Not eligible

3.7. Air Quality

Existing air quality throughout most of the Powder River Basin is in attainment with all ambient air quality standards. Although specific air quality monitoring is not conducted throughout most of the

Powder River Basin, air quality conditions in rural areas 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.

Existing air pollutant emission sources within the region include following:

- Exhaust emissions (primarily CO and nitrogen oxides [NOx]) from existing natural gas fired compressor engines used in production of natural gas and CBNG; and, gasoline and diesel vehicle tailpipe emissions of combustion pollutants;
- Dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas and road sanding during the winter months;
- Transport of air pollutants from emission sources located outside the region;
- Dust (particulate matter) from coal mines;
- NOx, particulate matter, and other emissions from diesel trains and,
- SO2 and NOx from power plants.

For a complete description of the existing air quality conditions in the Powder River Basin, please refer to the PRB Final EIS Volume 1, Chapter 3, pages 3-291 through 3-299.

4. ENVIRONMENTAL CONSEQUENCES

The changes to the proposed action (Alternative B) resulted in development of Alternative C as the preferred alternative. The changes have reduced impacts to the environment which will result from this action. The environmental consequences of Alternative C are described below.

4.1. Vegetation & Soils Direct and Indirect Effects

Impacts to vegetation and soils from surface disturbance will be reduced, by following the operator's plans and BLM applied mitigation. Of the 30 proposed well locations, 11 can be drilled without a well pad being constructed and 19 will require a constructed (cut & fill) well pad. Surface disturbance associated with the drilling of the 11 wells without constructed pads would involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (estimated approximate size of 2 pits, 32 x 20 feet each), and compaction (from vehicles driving/parking at the drill site). Estimated initial disturbance associated with these 11 wells would involve approximately 0.9 acre/well, but interim reclamation will reduce this to approximately 0.2 acre/well for 2.2 total acres. The other 19 wells requiring cut & fill pad construction would disturb approximately 0.93 acres/well pad for a total of 17.7 acres. The total estimated disturbance for all 30 wells would be 19.9 acres.

Approximately 13.5 miles of improved and template roads would be constructed to provide access to various well locations. The majority of proposed pipelines (gas and water) have been located in "disturbance corridors." Disturbance corridors involve the combining of 2 or more utility lines (water, gas, power) in a common trench, usually along access routes. This practice results in less surface disturbance and overall environmental impacts. Approximately 0.5 miles of pipeline would be constructed outside of corridors. Expedient reclamation of disturbed land with stockpiled topsoil, proper seedbed preparation techniques, and appropriate seed mixes, along with utilization of erosion control measures (e.g., waterbars, water wings, culverts, rip-rap, gabions etc.) would ensure land productivity/stability is regained and maximized.

Proposed stream crossings, including a Professional Engineer-certified railroad car bridge, a 12' square culvert-bridge, more typical 18" and 24" culverts, and low water crossings, are shown on the MSUP and the WMP maps (see the POD). These structures would be constructed in accordance with sound,

engineering practices and BLM standards.

The PRB FEIS made predictions regarding the potential impact of produced water to the various soil types found throughout the Basin, in addition to physical disturbance effects. "Government soil experts state that SAR values of 13 or more cause potentially irreversible changes to soil structure, especially in clayey soil types, that reduce permeability for infiltration of rainfall and surface water flows, restrict root growth, limit permeability of gases and moisture, and make tillage difficult." (PRB FEIS page 4-144).

Table 4.1 summarizes the proposed surface disturbance.

Table 4.1 - SUMMARY OF DISTURBANCE

Facility	Number or Miles	Factor	Acreage of Disturbance	Duration of Disturbance
Nonconstructed Pad	11	0.2/acre	2.2	Long Term
Constructed Pad	19	0.93/acre	17.7	
Gather/Metering Facilities	0	Site Specific	0.0	Long Term
Screw Compressors	0	Site Specific		Long Term
Monitor Wells		0.1/acre		Long Term
Impoundments	4		15.0	Long Term
On-channel	2	Site Specific	5.0	
Off-channel	2	Site Specific	10.0	
Water Discharge Points		Site Specific or 0.01 ac/WDP	0.24	
Channel Disturbance				
Headcut Mitigation*	0.0	Site Specific	0.0	
Channel Modification	0.0	Site Specific	0.0	
Engineered Roads				Long Term
No Corridor	0		0	
With Corridor	5.1	50' Width	30.96	
Template Roads				Long Term
No Corridor	0		0	
With Corridor	8.4	50' Width	50.72	
Pipelines				Short Term
No Corridor	0.04	35' Width	1.4	
With Corridor	0		0	
Buried Power Cable		12' Width or Site Specific		Short Term
No Corridor	0		0	
Overhead Powerlines	0.0	15' Width	0	Long Term
Additional Disturbance	0	Site Specific	0	

The designation of the duration of disturbance is defined in the PRB FEIS (pg 4-1 and 4-151). "For this EIS, short-term effects are defined as occurring during the construction and drilling/completion phases. Long-term effects are caused by construction and operations that would remain longer".

4.1.1. Wetland/Riparian

The PRB FEIS assumes that 15% of the impounded water will re-surface as channel flow (PRB FEIS pg 4-74). Re-surfacing water from the impoundments will potentially allow for wetland-riparian species establishment. "Continuous high stream flows into wetlands and riparian areas would change the composition of species and dynamics of the food web. The shallow groundwater table would rise closer to the surface with increased and continuous stream flows augmented by produced water discharges. Vegetation in riparian areas, such as cottonwood trees, that cannot tolerate year-round inundated root zones would die and would not be replaced. Other plant species in riparian areas and wetland edges that favor inundated root zones would flourish, thus changing the plant community composition and the associated animal species. A rise in the shallow ground groundwater table would also influence the hydrology of wetlands by reducing or eliminating the seasonal drying periods that affect recruitment of plant species and species composition of benthic and water column invertebrates. These changes to the aquatic food web base would affect the higher trophic levels of fish and waterfowl abundance and species richness for wetlands and riparian areas." (PRB FEIS Page 4-175).

The PRB FEIS identified effects to gallery forests of mature cottonwood trees stating that "(they) may be lost by bank undercutting caused by the increased surface water flows in channels." Included in the ROD is programmatic mitigation "which may be appropriate to apply at the time of APD approval if site specific conditions warrant."(ROD page A-30). One of the conditions included in that section addresses the impact to trees in A.5.8-2: "To reduce adverse effects on existing wetlands and riparian areas, water discharge should not be allowed if increased discharge volumes or subsequent recharge of shallow aquifers will inundate and kill woody species, such as willows or cottonwoods."(ROD Page A-32).

4.1.2. Invasive Species

Based on the investigations performed during the POD planning process, the operator has committed to the control of noxious weeds and species of concern using the following measures in an Integrated Pest Management Plan (IPMP) included in the proposal:

1. Control methods used to target the invasive weeds and species of concern in the project area include chemical, biological, and mechanical methods. Chemical agents used will vary according to species. 2,4-D can be used on all of the weeds found in the area; other possible chemical agents to be used include Picloram, Plateau, Dicamba, and Curtail. Biological methods include the use of Hawkmoth caterpillars, root feeding beetles, Canada thistle stemweevil and bud weevil, mealy bugs, and leaf beetles. Mechanical methods include mowing, burning, grazing, disking, and re-seeding disturbed areas immediately. There is no BLM surface in the project area. LOG will work with Campbell County Weed and Pest, and with the private landowners to achieve effective weed control.
2. Preventive practices to prevent the further spread of noxious weeds in the project area include washing vehicles before changing location, re-seeding disturbed areas, and the use of certified weed-free seed mixes.
3. LOG will provide periodic weed education and awareness programs to its employees and contractors. All field personnel will be encouraged to report any new noxious weed infestations to the company representative.

Cheatgrass or downy brome (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) are known to exist in the affected environment. These two species are found in such high densities and numerous locations throughout NE Wyoming that a control program is not considered feasible at this time.

The use of existing facilities along with the surface disturbance associated with construction of proposed access roads, pipelines, water management infrastructure, produced water discharge points and related facilities would present opportunities for weed invasion and spread. Produced CBNG water would likely

continue to modify existing soil moisture and soil chemistry regimes in the areas of water release and storage. The activities related to the performance of the proposed project would create a favorable environment for the establishment and spread of noxious weeds/invasive plants such as salt cedar, Canada thistle and perennial pepperweed. However, mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

4.1.3. Cumulative Effects

The PRB FEIS stated that cumulative impacts to soils could occur due to sedimentation from water erosion that could change water quality and fluvial characteristics of streams and rivers in the sub-watersheds of the Project Area. SAR in water in the sub-watersheds could be altered by saline soils because disturbed soils with a conductivity of 16 mmhos/cm could release as much as 0.8 tons/acre/year of sodium (BLM 1999c). Soils in floodplains and streambeds may also be affected by produced water high in SAR and TDS. (PRB FEIS page 4-151).

As referenced above, the PRB FEIS did disclose that cumulative impacts may occur to soils and vegetation as a result of discharged produced CBNG water. The cumulative effects on vegetation and soils are within the analysis parameters and impacts described in the PRB FEIS for the following reasons:

- They are proportional to the actual amount of cumulatively produced water in the Crazy Woman Creek drainage, which is approximately 0.9% of the total predicted in the PRB FEIS.
- The WDEQ enforcement of the terms and conditions of the WYPDES permit that are designed to protect irrigation downstream.
- The WMP for the Rose Draw Unit Beta proposes that produced water will not contribute significantly to flows downstream.

No additional mitigation measures are required.

4.2. Wildlife (Alternative C – Environmentally Preferred)

EFFECTS ANALYSIS

During the environmental analysis process, the BLM identified project modifications resulting in an environmentally preferred alternative (Alternative C). At the on-sites, all areas of proposed surface disturbance were inspected to ensure that potential impacts to natural resources would be reduced. In some cases, access roads were re-routed, and well locations, pipelines, discharge points and other water management control structures were moved, modified, mitigated or dropped from further consideration to alleviate or minimize environmental impacts.

4.2.1. Big Game Direct and Indirect Effects

Under the environmentally preferred alternative, Yearlong range for pronghorn antelope and Winter Yearlong range for mule deer will be directly disturbed with the construction of wells, reservoirs, pipelines and roads. Table 4.1 summarized the proposed activities; items identified as long term disturbance would be direct habitat loss. Short-term disturbances also result in direct habitat loss; however, they should provide some habitat value as these areas are reclaimed and native vegetation becomes established.

In addition to the direct habitat loss, big game would likely be displaced from the project area during drilling and construction. A study in central Wyoming reported that mineral drilling activities displaced mule deer by more than 0.5 miles (Hiatt and Baker 1981). The WGFD indicates a well density of eight wells per section creates a high level of impact for big game and that avoidance zones around mineral facilities overlap creating contiguous avoidance areas (WGFD 2004). A multi-year study on the Pinedale Anticline suggests mule deer avoid mineral activities, and after three years of drilling activity the deer have not become accustomed to the disturbance (Madson 2005).

Big game animals are expected to return to the project area following construction; however, populations will likely be lower than prior to project implementation as the human activities associated with operation and maintenance continue to displace big game. Mule deer are more sensitive to operation and maintenance activities than pronghorn, and, as the Pinedale Anticline study suggests, mule deer do not readily habituate. A study in North Dakota stated "Although the population (mule deer) had over seven years to habituate to oil and gas activities, avoidance of roads and facilities was determined to be long term and chronic" (Lustig 2003). Deer have even been documented to avoid dirt roads that were used only by 4-wheel drive vehicles, trail bikes, and hikers (Jalkotzy et al. 1997).

Winter big game diets are sub-maintenance, meaning they lose weight and body condition as the winter progresses. Survival below the maintenance level requires behavior that emphasizes energy conservation. Canfield et al. (1999) pointed out that forced activity caused by human disturbance exacts an energetic disadvantage, while inactivity provides an energetic advantage for animals. Geist (1978) further defined effects of human disturbance in terms of increased metabolism, which could result in illness, decreased reproduction, and even death.

Reclamation and other CBNG activities that occur within big game habitats during the spring will likely displace does and fawns due to the human presence in the area. This may cause reduced survival rate of does and fawns that must expend increased energies to avoid such activities.

4.2.1.1. Big Game Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-211.

4.2.2. Aquatics Direct and Indirect Effects

The proposed water crossings could affect native fish. Water crossings should be constructed in a manner that fish passage will not be impeded and channel and bank stability are not compromised. Maintaining fish passage will require that no plunging flow, or a drop from the crossing to the channel immediately below the crossing, occur over a crossing during low flow events.

Many of the native fishes in the Powder River Basin are highly migratory and are bottom-oriented swimmers that lack the ability to jump. Any structure that inhibits fish movements can disrupt spawning or leave fish stranded during times of little or no flows. Crossing should be located to avoid existing high banks and high gradient stream areas. The highly erosive nature of streams in the Powder River basin makes them vulnerable to changes in channel profile.

Monitoring of water crossings after each high-water event and after spring high flows will be required to maintain a stream profile that does not inhibit fish passage. If the stream profile on the water crossing is compromised by a high-water event, maintenance of the crossing will be required to restore fish passage.

Produced water is to be stored in four off-channel reservoirs. The Wyoming Department of Environmental Quality (DEQ) regulates effluent discharge through the National Pollution Discharge Elimination System in compliance with the Federal Water Pollution Control Act and the Wyoming Environmental Quality Act. The Wyoming DEQ has established effluent limits for the protection of game and non-game, aquatic life other than fish, wildlife, and other water uses.

4.2.3. Migratory Birds Direct and Indirect Effects

Disturbance of the habitat types within the project area is likely to impact migratory birds. Native habitats are being lost directly with the construction of wells, roads, and pipelines. Prompt re-vegetation of short-term disturbance areas should reduce habitat loss impacts. Human activities likely displace migratory birds farther than simply the physical habitat disturbance. Drilling and construction noise can be troublesome for songbirds by interfering with the males' ability to attract mates and defend territory, and the ability to recognize calls from conspecifics (BLM 2003).

Habitat fragmentation results in more than just a quantitative loss in the total area of habitat available; the remaining habitat area is also qualitatively altered (Temple and Wilcox 1986). Ingelfinger (2004) identified that the density of breeding Brewer's sparrows declined by 36% and breeding sage sparrows declined by 57% within 100 m of dirt roads within a natural gas field. Effects occurred along roads with light traffic volume (<12 vehicles per day). The increasing density of roads constructed in developing natural gas fields exacerbated the problem creating substantial areas of impact where indirect habitat losses (displacement) were much greater than the direct physical habitat losses.

Reclamation and other CBNG activities that occur in the spring may be detrimental to migratory bird survival. Those species that are edge-sensitive will be displaced further away from vegetative edges due to increased human activity, causing otherwise suitable habitat to be abandoned. If the interior habitat is at carrying capacity, then birds displaced from the edges will have no place to relocate. One consequences of habitat fragmentation is a geometric increase in the proportion of the remaining habitat that is near edges (Temple 1986). In severely fragmented habitats, all of the remaining habitat may be so close to edges that no interior habitat remains (Temple and Cary 1988). Over time, this will lead to a loss of interior habitat species in favor of edge habitat species. Other migratory bird species that utilize the disturbed areas for nesting may be disrupted by the human activity and nests may be destroyed by equipment.

Migratory bird species within the Powder River Basin nest in the spring and early summer and are vulnerable to the same affects as sage-grouse and raptor species. Though no timing restrictions are typically applied specifically to protect migratory bird breeding or nesting, where sage-grouse or raptor nesting timing limitations are applied, nesting migratory birds are also protected. Where these timing limitations are not applied and migratory bird species are nesting, migratory birds remain vulnerable. Additional direct and indirect effects to migratory birds are discussed in the PRB FEIS (4-231-235).

4.2.3.1. Migratory Birds Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, Page 4-235. No additional mitigation measures are required.

4.2.4. Raptors Direct and Indirect Effects

Human activities in close proximity to active raptor nests may interfere with nest productivity. Romin and Muck (1999) indicate that activities within 0.5 miles of a nest are prone to cause adverse impacts to nesting raptors. If mineral activities occur during nesting, they could be sufficient to cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to overheating or chilling of eggs or chicks. Prolonged disturbance can also lead to the abandonment of the nest by the adults. Both actions can result in egg or chick mortality. In addition, routine human activities near these nests can draw increased predator activity to the area and increase nest predation.

To reduce the risk of decreased productivity or nest failure, the BLM BFO requires a one-half mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructure requiring human visitation to be located greater than one-quarter mile from occupied raptor nests.

As is the case in most of the Powder River Basin, the creek bottom contains Fee mineral rights with one State section. The raptors living in Crazy Woman Creek's gallery forest have 21 Fee and State wells within 0.5 mile. Of the 30 proposed Federal well locations, nine are staked within ½ mile of raptor nests. Due to the proximity of Crazy Woman Creek's cottonwood gallery forest to the project wells, it was impossible for the operator to avoid placing wells within 0.5 miles of raptor nests. Three golden eagle nest locations were of particular concern. The operator, BLM, and the US Fish and Wildlife Service met on August 27, 2008 in Buffalo to determine how to avoid and mitigate impacts to these nests. As a result of project planning, the onsite visits, and the August 27 meeting, Lance modified their proposal to avoid driving under the golden eagle nests in sections 20, 22, and 30 as well as producing a travel management plan for these locations. The main component of the travel plan is limiting traffic between 9 AM and 3 PM on affected roads. Drilling and surface disturbance for the Federal development will be limited to areas more than 0.5 mile from the golden eagle nests. Those areas where production traffic (well pumpers and roustabouts) may affect golden eagle nests were included in the travel management plan.

The proposed access road from Tipperary Road to the RDU State 11-23 well and on to the 12-23 Federal well was field checked by BLM and USFWS to ensure that impacts to the golden eagle nests would be avoided with this access.

Additional direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS (4-216-221).

4.2.4.1. Raptors Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-221.

4.2.5. Threatened and Endangered and Sensitive Species

Potential project effects on Threatened and Endangered Species were analyzed and a summary is provided in Table 4.2.5.1. Threatened and Endangered Species potentially affected by the proposed project area are further discussed following the table.

4.2.5.1. Threatened and Endangered Species

Table 4.2 Summary of Threatened and Endangered Species Habitat and Project Effects.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Endangered				
Black-footed ferret (*Mustela nigripes*)	Black-tailed prairie dog colonies or complexes > 1,000 acres.	NS	NLAA	Habitat not occupied.
Threatened				
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Riparian areas with permanent water	NP	No Effect	No suitable habitat impacted.

Presence
K Known, documented observation within project area.
S Habitat suitable and species suspected, to occur within the project area.
NS Habitat suitable but species is not suspected to occur within the project area.
NP Habitat not present and species unlikely to occur within the project area.

4.2.5.1.1. Black-Footed Ferret Direct and Indirect Effects

Suitable habitat is of sufficient size to support a black-footed ferret population and the project area is adjacent to the Arvada complex. No surveys for ferrets were required or conducted. It is extremely unlikely that any black-footed ferret is present in the project area. However, if any become present, the proposed action will most likely make portions of the project area unsuitable for ferret inhabitance. Implementation of the proposed development "may affect, but is not likely to adversely affect" the black-footed ferret.

4.2.5.1.2. Ute Ladies'-Tresses Orchid Direct and Indirect Effects

The Ute ladies'-tresses orchid is threatened by energy developments, noxious weeds, and water developments. Prolonged idle conditions in the absence of disturbance (flooding, grazing, mowing) may be a threat just as repeated mowing and grazing during flowering may lead to decline (Hazlett 1996, 1997, Heidel 2007). Heavy equipment used in energy development construction could dig up plants. Invasive weeds transplanted by vehicle and foot traffic in habitat could outcompete this fragile species. Restricting work from areas of Ute ladies'-tresses orchid habitat reduces these impacts.

Potential habitat is present within the project area at roads and utilities crossing Crazy Woman Creek. Due to the amount of private mineral rights along the creek, the roads and pipelines were constructed as a non-federal action prior to submission of the proposed action. The proposed action includes two water crossings of Crazy Woman Creek. Big Horn Environmental assessed the habitat quality at those locations and determined no potential habitat would be impacted. Therefore the proposed action shall have "**no effect**" on Ute ladies'- tresses orchid.

4.2.5.2. Sensitive Species Direct and Indirect Effects

BLM will take necessary actions to meet the policies set forth in sensitive species policy (BLM Manual 6840). BLM Manual 6840.22Astates: "The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other proposed actions and to develop sound conservation practices. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary."

4.2.5.2.1. Prairie dog colony obligates

Wells, roads, pipelines and other infrastructure associated with energy development constructed within prairie dog colonies will directly remove habitat for prairie dog colony obligate species. Activities that disturb these species could lead to temporary or even long-term or permanent abandonment. Direct loss of species may also occur from vehicle traffic. Continued loss of prairie dog habitat and active prairie dog towns will result in the decline of numerous sensitive species in the short grass prairie ecosystem.

4.2.5.2.2. Sagebrush obligates

Shrubland and grassland birds are declining faster than any other group of species in North America (Knick et al. 2003). In Wyoming, existing oil and gas wells are located primarily in landscapes dominated by sagebrush, causing direct loss of this habitat. Associated road networks, pipelines, and powerline transmission corridors also influence vegetation dynamics by fragmenting habitats or by creating soil conditions facilitating the spread of invasive species (Braun 1998, Gelbard and Belnap 2003). Density of sagebrush-obligate birds within 100 m of roads constructed for natural gas development in Wyoming was 50% lower than at greater distances (Ingelfinger 2001). Increased numbers of corvids and raptors associated with powerlines (Steenhof et al. 1993, Knight and Kawashima 1993, Vander Haegen et al. 2002) increases the potential predation impact on sage-grouse and other

sagebrush-breeding birds (Knick et al. 2003)

Fragmentation of shrubsteppe habitat is a major disruption that has consequences for sagebrush-obligate species (Braun et al. 1976; Rotenberry & Wiens 1980a). In fragmented habitats, suitable habitat area remains only as a remnants surrounded by unusable environments (Urban and Shugart 1984; Fahrig & Paloheimo 1988). Populations of sagebrush-obligate species decline because areas of suitable habitat decrease (Temple & Cary 1988), because of lower reproduction, and/or because of higher mortality in remaining habitats (Robinson 1992; Porneluzi et al. 1993). Fragmentation of shrubsteppe has the further potential to affect the conservation of shrub-obligate species because of the permanence of disturbance (Knick and Rotenberry 1995). Several decades are required to reestablish ecologically functioning mature sagebrush communities. Due to this, sagebrush obligate species may not return until after habitat reestablishment.

Table 4.3 Summary of Sensitive Species Habitat and Project Effects.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Amphibians				
Northern leopard frog (*Rana pipiens*)	Beaver ponds, permanent water in plains and foothills	S	MIIH	Additional water may affect frog habitat.
Spotted frog (*Ranus pretiosa*)	Ponds, sloughs, small streams	NP	NI	Prairie not mountain habitat.
Birds				
Baird's sparrow (*Ammodramus bairdii*)	Grasslands, weedy fields	S	MIIH	Sagebrush cover will be affected.
Bald eagle (*Haliaeetus leucocephalus*)	Mature forest cover often within one mile of large water body.	K	MIIH	Project includes overhead power.
Brewer's sparrow (*Spizella breweri*)	Basin-prairie shrub	K	MIIH	Sagebrush cover will be affected.
Burrowing owl (*Athene cunicularia*)	Grasslands, basin-prairie shrub	K	MIIH	Prairie dog colony present.
Ferruginous hawk (*Buteo regalis*)	Basin-prairie shrub, grasslands, rock outcrops	S	MIIH	Basin-prairie shrub will be affected.
Greater sage-grouse (*Centrocercus urophasianus*)	Basin-prairie shrub, mountain-foothill shrub	K	WIPV	Sagebrush cover will be affected.
Loggerhead shrike (*Lanius ludovicianus*)	Basin-prairie shrub, mountain-foothill shrub	K	MIIH	Sagebrush cover will be affected.
Long-billed curlew (*Numenius americanus*)	Grasslands, plains, foothills, wet meadows	NP	NI	Habitat not present.
Mountain plover (*Charadrius montanus*)	Short-grass prairie with slopes < 5%	K	MIIH	Prairie dog colonies will be affected.
Northern goshawk (*Accipiter gentilis*)	Conifer and deciduous forests	NP	NI	No forest habitat present.
Peregrine falcon (*Falco peregrinus*)	cliffs	NP	NI	No nesting habitat present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Sage sparrow (*Amphispiza billneata*)	Basin-prairie shrub, mountain-foothill shrub	NP	NI	No known records in or near the project area.
Sage thrasher (*Oreoscoptes montanus*)	Basin-prairie shrub, mountain-foothill shrub	K	MIIH	Sagebrush cover will be affected.
Trumpeter swan (*Cygnus buccinator*)	Lakes, ponds, rivers	S	MIIH	Reservoirs may provide migratory habitat.
White-faced ibis (*Plegadis chihi*)	Marshes, wet meadows	NP	NI	Permanently wet meadows not present.
Yellow-billed cuckoo (*Coccyzus americanus*)	Open woodlands, streamside willow and alder groves	NP	NI	Streamside habitats not present
Fish				
Yellowstone cutthroat trout (*Oncoryhynchus clarki bouvieri*)	Mountain streams and rivers in Tongue River drainage	NP	NI	Outside species range.
Mammals				
Black-tailed prairie dog (*Cynomys ludovicianus*)	Prairie habitats with deep, firm soils and slopes less than 10 degrees.	K	MIIH	Some impact to prairie dogs is anticipated.
Fringed myotis (*Myotis thysanodes*)	Conifer forests, woodland chaparral, caves and mines	NP	NI	Habitat not present.
Long-eared myotis (*Myotis evotis*)	Conifer and deciduous forest, caves and mines	NP	NI	Habitat not present.
Spotted bat (*Euderma maculatum*)	Cliffs over perennial water.	NP	NI	Cliffs & perennial water not present.
Swift fox (*Vulpes velox*)	Grasslands	S	NI	Habitat present.
Townsend's big-eared bat (*Corynorhinus townsendii*)	Caves and mines.	NP	NI	Habitat not present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Plants				
Porter's sagebrush (*Artemisia porteri*)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	NI	Habitat not present.
William's wafer parsnip (*Cymopterus williamsii*)	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6000-8300 ft.	NP	NI	Habitat not present.

Presence
K Known, documented observation within project area.
S Habitat suitable and species suspected, to occur within the project area.
NS Habitat suitable but species is not suspected to occur within the project area.
NP Habitat not present and species unlikely to occur within the project area.

Project Effects
NI No Impact.
MIIH May Impact Individuals or Habitat, but will not likely contribute to a trend towards Federal listing or a loss of viability to the population or species.
WIPV Will Impact Individuals or Habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
BI Beneficial Impact

4.2.5.2.1. Bald eagle Direct and Indirect Effects

Based on the completed and continuing raptor nesting and bald eagle winter roost surveys, suitable roosting and marginal nesting habitat exist in the project area. A documented roost is located approximately one mile to the west of the project area. A nesting attempt was documented within the project area. The entire project area is proposed within one mile of occupied bald eagle habitat.

Typically two-tracks and improved project roads pose minimal collision risk. In one year of monitoring road-side carcasses the BLM Buffalo Field Office reported 439 carcasses, 226 along Interstates (51%), 193 along paved highways (44%), 19 along gravel county roads (4%), and 1 along an improved CBNG road (<1%) (Bills 2004). No road-killed eagles were reported; eagles (bald and golden) were observed feeding on 16 of the reported road-side carcasses (<4%). The risk of big-game vehicle-related mortality along CBNG project roads is so insignificant or discountable that when combined with the lack of bald eagle mortalities associated with highway foraging leads to the conclusion that CBNG project roads do not affect bald eagles.

The proposed access road from Tipperary Road to the RDU State 11-23 well and on to the 12-23 Federal well was field checked by BLM and USFWS to ensure that impacts to nesting raptors would be avoided with this access. This proposed access does travel approximately 0.25 miles from the failed 2008 bald eagle nest. Due to the proximity of Tipperary Road, the present level of CBNG activity, the 2008 nest failure, and the high density of golden eagle nests the USFWS and BLM doubt this nest will be reoccupied.

Due to the number of bald eagles using Crazy Woman Creek in the winter, the operator will be required to survey for roosting eagles each winter and a timing limitation will be enforced within one-mile of occupied habitat to reduce disturbance to roosting and foraging eagles.

4.2.5.2.2. Grouse

4.2.5.2.2.1. Greater sage-grouse Direct and Indirect Effects

Eleven sage-grouse leks are known within 4 miles of the project. The proposed action will adversely impact high quality nesting, brood rearing, late summer, and winter habitats. Proposed project elements that are anticipated to negatively impact grouse are listed in the project impact table (Table # 4.1). Using 0.6 miles as a distance for effective sage-grouse estimated habitat loss (Holloran et al. 2007, Aldridge and Boyce 2007), will be 1,920 acres from existing overhead power, 10,000 acres from roads, and 21,000 acres from 29 well locations. These numbers are not additive since each well location has an associated road and power and in many cases wells are closer than 0.6 miles to each other. Therefore, the above numbers over-represent anticipated impacts within the project area if totaled, however since most well locations are within 0.6 miles of each other the entire project area (approximately 5,200 acres) can be considered affected.

4.2.5.2.2.1.1. Greater sage-grouse Cumulative Effects

Based on the best available science, which is summarized below, the proposed action could affect the local grouse population. Future development in the area, coupled with the proposed action, may contribute to the subsequent abandonment of the 11 leks within four miles of the project.

In addition to the direct impacts to sage-grouse habitat that will be created by the federal wells and associated infrastructure the project area does contain existing fee, state, and federal fluid mineral development. The sage-grouse cumulative impact assessment area for this project encompasses a four mile radius from the earlier listed sage-grouse leks. As of September 2, 2008, there are approximately 337 existing wells and associated infrastructure within four miles of these leks - an area of 180 square miles. The existing well density is approximately 1.9 wells/section across the area defined by the four-mile buffers around the 11 leks.

There are 593 proposed wells (including the wells from this project) within four miles of the leks. With the addition of the 457 proposed wells that are not associated with this proposed action, the well density within four miles of the leks increases to 2.5 wells/section. With approval of alternative C (30 proposed well locations) the well density 3.3 wells/section.

CBNG is a recent development, with the first well drilled in 1987 (Braun et al. 2002). In February 1998 there were 420 producing wells primarily restricted to eastern Campbell County (BFO 1999). By May 2003 there were 26,718 CBNG wells permitted within the BFO area (WGFD 2004). The PRB FEIS estimated 51,000 additional CBNG wells to be drilled over a ten year period beginning in 2003 (BFO 2003).

The Powder River Basin Oil and Gas Project FEIS (BLM 2003) concluded that "Activities associated with the proposed project would affect sage-grouse in several ways. These effects may include: (1) increased direct mortality (including legal hunting, poaching, and collision with power lines and vehicles); (2) the introduction of new perches for raptors and thus the potential change in rate of predation; (3) direct loss or degradation of habitats; (4) indirect disturbance resulting from human activity (including harassment, displacement, and noise); (5) habitat fragmentation (particularly through construction of roads); and (6) changes in population (pg. 4-257)." The FEIS goes on to state that "implementation of several mitigation measures would reduce the extent of each impact addressed by those measures. Despite these measures, the synergistic effect of several impacts would likely result in a downward trend for the sage-grouse population, and may contribute to the array of cumulative effects that may lead to its federal listing. Local populations may be extirpated in areas of concentrated development, but viability across the Project Area (Powder River Basin) or the entire range of the species is not likely to be compromised (pg. 4-270)."

The Powder River Basin Oil and Gas Project Record of Decision (BLM 2003) included a Mitigation Monitoring and Reporting Plan (MMRP). The uncertainties as to where and at what level development was to proceed as well as the uncertainties associated with the assumptions that were used to predict impacts suggests that one-time determination of impacts that is included in the EIS may not occur as projected. The MMRP helps to continually assess the effects of the project and the adequacy of the mitigation. Such a plan/process provides a mechanism to continuously modify management practices in order to allow development while continuing to protect the environment (E-1)." In other words, development pace and patterns may not occur as predicted, and so the BLM may use the adaptive management process provided for in the BFO RMP.

Impacts from CBNG development are likely to be significant and additive to the long-term impacts afflicting the sage-grouse population (WGFD 2004). Greater sage-grouse habitat is being directly lost with the addition of well sites, roads, pipelines, powerlines, reservoirs and other infrastructure in the Powder River Basin (WGFD 2005, WGFD 2004). Sage-grouse avoidance of CBNG infrastructure results in even greater indirect habitat loss. In southwestern Wyoming, yearling female greater sage-grouse avoid nesting in areas within 0.6 miles of producing well pads (Holloran et al. 2007), and in southern Alberta, brood-rearing females avoid areas within 0.6 miles of producing wells (Aldridge and Boyce 2007). Doherty et al. (2008) demonstrated that sage-grouse in the Powder River Basin avoided otherwise suitable wintering habitats once they have been developed for energy production, even after timing and lek buffer stipulations had been applied. The WGFD feels a well density of eight wells per section creates a high level of impact for sage-grouse and that sage-grouse avoidance zones around mineral facilities overlap creating contiguous avoidance areas (WGFD 2004). As interpreted by coordinated effort with state fish and wildlife agencies from Montana, Colorado, Utah, South Dakota, North Dakota and Wyoming, (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008), research indicates that oil or gas development exceeding approximately 1 well pad per square mile

with the associated infrastructure, results in calculable impacts on breeding populations, as measured by the number of male sage-grouse attending leks (Holloran 2005, Walker et al. 2007)

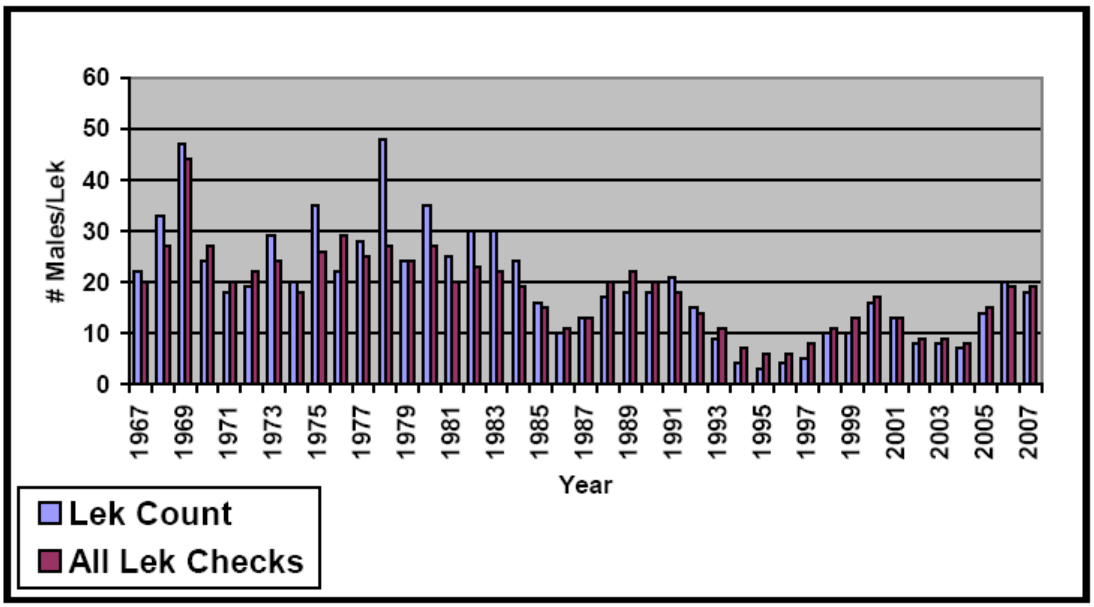
Noise can affect sage-grouse by preventing vocalizations that influence reproduction and other behaviors (WGFD 2003). In a study of greater sage-grouse population response to natural gas field development in western Wyoming, Holloran (2005) concluded that increased noise intensity, associated with active drilling rigs within 5 km (3.1 miles) of leks, negatively influenced male lek attendance. In 2002, Braun et al. documented approximately 200 CBNG facilities within one mile of sage-grouse leks. Sage-grouse numbers were found to be consistently lower for these leks than for leks without this disturbance. Direct habitat losses from the facilities themselves, roads and traffic, and the associated noise were found to be the likely reason for this finding.

Vegetation communities within the Powder River Basin are naturally fragmented, as they represent a transition between the intermountain basin sagebrush communities to the west and the prairie communities to the east. The Powder River Basin is also near the eastern edge of greater sage-grouse range. A sagebrush cover assessment within Wyoming basins estimated sagebrush coverage within the Powder River Basin to be 35% with an average patch size less than 300 acres (Rowland et al. 2005). The Powder River Basin patch size has decreased by more than 63% in the past forty years, from 820 acre patches and an overall coverage of 41% in 1964 (Rowland et al. 2005). The existing development within the cumulative impacts assessment area has further fragmented the sage-grouse habitat. Disturbance created by this project will contribute to additional fragmentation.

Another concern with CBNG development is that reservoirs created for water disposal provide habitat for mosquitoes associated with West Nile virus (WGFD 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse an average of 25% within four populations including the Powder River Basin (Naugle et al. 2004). In northeastern Wyoming and southeastern Montana, West Nile virus-related mortality during the summer resulted in an average decline in annual female survival of 5% from 2003 to 2006 (Walker et al. 2007). Powder River Basin sage-grouse losses during 2004 and 2005 were not as severe. Summer 2003 was warm and dry, more conducive to West Nile virus replication and transmission than the cooler summers of 2004 and 2005 (Cornish pers. comm.).

The sage-grouse population within northeast Wyoming is exhibiting a steady long term downward trend (Figure 1) (WGFD 2005). The figure illustrates a ten-year cycle of periodic highs and lows. Each subsequent population peak is lower than the previous peak. Long-term harvest trends are similar to that of lek attendance (WGFD 2005).

Figure 1. Male sage-grouse lek attendance within northeastern Wyoming, 1967-2007.



The BFO Resource Management Plan (BLM 2001) and the Powder River Basin Oil and Gas Project Record of Decision (BLM 2003) include a two-mile timing limitation within sage-grouse nesting habitat. The two-mile measure originated with the Western Association of Fish and Wildlife Agencies (WAFWA) (BLM 2004). BLM Wyoming adopted the two-mile recommendation in 1990 (BLM 1990). The two-mile recommendation was based on early research which indicated between 59 and 87 percent of sage-grouse nests were located within two miles of a lek (BLM 2004). These studies were conducted within prime, contiguous sage-grouse habitat such as Idaho's Snake River plain.

Additional studies, across more of the sage-grouse's range, indicate that many populations nest much farther than two miles from the breeding lek (BLM 2004). Holloran and Anderson (2005), in their Upper Green River Basin study area, reported only 45% of their sage-grouse hens nested within 3 km (1.86 mi) of the capture lek. Moynahan and Lindberg (2004) found only 36% of their grouse nesting within 3 km of the capture lek. Moynahan's study area was north-central Montana in an area of mixed-grass prairie and sagebrush steppe, with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) being the dominant shrub species (Moynahan et al. 2007). Habitat conditions and sage-grouse biology within the Buffalo Field Office are more similar to Moynahan's north-central Montana study area than the Upper Green River area.

A two-mile timing limitation, given the long-term population decline and that less than 50% of sage-grouse are expected to nest within the limitation area, is insufficient to reverse the population decline. Moynahan and Lindberg (2004) like WAFWA (Connelly et al. 2000), recommend increasing the protective distance around sage-grouse leks. The BLM and University of Montana are currently researching nest location and other sage-grouse questions and relationships between grouse and coalbed natural gas development. Thus far, this research suggests that impacts to leks from energy development are discernable out to a minimum of four miles, and that some leks within this radius have been extirpated as a direct result of energy development (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008). Even with a timing limitation on construction activities, sage-grouse may avoid nesting within CBNG fields because of the activities associated with operation and production. In a typical landscape in the Powder River Basin, energy development within two miles of leks is projected to reduce the average probability of lek persistence from 87% to 5% percent (Walker et al. 2007).

Walker et al, 2007 indicates the size of a no-development buffer sufficient to protect leks would depend on the amount of suitable habitat around the lek and the population impact deemed acceptable. Also, rather than limiting mitigation to only timing restrictions, research suggests more effective mitigation strategies include, at a minimum, burying power lines (Connelly et al. 2000 b); minimizing road and well pad construction, vehicle traffic, and industrial noise (Lyon and Anderson 2003, Holloran 2005); and managing produced water to prevent the spread of mosquitoes with the potential to vector West Nile Virus in sage grouse habitat (Walker et al 2007).

The multi-state recommendations presented to the WGFD for identification of core sage grouse areas acknowledges there may be times when development in important sage grouse breeding, summer, and winter habitats cannot be avoided. In those instances they recommend, "…infrastructure should be minimized and the area should be managed in a manner that effectively conserves sagebrush habitats (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008).

4.2.5.2.3. Sharp-tailed grouse Direct and Indirect Effects

Effects similar to sage-grouse.

4.2.5.2.4. Mountain plover Direct and Indirect Effects

Suitable mountain plover habitat is present within the project area. The project should not impact mountain plovers due to project planning that provides minimal impact to prairie dog colonies and no that plovers found in three years of surveys.

Mineral development has mixed effects on mountain plovers. Disturbed ground, such as buried pipeline corridors and roads, may be attractive to plovers, while human activities within one-quarter mile may be disruptive.

4.2.5.3. Sensitive Species Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-271.

4.3. West Nile Virus Direct and Indirect Effects

This project is likely to result in standing surface water which may potentially increase mosquito breeding habitat. BLM has consulted with applicable state agencies, County Weed and Pest and the State Health Department, per above mitigation in the PRB ROD page 18, regarding the disease and the need to treat. BLM has also consulted with the researchers that are studying the dynamics of WNv species and its effects in Wyoming.

There is no evidence that treatment, either through the use of larvicides or malithion, on a site specific or basin-wide scale will have any effect on the overall spread of the disease. The State agencies have not instituted state-wide treatment for mosquitoes due to WNv, nor are they requiring any mitigation specific to permitting for CBM operations.

Cumulatively, there are many sources of standing water, beyond CBM discharge, throughout the PRB that would add to the potential for mosquito habitat. Sources include; natural flows, livestock watering facilities, coal mining operations, and outdoor water use and features in and around communities.

BLM will keep monitoring this issue by continuing to consult with the State agencies and the researchers working in the area in order to stay abreast of the most current developments and any need to apply mitigation.

4.4. Water Resources

The operator has submitted a comprehensive WMP for this project. It is incorporated-by-reference into this EA pursuant to 40 CFR 1502.21. The WMP incorporates sound water management practices, monitoring of downstream impacts within the Crazy Woman Creek watershed and the commitment to comply with Wyoming State water laws/regulations. It also addresses potential impacts to the environment and landowner concerns. Qualified hydrologists, in consultation with the BLM, developed the water management plan. Adherence with the plan, in addition to BLM applied mitigation (in the form of COAs), would reduce project area and downstream impacts from proposed water management strategies. CBNG discharge water will initially be fully contained within the POD, but later in POD development water will be piped off site to Anadarko's deep well injection project at the Salt Creek field.

The WDEQ has assumed primacy from United States Environmental Protection Agency for maintaining the water quality in the waters of the state. The WSEO has authority for regulating water rights issues and permitting impoundments for the containment of surface waters of the state.

The maximum water production is predicted to be 15 gpm per well and will total 450 gpm (1.04 cfs or 726 acre-feet per year) for this POD. The PRB FEIS projected the total amount of water that was anticipated to be produced from CBNG development per year (Table 2-8 Projected Amount of Water Produced from CBM Wells Under Alternatives 1, 2A and 2B pg 2-26). For the Crazy Woman Creek drainage, the projected volume produced within the watershed area was 20,279 acre-feet in 2008 (maximum production is estimated in 2006 at 21,135 acre-feet). As such, the volume of water resulting from the production of these wells is 4.0% of the total volume projected for 2008. This volume of produced water is also within the predicted parameters of the PRB FEIS.

4.4.1. Groundwater

The PRB FEIS predicts an infiltration rate of 43% to groundwater aquifers and coal zones in the Crazy Woman Creek drainage area (PRB FEIS pg 4-5). For this action, it may be assumed that a maximum of 193.5 gpm will infiltrate at or near the discharge points and impoundments (312.1 acre feet per year). This water will saturate the near surface alluvium and deeper formations prior to mixing with the groundwater used for stock and domestic purposes. According to the PRB FEIS, "the increased volume of water recharging the underlying aquifers of the Wasatch and Fort Union Formations would be chemically similar to alluvial groundwater." (PRB FEIS pg 4-54). Therefore, the chemical nature and the volume of the discharged water may not degrade the groundwater quality.

The PRB FEIS predicts that one of the environmental consequences of coal bed natural gas production is possible impacts to the groundwater. "The effects of development of CBM on groundwater resources would be seen as a drop in the water level (drawdown) in nearby wells completed in the developed coal aquifers and underlying or overlying sand aquifers." (PRB FEIS page 4-1). In the process of dewatering the coal zone to increase natural gas recovery rates, this project may have some effect on the static water level of wells in the area. The permitted water wells produce from depths which range from 4 to 1,550 feet compared to a range 1,900 feet to 3,200 for the Wall Coal. As mitigation, the operator has committed to offer water well agreements to holders of properly permitted domestic and stock wells within the circle of influence (½ mile of a federal CBNG producing well) of the proposed wells.

Recovery of the coal bed aquifer was predicted in the PRB FEIS to "…resaturate and repressurize the areas that were partially depressurized during operations. The amount of groundwater storage within the coals and sands units above and below the coals is enormous. Almost 750 million acre-feet of recoverable groundwater are stored within the Wasatch Formation - Tongue River Member sands and coals (PRB FEIS Table 3-5). Redistribution is projected to result in a rapid initial recovery of water levels in the coal. The model projects that this initial recovery period would occur over 25 years." (PRB FEIS page 4-38).

Adherence to the drilling plan, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and utilizing proper cementing procedures will protect any potential fresh water aquifers above the target coal zone. This will ensure that ground water will not be adversely impacted by well drilling and completion operations.

In order to determine the actual water quality of the producing formations in this POD, and to verify the water analysis submitted for the pre-approval evaluation, the operator has committed to designate a reference well within the POD. The reference well will be sampled at the well head for analysis within sixty days of initial production and a copy of the water analysis will be submitted to the BLM Authorizing Officer.

Shallow ground water monitoring is ongoing at impoundment sites across the basin. Due to the limited data available from these sites, the still uncertain overall fate or extent of change that is occurring due to infiltration at those sites, and the extensive variable site characteristics both surface and subsurface, it is not reliable at this time to infer that findings from these monitoring wells should be directly applied to other impoundment locations across the basin.

As of April, 2008, approximately 1774 impoundment sites have been investigated. These sites had more than 1988 borings. Of those impoundments, 259 met the criteria to provide compliance monitoring data if constructed and used for CBNG water containment. Only 109 monitored impoundments are currently in use. As of the 1st quarter of 2008, only 16 monitored impoundments exceeded groundwater class of use limits (Fischer, 2008). The BLM requires that operators comply with the DEQ compliance monitoring guidance document prior to discharge of federally-produced water into newly constructed or upgraded impoundments.

4.4.1.1. Groundwater Cumulative Effects:

As stated in the PRB FEIS, "The aerial extent and magnitude of drawdown effects on coal zone aquifers and overlying and underlying sand units in the Wasatch Formation also would be limited by the discontinuous nature of the different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation." (PRB FEIS page 4-64).

Development of CBNG through 2018 (and coal mining through 2033) would remove 4 million acre-feet of groundwater from the coal zone aquifer (PRB FEIS page 4-65). This volume of water "…cumulatively represents 0.5 percent of the recoverable groundwater stored in the Wasatch Formation – Tongue River Member sands and coals (nearly 750 million acre-feet, from Table 3-5). All of the groundwater projected to be removed during reasonably foreseeable CBNG development and coal mining would represent less than 0.3 percent of the total recoverable groundwater in the Wasatch and Fort Union Formations within the PRB (nearly 1.4 billion acre-feet, from Table 3-5)." (PRB FEIS page 4-65). No additional mitigation is necessary.

4.4.2. Surface Water

The following table shows Wyoming proposed numeric limits for the watershed for SAR, and EC, the average value measured at selected USGS gauging stations at high and low monthly flows, and Wyoming groundwater quality standards for TDS and SAR for Class I to Class III water. It also shows pollutant limits for TDS, SAR and EC detailed in the WDEQ's WYPDES permit, and the levels found in the POD's representative water sample.

Table 4.5 Comparison of Regulated Water Quality Parameters to Predicted Water

Predicted Values	**TDS, mg/l**	**SAR**	**EC,** μmhos/cm
Most Restrictive Proposed Limit –		2.0	1,000
Least Restrictive Proposed Limit		10	3,200
Crazy Woman Creek at 06316400 Gauging station near Arvada Historic Data Average at Maximum Flow Historic Data Average at Minimum Flow		 1.29 2.26	 1,066 1,937
WDEQ Quality Standards for Wyoming Groundwater (Chapter 8) Drinking Water (Class I) Agricultural Use (Class II) Livestock Use (Class III)	 500 2,000 5,000	 8	
WDEQ Water Quality Typical Requirements for WYPDES Permit At discharge point	na	2.0	1,800
Predicted Produced Water Quality Wall Coal Zone	 2,190	 36.5	 3,440

Based on the analysis performed in the PRB FEIS, the primary beneficial use of the surface water in the Powder River Basin is the irrigation of crops (PRB FEIS pg 4-69). The water quality projected for this POD is 2190.0 mg/l TDS which is not within the WDEQ criteria for agricultural use (2000 mg/l TDS).

The quality for the water produced from the Wall Coal target coal zone from these wells is predicted to be similar to the sample water quality collected from a location near the POD. A maximum of 15 gallons per minute (gpm) is projected is to be produced from each the 30 wells, for a total of 450 gpm for the POD. See Table 4.5 .

For more information, please refer to the WMP included in this POD.

There are 4 discharge points proposed for this project. They have been appropriately sited and utilize appropriate water erosion dissipation designs. Existing and proposed water management facilities were evaluated for compliance with best management practices during the onsite.

To manage the produced water 4 impoundments (119.9 acre-feet) would potentially be constructed within the project area. These impoundments will disturb approximately 15.0 acres including the dam structures. Of these water impoundments, 2 would be on-channel reservoirs disturbing 5.0 acres, and 2 would be off-channel ponds disturbing 10.0 acres. The off-channel impoundments would result in evaporation and infiltration of CBNG water. Criteria identified in "Off-Channel, Unlined CBNG Produced Water Pit Siting Guidelines for the Powder River Basin, Wyoming" (WDEQ, 2002) was used to locate these impoundments. Monitoring may be required based upon WYDEQ findings relative to "Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments" (June 14, 2004). All water management facilities were evaluated for compliance with best management practices during the onsite.

The PRB FEIS assumes that 15% of the impounded water will re-surface as channel flow (PRB FEIS pg 4-74). Consequently, the volume of water produced from these wells may result in the addition of 81gpm or 0.2 cfs below the lowest reservoir (after infiltration and evapotranspiration losses). The operator has committed to monitor the condition of channels and address any problems resulting from discharge. Discharge from the impoundments will potentially allow for streambed enhancement through wetland-

riparian species establishment. Phased reclamation plans for the impoundments will be submitted and approved on a site-specific, case-by-case basis as they are no longer needed for disposal of CBNG water, as required by BLM applied COAs.

Alternative (2A), the approved alternative in the Record of Decision for the PRB FEIS, states that the peak production of water discharged to the surface will occur in 2006 at a total contribution to the mainstem of the Crazy Woman Creek of 3 cfs (PRB FEIS pg 4-86). The predicted maximum discharge rate from these 30 wells is anticipated to be a total of 450 gpm or 1.04 cfs to impoundments. Using an assumed conveyance loss of 20% (PRB FEIS pg 4-74) and full containment the produced water re-surfacing in Crazy Woman Creek from this action (0.16 cfs) may add a maximum 0.12 cfs to the Crazy Woman Creek flows, or 4.0% of the predicted total CBNG produced water contribution. For more information regarding the maximum predicted water impacts resulting from the discharge of produced water, see Table 4-6 (PRB-FEIS pg 4-85).

The proposed method for surface discharge provides passive treatment through the aeration supplied by the energy dissipation configuration at each discharge point outfall. Aeration adds dissolved oxygen to the produced water which can oxidize susceptible ions, which may then precipitate. This is particularly true for dissolved iron. Because iron is one of the key parameters for monitoring water quality, the precipitation of iron oxide near the discharge point will improve water quality at downstream locations.

The operator has submitted a Wyoming Pollutant Discharge Elimination System (WYPDES) permit application for the discharge of water produced from this project from the WDEQ.

Permit effluent limits were not set at the time of POD approval, but typical values for this area shown below:

pH	6.5 to 9.0
Specific Conductance	1800 mg/l max
Sodium Absorption Ratio	2
Sulfates	1250 mg/l max
Dissolved iron	1000 µg/l max
Dissolved manganese	50 µg/l max
Total Barium	465 µg/l max
Chlorides	180 mg/l

The WYPDES permit also addresses existing downstream concerns, such as irrigation use, in the COA for the permit. The designated point of compliance identified for this permit is end of pipe.

In order to determine the actual water quality of the producing formations in this POD and to verify the water analysis submitted for the pre-approval evaluation, the operator has committed to designate a reference well to each coal zone within the POD boundary. The reference well will be sampled at the wellhead for analysis within sixty days of initial production. A copy of the water analysis will be submitted to the BLM Authorized Officer.

As stated previously, the operator has committed to offer water well agreements to properly permitted domestic and stock water wells within the circle of influence of the proposed CBNG wells.

The development of coal bed natural gas and the production and discharge of water in the area surrounding the existing natural spring may affect the flow rate or water quality of the spring.

In-channel downstream impacts are addressed in the WMP for the Rose Draw Beta POD prepared by WWC Engineering for Lance Oil & Gas Company, Inc.

4.4.2.1. Surface Water Cumulative Effects

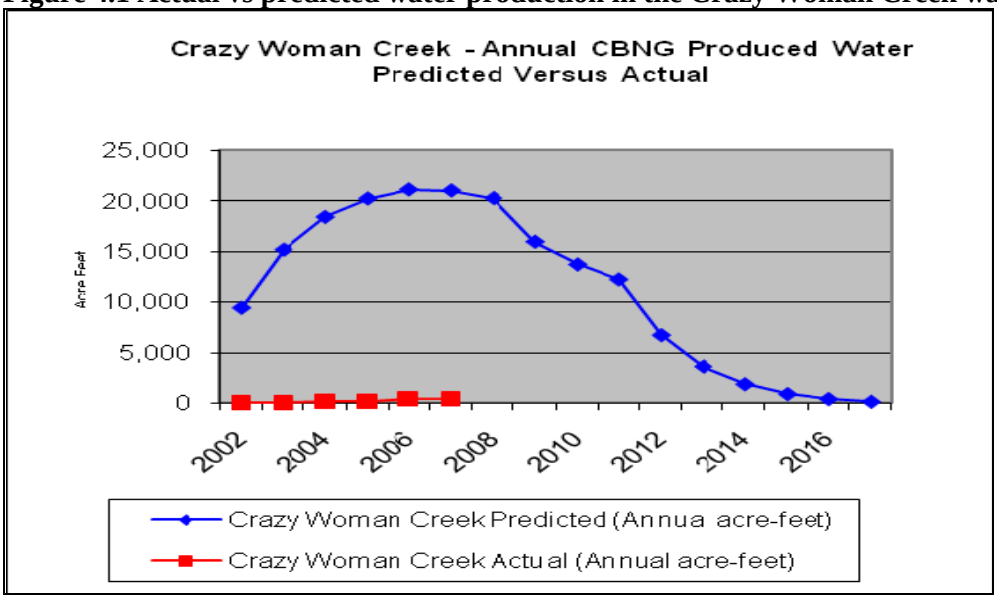
The analysis in this section includes cumulative data from Fee, State and Federal CBNG development in the Crazy Woman Creek watershed. These data were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC).

As of December 2007, all producing CBNG wells in the Crazy Woman Creek watershed have discharged a cumulative volume of 984 acre-ft of water compared to the predicted 105,463 acre-ft disclosed in the PRB FEIS (Table 2-8 page 2-26). These figures are presented graphically in Table 4.6 and Figure 4.1 below. This volume is 0.9 % of the total predicted produced water analyzed in the PRB FEIS for the Crazy Woman Creek watershed.

Table 4.6 Actual vs predicted water production in the Crazy Woman Creek watershed *2007 Data Update 3-08-08*

Year	Crazy Woman Creek Predicted (Annual acre-feet)	Crazy Woman Creek Predicted (Cumulative acre-feet from 2002)	Crazy Woman Creek Actual (Annual acre-feet)		Crazy Woman Creek Actual (Cumulative acre-feet from 2002)	
			Actual Ac-ft	% of Predicted	Cum Ac-ft	% of Predicted
2002	9,449	9,449	4	0.0	4	0.0
2003	15,185	24,634	1	0.0	5	0.0
2004	18,418	43,052	126	0.7	130	0.3
2005	20,240	63,292	113	0.6	243	0.4
2006	21,135	84,427	392	1.9	635	0.8
2007	21,036	105,463	349	1.7	984	0.9
2008	20,279	125,742				
2009	15,962	141,704				
2010	13,716	155,420				
2011	12,240	167,660				
2012	6,731	174,391				
2013	3,629	178,020				
2014	1,881	179,901				
2015	910	180,811				
2016	422	181,233				
2017	150	181,383				
Total	**181,383**		**984**			

Figure 4.1 Actual vs predicted water production in the Crazy Woman Creek watershed



The PRB FEIS identified downstream irrigation water quality as the primary issue for CBNG produced water. Electrical Conductivity (EC) and SAR are the parameters of concern for suitability of irrigation water. The water quality analysis in the PRB FEIS was conducted using produced water quality data, where available, from existing wells within each of the ten primary watersheds in the Powder River Basin. These predictions of EC and SAR can only be reevaluated when additional water quality sampling is available.

The PRB FEIS states, "Cumulative effects to the suitability for irrigation of the Powder River would be minimized through the interim Memorandum of Cooperation (MOC) that the Montana and Wyoming DEQ's (Departments of Environmental Quality) have signed. This MOC was developed to ensure that designated uses downstream in Montana would be protected while CBM development in both states continued. However, this MOC has expired and has not been renewed. The EPA has approved the Montana Surface Water Standards for EC and SAR and as such the WDEQ is responsible for ensuring that the Montana standards are met at the state line under the Clean Water Act (CWA). Thus, through the implementation of in-stream monitoring and adaptive management, water quality standards and interstate agreements can be met." (PRB FEIS page 4-117)

As referenced above, the PRB FEIS did disclose that cumulative impacts may occur as a result of discharged produced CBNG water. The cumulative effects relative to this project are within the analysis parameters and impacts described in the PRB FEIS for the following reasons:

1. They are proportional to the actual amount of cumulatively produced water in the Crazy Woman Creek drainage, which is approximately 0.9% of the total predicted in the PRB FEIS.
2. The WDEQ enforcement of the terms and conditions of the WYPDES permit that are designed to protect irrigation downstream.
3. The commitment by the operator to monitor the volume of water discharged into the WMP.

No additional mitigation measures are required.

Refer to the PRB FEIS, Volume 2, page 4-115 – 117 and table 4-13 for cumulative effects relative to the Crazy Woman Creek watershed and page 117 for cumulative effects common to all sub-watersheds.

4.5. Cultural Resources

BLM review, conducted by Wendy Sutton, has determined that one (1) site and six (6) isolated resources will be impacted by the current project. The impacted isolates (IR1, IR6, IR8, IR10, IR11 & IR12) have been recommended as not eligible to the National Register of Historic Places. As such, these resources are not considered historic properties. The impacted site (48JO3681) is eligible to the NRHP under criterion D; impacts to the site will be restricted to non contributing portions of the site, resulting in a finding of *no adverse effect* to the site. Following the Wyoming State Protocol, Section VI(A)(1) the Bureau of Land Management electronically notified the Wyoming State Historic Preservation Officer (SHPO) on 9/23/2008 that the proposed project would result in *no adverse effect* (DBU_WY_2008_2203).

If any cultural values [sites, artifacts, human remains (Appendix L PRB FEIS)] are observed during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. Further discovery procedures are explained in the ***Standard COA*** (General)(A)(1).

4.6. Air Quality

In the project area, air quality impacts would occur during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including non-CBM well production equipment, booster and pipeline compression engine exhaust). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils, and by air pollutant emission limitations imposed by applicable air quality regulatory agencies. Air quality impacts modeled in the PRB FEIS concluded that projected oil & gas development would not violate any local, state, tribal or federal air quality standards.

5. CONSULTATION/COORDINATION

Contact	Title	Organization	Present at Onsite
Ethan Jahnke	Permitting Agent	Anadarko	8/29
J Bunderson	Civil Engineer	Anadarko	8/29
Shane Gasvoda	Water Management Specialist	Anadarko	4/21

6. OTHER PERMITS REQUIRED

A number of other permits are required from Wyoming State and other Federal agencies. These permits are identified in Table A-1 in the PRB FEIS Record of Decision.

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