

**FINDING OF NO SIGNIFICANT IMPACT & DECISION RECORD  
FOR**

Lance Oil & Gas  
**Quarter Circle Nine**

ENVIRONMENTAL ASSESSMENT –WY-070-07-140

DECISION: Is to approve Alternative C as described in the attached Environmental Assessment (EA) and authorize Lance Oil & Gas’s Quarter Circle Nine Coal Bed Natural Gas (CBNG) POD comprised of the following 35 Applications for Permit to Drill (APDs), as follows:

#	Well Name	Well #	Qtr/Qtr	Sec	Twp	Rng	Lease #
1	QUARTER CIRCLE 9	34-22	SWSE	22	51N	79W	WYW142092
2	QUARTER CIRCLE 9	33-22	NWSE	22	51N	79W	WYW142092
3	QUARTER CIRCLE 9	44-22	SESE	22	51N	79W	WYW142092
4	QUARTER CIRCLE 9	11-25	NWNW	25	51N	79W	WYW142095
5	QUARTER CIRCLE 9	13-25	NWSW	25	51N	79W	WYW142095
6	QUARTER CIRCLE 9	22-25	SESW	25	51N	79W	WYW142095
7	QUARTER CIRCLE 9	24-25	SESW	25	51N	79W	WYW142095
8	QUARTER CIRCLE 9	34-25	SWSE	25	51N	79W	WYW142095
9	QUARTER CIRCLE 9	12-26	SWNW	26	51N	79W	WYW142095
10	QUARTER CIRCLE 9	13-26	NWSW	26	51N	79W	WYW142095
11	QUARTER CIRCLE 9	22-26	SESW	26	51N	79W	WYW142095
12	QUARTER CIRCLE 9	33-26	NWSE	26	51N	79W	WYW142095
13	QUARTER CIRCLE 9	31-26	NWNE	26	51N	79W	WYW142095
14	QUARTER CIRCLE 9	34-26	SWSE	26	51N	79W	WYW142095
15	QUARTER CIRCLE 9	42-26	SENE	26	51N	79W	WYW142095
16	QUARTER CIRCLE 9	44-26	SESE	26	51N	79W	WYW142095
17	QUARTER CIRCLE 9	12-27	SWNW	27	51N	79W	WYW142092
18	QUARTER CIRCLE 9	14-27	SWSW	27	51N	79W	WYW142092
19	QUARTER CIRCLE 9	24-27	SESW	27	51N	79W	WYW142092
20	QUARTER CIRCLE 9	32-27	SWNE	27	51N	79W	WYW142092
21	QUARTER CIRCLE 9	41-27	NENE	27	51N	79W	WYW142092
22	QUARTER CIRCLE 9	43-27	NESE	27	51N	79W	WYW142092
23	QUARTER CIRCLE 9	44-27	SESE	27	51N	79W	WYW142092
24	QUARTER CIRCLE 9	23-34	NESW	34	51N	79W	WYW142092
25	QUARTER CIRCLE 9	31-34	NWNE	34	51N	79W	WYW142092
26	QUARTER CIRCLE 9	34-34	SWSE	34	51N	79W	WYW142092
27	QUARTER CIRCLE 9	42-34	SENE	34	51N	79W	WYW142092
28	QUARTER CIRCLE 9	43-34	NESE	34	51N	79W	WYW142092
29	QUARTER CIRCLE 9	14-35	SWSW	35	51N	79W	WYW142095
30	QUARTER CIRCLE 9	22-35	SESW	35	51N	79W	WYW142095
31	QUARTER CIRCLE 9	23-35	NESW	35	51N	79W	WYW142095
32	QUARTER CIRCLE 9	31-35	NWNE	35	51N	79W	WYW142095
33	QUARTER CIRCLE 9	34-35	SWSE	35	51N	79W	WYW142095
34	QUARTER CIRCLE 9	41-35	NENE	35	51N	79W	WYW142095
35	QUARTER CIRCLE 9	43-35	NESE	35	51N	79W	WYW142095

The following impoundments have been approved under this federal action:

	<b>IMPOUNDMENT Name / Number</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease Number</b>
1	32-23-5179	SWNE	23	51	79	WYW142091
2	14-24-5179	SWSW	24	51	79	WYW142091
3	11-25-5179	NWNW	25	51	79	WYW142095
4	13-25-5179	NWSW	25	51	79	WYW142095
5	31-34-5179	NWNE	34	51	79	WYW142092
6	34-34-5179	SWSE	34	51	79	WYW142092
7	41-35-5179	NENE	35	51	79	WYW142095
8	43-35-5179	NESE	35	51	79	WYW142095
9	23-35-5179	NESW	35	51	79	WYW142095
10	44-35-5179	NESE	35	51	79	WYW142095
11	42-35-5179	SESE	35	51	79	WYW142095
12	12-1-5079	SWNW	1	50	79	WYW140577
13	44-26-5179	SESE	26	51	79	State
14	34-27-5179	SWSE	27	51	79	State
15	14-27-5179	SWSW	27	51	79	State
16	Pit 24-34	SESW	34	51	79	WYW142092
17	Pit 32-23	SWNE	23	51	79	WYW142091
18	Pit 41-3	NENE	3	51	79	WYW140577

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 within 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  
Lance Oil & Gas  
Quarter Circle Nine  
PLAN OF DEVELOPMENT  
WY-070-07-140**

## **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/or impacts that are not covered within the PRB FEIS.

### **1. PURPOSE AND NEED**

The purpose for the proposal is to produce coal bed natural gas (CBNG) on two valid federal oil and gas mineral leases issued to the applicant by the BLM. Analysis has determined that federal CBNG is being drained from the federal leases by surrounding fee or state mineral well development. The need exists because without approval of the Applications for Permit to Drill (APDs), federal lease royalties will be lost and the lessee will be deprived of the federal gas they have the rights to develop.

#### **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**

Description of the Proposed Action

Proposed Action Title/Type: Lance Oil & Gas’s Quarter Circle 9 Plan of Development (POD) for 37 coal bed natural gas well APD’s and associated infrastructure.

Proposed Well Information: There are 37 wells proposed within this POD, as follows:

#	Well Name	Well #	Qtr/Qtr	Sec	Twp	Rng	Lease #
1	QUARTER CIRCLE 9	24-22	SESW	22	51N	79W	WYW142092
2	QUARTER CIRCLE 9	33-22	NWSE	22	51N	79W	WYW142092
3	QUARTER CIRCLE 9	44-22	SESE	22	51N	79W	WYW142092
4	QUARTER CIRCLE 9	11-25	NWNW	25	51N	79W	WYW142095
5	QUARTER CIRCLE 9	13-25	NWSW	25	51N	79W	WYW142095
6	QUARTER CIRCLE 9	22-25	SESW	25	51N	79W	WYW142095
7	QUARTER CIRCLE 9	24-25	SESW	25	51N	79W	WYW142095
8	QUARTER CIRCLE 9	33-25	NWSE	25	51N	79W	WYW142095
9	QUARTER CIRCLE 9	44-25	SESE	25	51N	79W	WYW142095
10	QUARTER CIRCLE 9	11-26	NWNW	26	51N	79W	WYW142095
11	QUARTER CIRCLE 9	13-26	NWSW	26	51N	79W	WYW142095
12	QUARTER CIRCLE 9	22-26	SESW	26	51N	79W	WYW142095
13	QUARTER CIRCLE 9	24-26	SESW	26	51N	79W	WYW142095
14	QUARTER CIRCLE 9	31-26	NWNE	26	51N	79W	WYW142095
15	QUARTER CIRCLE 9	33-26	NWSE	26	51N	79W	WYW142095
16	QUARTER CIRCLE 9	42-26	SENE	26	51N	79W	WYW142095
17	QUARTER CIRCLE 9	44-26	SESE	26	51N	79W	WYW142095
18	QUARTER CIRCLE 9	12-27	SWNW	27	51N	79W	WYW142092
19	QUARTER CIRCLE 9	14-27	SWSW	27	51N	79W	WYW142092
20	QUARTER CIRCLE 9	24-27	SESW	27	51N	79W	WYW142092
21	QUARTER CIRCLE 9	32-27	SWNE	27	51N	79W	WYW142092
22	QUARTER CIRCLE 9	41-27	NENE	27	51N	79W	WYW142092
23	QUARTER CIRCLE 9	43-27	NESE	27	51N	79W	WYW142092
24	QUARTER CIRCLE 9	44-27	SESE	27	51N	79W	WYW142092
25	QUARTER CIRCLE 9	23-34	NESW	34	51N	79W	WYW142092
26	QUARTER CIRCLE 9	31-34	NWNE	34	51N	79W	WYW142092
27	QUARTER CIRCLE 9	34-34	SWSE	34	51N	79W	WYW142092
28	QUARTER CIRCLE 9	42-34	SENE	34	51N	79W	WYW142092
29	QUARTER CIRCLE 9	43-34	NESE	34	51N	79W	WYW142092
30	QUARTER CIRCLE 9	11-35	NWNW	35	51N	79W	WYW142095
31	QUARTER CIRCLE 9	14-35	SWSW	35	51N	79W	WYW142095
32	QUARTER CIRCLE 9	22-35	SESW	35	51N	79W	WYW142095
33	QUARTER CIRCLE 9	23-35	NESW	35	51N	79W	WYW142095
34	QUARTER CIRCLE 9	31-35	NWNE	35	51N	79W	WYW142095
35	QUARTER CIRCLE 9	34-35	SWSE	35	51N	79W	WYW142095
36	QUARTER CIRCLE 9	41-35	NENE	35	51N	79W	WYW142095
37	QUARTER CIRCLE 9	43-35	NESE	35	51N	79W	WYW142095

The following impoundments were proposed under this federal action:

	<b>IMPOUNDMENT Name / Number</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease Number</b>
1	32-23-5179	SWNE	23	51	79	WYW142091
2	14-24-5179	SWSW	24	51	79	WYW142091
3	11-25-5179	NWNW	25	51	79	WYW142095
4	13-25-5179	NWSW	25	51	79	WYW142095
5	31-34-5179	NWNE	34	51	79	WYW142092

	<b>IMPOUNDMENT Name / Number</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease Number</b>
6	34-34-5179	SWSE	34	51	79	WYW142092
7	41-35-5179	NENE	35	51	79	WYW142095
8	43-35-5179	NESE	35	51	79	WYW142095
9	23-35-5179	NESW	35	51	79	WYW142095
10	44-35-5179	NESE	35	51	79	WYW142095
11	42-35-5179	SESE	35	51	79	WYW142095
12	12-1-5079	SWNW	1	50	79	WYW140577
13	44-26-5179	SESE	26	51	79	State
14	34-27-5179	SWSE	27	51	79	State
15	14-27-5179	SWSW	27	51	79	State
16	Pit 24-34	SESW	34	51	79	WYW142092
17	Pit 32-23	SWNE	23	51	79	WYW142091
18	Pit 41-3	NENE	3	51	79	WYW140577

County: Johnson

Applicant: Lance Oil & Gas

Surface Owners: Duane Fadness, State of Wyoming, BLM

The proposed action involves the development of the project, which includes the following:

- Drilling of 37 total federal CBM wells in the Big George and Wall coals, to depths of approximately 3000 feet. The coal seam targeted in this project is approximately 25 feet thick. Construction of this project will commence upon approval of APDs, and each well will take approximately 4 days to drill and 2 days to complete. APDs will be valid for two years from approval date.
- An unimproved and improved road network.
- A Water Management Plan (WMP) that involves the following infrastructure and strategy: 20 (19 proposed) discharge points and 17 stock water reservoirs within Fleetwood and McCray Draws, tributaries to the Upper Powder River watershed. Alternatives also include discharge of treated water to Flying E Creek from the Bear Draw Unit Beta reverse osmosis (RO) facility or piped and re-injected in the Tensleep or Madison formations near Midwest.
- A buried gas, water and power line network. An above ground power line network.

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(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 MSRP, 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 within 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 ensure that potential impacts to natural resources would be minimized. 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 Quarter Circle 9 POD are listed below under 2.3.1:

#### **2.3.1. Changes as a result of the on-sites**

1. 24-22 well: Moved well 1142' SE to shorten the access road. This move saves building that entire 1142' of access road. Well will now be the 34-22 well.
2. 11-25 well: Moved well 186' SE to avoid sagebrush disturbance and take advantage of flatter topography.
3. 22-25 well: Moved well 91' SW to avoid sagebrush habitat.
4. 33-25 well: Replaced with the 34-25 well. The well was moved 709' south to shorten the access road and avoid building the access road over a ridge and around a head cut.
5. 44-25 well: This well has been staked on a section of road that was permanently closed October 2006 as a Condition of Approval of the Coal Gulch Unit Beta POD. The well will be dropped.
6. 11-26 well: Moved well 730' SE to take advantage of flatter topography. Well will now be the 12-26 well.
7. 22-26 well: Access road re-routed per Civil Engineer's recommendation. New access will go around downhill side of ridge and stay away from highly erosive soils on the ridge top.
8. 33-26 well: Well moved 250' NE to avoid highly erosive soils.

9. 44-26 well: Moved well 115' NE because it was originally staked in a proposed reservoir.
10. 12-27 well: Moved 76' SW to avoid digging into highly erosive sandy soils to build a pad.
11. 14-27 well: Pad will be built to provide defined work area on small location. Without a defined work area, excessive driving and spreading out of work area may occur on fragile hillside.
12. 41-27 well: Moved well 263' NE off of ridge to make the engineered road easier to reclaim, and to make the engineered access safer.
13. 43-27 well: Moved well 103' S to an area more conducive to reclamation. This pad location will also serve to widen out a section of the engineered road where the sight distance is too narrow.
14. 31-34 well: Moved well 577' NE to reduce disturbance on an unstable ridge top with sandy, highly erosive soils.
15. 42-34 well: Well moved 205' SE to flatter area to avoid building a pad on a sandy ridge. The well will be slotted.
16. 11-35 well: This well will be dropped. It is staked in an area of highly erosive soils that is not reclaimable
17. 31-35 well: Moved well 776' SE to avoid disturbance to sagebrush.

Implementation of committed mitigation measures contained in the Master Surface Use Plan, Drilling Program and Water Management Plan, in addition to the Standard COA contained in the PRB FEIS Record of Decision Appendix A, are incorporated and analyzed in this alternative.

### **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**

In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed and revised a guidance document, "Compliance Monitoring and siting Requirements for Unlined Impoundments Containing Coalbed Methane Produced Water" (September, 2006) which can be accessed on their website. For all WYPDES permits the BLM will require that operators comply with the latest DEQ standards and monitoring guidance.

#### **2.3.2.2. Surface Water**

1. Channel Crossings:
  - a) Minimize channel disturbance as much as possible by limiting pipeline and road crossings.
  - b) Avoid running pipelines and access roads within floodplains or parallel to a stream channel.
  - c) 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.

- d) 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 CBM water on downstream irrigation use may require operators to increase the amount of storage of CBM 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 a copy of the complete approved Chapter 3 permit to construct associated with treatment facilities to BLM as they are issued by WDEQ.

#### **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 CBM discharges at concentrations exceeding detectable limits.

#### **2.3.2.4. 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. The Companies will locate facilities so that noise from the facilities at any nearby sage grouse or sharp-tailed grouse display grounds does not exceed 49 decibels (10 dBA above background noise) at the display ground.
3. The Companies will construct power lines to minimize the potential for raptor collisions with the lines. Potential modifications include burying the lines, avoiding areas of high avian use (for example, wetlands, prairie dog towns, and grouse leks), and increasing the visibility of the individual conductors.
4. The Companies will locate aboveground power lines, where practical, at least 0.5 mile from any sage grouse breeding or nesting grounds to prevent raptor predation and sage grouse collision with the conductors. Power poles within 0.5 mile of any sage grouse breeding ground will be raptor-proofed to prevent raptors from perching on the poles.
5. Containment impoundments will be fenced to exclude wildlife and livestock. If they are not fenced, they will be designed and constructed to prevent entrapment and drowning.
6. The Companies will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl colliding with power lines.
7. 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.

**2.3.2.5. Threatened, Endangered, or Sensitive Species**

**2.3.2.5.1. Bald Eagle**

1. Special habitats for raptors, including wintering bald eagles, will be identified and considered during the review of Sundry Notices.
2. Surveys for active bald eagle nests and winter roost sites will be conducted within suitable habitat by a biologist. Surface disturbing activities will not be permitted within one mile of suitable habitat prior to survey completion.

**2.3.2.5.2. Mountain Plover**

1. Project-related features that encourage or enhance the hunting efficiency of predators of mountain plover will not be constructed within ¼ mile of known mountain plover nest sites.
2. Construction of ancillary facilities (for example, compressor stations, processing plants) will not be located within ½ mile of known nesting areas. The threats of vehicle collision to adult plovers and their broods will be minimized, especially within breeding aggregation areas.
3. Creation of hunting perches or nest sites for avian predators within 0.5 mile of identified nesting areas will be avoided by burying power lines, using the lowest possible structures for fences and other structures and by incorporating perch-inhibiting devices into their design.
4. Reclamation of areas of previously suitable mountain plover habitat will include the seeding of vegetation to produce suitable habitat for mountain plover.

**2.3.2.5.3. Ute Ladies'-tresses Orchid**

1. Moist soils near wetlands, streams, lakes, or springs in the project area will be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation will be designed to avoid the establishment of noxious weeds.

**2.3.2.6. 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.

**2.3.2.7. 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.

**2.3.2.8. 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.

1. 33-25, 24-25, 33-22, 34-22, 43-27, 22-35, 23-34, Wells: the downhill side of the pad or slot should be stabilized to prevent erosion.
2. 13-26, 41-27 Wells: As discussed at the onsite, keep spoil pile close to the site to reduce disturbance to sage brush.
3. 44-27, 14-35, 43-34, 43-27, 22-26, and 33-22 Wells: To reduce disturbance to sagebrush and facilitate reclamation, sagebrush mowing will be restricted to a 25' width for the road access, and to a 35' radius from the well stake.
4. 43-35 Well: This well is staked in a drainage. LOG will provide the BLM with plans for specific stabilization measures to prevent pad erosion during weather events.
5. The approval of this project does not grant authority to use off lease Federal lands. No access or surface activity is allowed on or off the affected leases on Federal lands until right-of-way grants become authorized.
6. The Record of Decision for the Powder River Basin EIS includes a programmatic mitigation measure that states, "The companies will conduct clearance surveys for threatened and endangered or other special-concern species at the optimum time". The measure requires companies to coordinate with the BLM before November 1 annually to review the potential for disturbance and to agree on inventory parameters. Should this project not be completed by November 1, Lance/Anadarko Energy will coordinate with the BLM to determine if additional surveys will be required.
7. The following conditions will minimize impacts to roosting and nesting bald eagles;
  - a. Surveys for bald eagle winter roosts and nest sites are required annually until project completion throughout the project boundaries.
  - b. If a roost is identified 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.
  - c. If a nest is identified 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).
  - d. 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.
8. The following conditions will minimize impacts to raptors;
  - a. No disturbing activities shall occur within ½ mile of all identified nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season. This affects the following;

Township/Range	Section	Wells and Infrastructure
51/79	23	Water pipeline, Overhead power and drops, all proposed roads and corridors, and low water crossings.
51/79	25	The 24-25, 33-25, 13-25, 44-25 wells and their associated road corridors, P13-25, P43-25, P42-25 and their associated temporary access roads, monitoring wells, and discharge points, low water crossings, overhead power and drops.
51/79	26	The 12-26, 22-26, 31-26, 44-26, and 34-26 wells and their associated road corridors, road corridor associated with the 33-26, water pipeline, overhead power and drops, low water crossing and culverts. P44-26 and its associated temporary access, monitoring wells, and discharge points.
51/79	34	The 42-34 and 43-34 wells, their associated road corridors, low water crossings, overhead power and power drops.
51/79	35	The entire section including all wells, all roads and corridors, pipelines, low water crossings, culverts, overhead power and drops, pits and reservoirs and their associated temporary access, monitoring wells, and discharge points.
51/79	36	Road corridor associated with the 41-35 well, low water crossings, culverts, overhead power and drops.

- b. 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. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a ½ mile timing buffer will be implemented. The timing buffer restricts surface disturbing activities within ½ mile of occupied raptor nests from February 1 to July 31.
- c. Nest productivity checks shall be completed for all raptor nests within the Quarter Circle Nine POD listed in the table below. The productivity checks shall be completed for the first five years following project completion. The occupancy checks shall be conducted no earlier than June 1 or later than June 30 and any evidence of nesting success/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.

BLM ID	T:R:S	UTM E	UTM N	Species	2006 Activity
2648	51:78:30	397113	4912610	GOEA	Active
2652	51:79:25	396382	4912678	LEOW	Active
	51:78:35	394059	4912053	LEOW	Active
	51:78:36	394992	4912272	LEOW	Active
	51:78:35	394029	4911475	LEOW	Active
	51:78:35	393952	4911915	LEOW	Active
	51:78:25	396078	4912725	LEOW	Active
	51:78:14	393460	4916095	RTHA	Active
	51:78:31	396903	4912314	LEOW	Active
	51:78:23	394060	4914114	AMKE	Active

- d. Routine maintenance should be scheduled outside the nesting season (Feb 1-July 31) for all active nests. Emergency activities should be reduced as much as possible and restricted between the hours of 9:00 am and 3:00 pm.
9. The following conditions will minimize impacts to sage-grouse:

- a. Sage-grouse surveys are required throughout the project area for the current breeding season and results reviewed by a BLM biologist. This condition will be implemented on an annual basis for the duration of surface disturbing activities.
  - 1) If an active lek is identified during the survey, the 2 mile timing restriction (March 1-June 15) will be applied and disturbing activities will not be permitted until after the nesting season.
  - 2) If the Fleetwood Lek is active the following will be affected:

<b>Township/Range</b>	<b>Section</b>	<b>Wells and Infrastructure</b>
51/79	22,23,24,25,26	All wells and associated infrastructure, pipelines, low water crossings, culverts, pits and reservoirs and their associated monitoring wells, temporary access roads, discharge points and water discharge lines, and overhead power and drops.
51/79	27	The 41-27, 32-27, 43-27 wells and their associated infrastructure, road corridor south of the 44-27 well head, overhead power and drops, low water crossings and culverts.
51/79	35	The 11-35, 41-35, and 31-35 wells and their associated infrastructure, infrastructure south of the 24-26 well, culverts, low water crossings, overhead power and drops.
51/79	36	Infrastructure north of the 12-26 and northwest of the 41-36 state wells.

- 3) If the Well Lek is active the following will be affected:

<b>Township/Range</b>	<b>Section</b>	<b>Wells and Infrastructure</b>
51/79	34, 35, 36	All wells and associated infrastructure, pipelines, low water crossings, culverts, pits and reservoirs and their associated monitoring wells, temporary access roads, discharge points and water discharge lines, and overhead power and drops.
50/79	01, 02	All wells and associated infrastructure, pipelines, low water crossings, culverts, pits and reservoirs and their associated monitoring wells, temporary access roads, discharge points and water discharge lines, and overhead power and drops.
51/79	25	13-25, 24-25, 33-25, 44-25 wells and their associated infrastructure, P13-25 its associated monitoring wells, temporary access roads, discharge points and water discharge lines, overhead power and drops, low water crossings and culverts.
51/79	26	Infrastructure south of the 13-26, 44-26 well and its associated infrastructure, water pipelines, P44-26 its associated monitoring wells, temporary access roads, discharge points and water discharge lines, overhead power and drops, low water crossings and culverts.
51/79	27	14-27 well and its associated infrastructure, discharge point, water line and temporary access for the P34-27, overhead power and drops, low water crossings and culverts.

- 4) If sage-grouse are identified displaying at the Dried Pond and STGR sharp-tailed lek sites, the 0.64 mile timing limit restriction will be increased to a 2 mile timing restriction.

10. The following conditions will minimize impacts to sharp-tail-grouse:

- a. If an active sharp-tail lek is identified during the sage-grouse survey, the 0.64 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 0.5 mile buffer until the following breeding season (April 1). The required sharp-tailed grouse survey will be conducted by a biologist following WGFD protocol. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities.

- b. Creation of raptor hunting perches will be avoided within 0.64 miles of documented sharp-tailed grouse lek sites. Perch inhibitors will be installed to deter avian predators from preying on grouse.

## **2.4. Alternatives considered but not analyzed in detail**

### **Direct Discharge**

Direct discharge to Crazy Woman Creek and its tributaries is not a feasible water management strategy because there are not a sufficient number of tributaries to contain the proposed water production volume prior to reaching the Powder River, as required by the WDEQ. Downstream landowners have expressed concern to ranching operations as a result of discharge directly into channels, including erosion, deposition and vegetation change.

### **Re-injection**

Re-injection of produced water within the Quarter Circle 9 POD has also been considered. 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 within the Quarter Circle 9 POD. Re-injection into deep saltwater aquifers would also render the relatively high quality produced water unsuitable for future use. Therefore, re-injection is not a reasonable solution for the disposal of produced water within the Quarter Circle 9 POD. However, Lance may transport water via the Salt Creek Pipeline to an area near Midwest, Wyoming, where it would be re-injected into the Madison or Tensleep formations.

### **Land Application**

Land application of produced water within the Quarter Circle 9 POD has also been 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 and lack of landowner interest, land application was ruled out.

### **Treatment of Produced Water**

Treatment of produced water from the Quarter Circle 9 POD with subsequent discharge into the Crazy Woman Creek has been extensively researched to examine the full range of possibilities. The following potential treatment technologies were considered: Sulfur burners, constructed wetlands, rapid spray distillation, electro dialysis 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 the Crazy Woman 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. Electro dialysis reversal has not been cost effectively applied the treatment of CBNG water. Both electro dialysis 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 electro dialysis 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. A reverse osmosis facility is currently under construction in the Bear Draw Unit Beta POD and excess produced water may be transferred there.

**Total Containment**

Total containment within existing and proposed reservoirs was assessed in relation to the potential produced water volumes and was seen as a viable option to store a large percentage of produced water in conjunction with treatment and injection options.

**3. DESCRIPTION OF AFFECTED ENVIRONMENT**

Applications to drill were received on 07/03/2006. Field inspections of the proposed Quarter Circle 9 CBM project were conducted on 12/18, 12/19, 12/20/2006, 1/18, and 1/23/2007 by Joy Kennedy, Colt Rodeman, Craig Klaasen-Lance; Liz Hunter-Kadmas, Lee, & Jackson; Lee Harrelson, Mike McKinley, Arlene Kosic, Arnie Irwin, Melanie Hunter-BLM.

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.**

<b>Mandatory Item</b>	<b>Potentially Impacted</b>	<b>No Impact</b>	<b>Not Present On Site</b>	<b>BLM Evaluator</b>
Threatened and Endangered Species	X			Arlene Kosic
Floodplains			X	Melanie Hunter, Mike McKinley
Wilderness Values			X	Melanie Hunter
ACECs			X	Melanie Hunter
Water Resources	X			Melanie Hunter, Mike McKinley
Air Quality	X			Melanie Hunter
Cultural or Historical Values		X		Rob Wilson and G.L. "Buck" Damone III
Prime or Unique Farmlands			X	Melanie Hunter
Wild & Scenic Rivers			X	Melanie Hunter
Wetland/Riparian			X	Melanie Hunter, Mike McKinley
Native American Religious Concerns			X	Rob Wilson and G.L. "Buck" Damone III
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 Quarter Circle Nine POD is located in the Powder River “breaks” country approximately 16 miles east of Buffalo in Johnson County, Wyoming. Elevations in the project area average 4000 feet. The area is characterized by narrow, steep-sided ridges which terminate into round knobs with sandy or rocky outcroppings. There are numerous rugged draws, with some gradual bench areas between the ridgelines and the steeper drainage bottoms.

### 3.2. Soils & Vegetation

The soils and landforms of this area present distinct challenges for development. Soils are shallow and fragile, making reclamation and revegetation difficult. Erosion potential is high for most of the proposed project area and reclamation potential is low. Approximately **70 percent** of the area within the boundary of the proposed action contains soil mapping units with a named component identified as being **highly erosive**. Highly erosive soils (low reclamation potential areas) in this POD are identified as areas having slopes in excess of 25%, soils classified as miscellaneous areas, taxon above the family level of soil taxonomy, and/or existing ecological sites of Very Shallow or Shale.

Soils within the project area were identified from the *North Johnson County Survey Area, Wyoming*. The soil survey was performed by the Natural Resource Conservation Service according to National Cooperative Soil Survey standards. Pertinent information for analysis was obtained from the published soil survey and the National Soils Information System (NASIS) database for the area.

#### **Dominant soils affected by the proposed action include:**

##### **Dominant Soil Map Units**

<b>Soil Map Units</b>	<b>Acres</b>
684 Samday-Shingle-Badland complex, 10 to 45 percent slopes	4394
708 Theedle-Kishona-Shingle loams, 3 to 30 percent slopes	773
640 Forkwood-Cushman loams, 6 to 15 percent slopes	564
615 Cambria-Kishona-Zigweid loams, 6 to 15 percent slopes	336

**Dominant Ecological Sites and Plant Communities identified in this POD and its infrastructure, by dominant soil series are shallow clayey and loamy-mixed sagebrush/grass plant communities.**

<b>Ecological Site</b>	<b>Acres</b>
Shallow Clayey (10-14NP)	4394
Loamy (10-14NP)	1843
Sandy (10-14 NP)	36
Lowland (10-14NP)	21

#### ***Shallow Clayey Sites:***

This site occurs on slopes and ridge tops, landforms include hill sides, ridges and escarpments in the 10-14”precipitation zone. The soils of this site are shallow (less than 20” to bedrock) well drained soils formed in alluvium or residuum. These soils have moderate to slow permeability and may occur on all slopes. The bedrock is clay shale which is virtually impenetrable to plant roots. The main soil limitations include shallow depth to bedrock, high clay content and low organic matter content.

The present plant community is a Mixed Sagebrush/Grass.

Wyoming big sagebrush is a significant component of this Mixed Sagebrush/Grass 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 grass, and miscellaneous forbs. Specific species observed during the onsite include sage brush, Prairie Junegrass, Needleandthread grass, prickly pear, and cheatgrass.

***Loamy Sites:***

This site occurs on gently undulating to rolling land and includes landforms which include hill sides, alluvial fans, ridges and stream terraces, in the 10-14 inch precipitation zone.

The soils of this site are moderately deep to deep (greater than 20" to bedrock), well drained soils that formed in alluvium and residuum. These soils have moderate permeability and may occur on all slopes. The main soil limitations include low organic matter content and soil droughtiness.

The present plant community is a Mixed Sagebrush/Grass, as described above.

**3.2.1. Wetlands/Riparian**

No wetland/riparian areas were noted during the onsite within the POD boundary. The channels within the project area are well vegetated grassy swales of dry land species, generally without defined bed and bank and therefore are not indicative of a riparian environment. Riparian areas have developed along Crazy Woman Creek from spring runoff and storm events, but not as a result of treated or non-treated CBNG-produced water being direct-discharged to tributaries or the mainstem.

**3.2.2. Invasive Species**

A search of the inventory maps and databases compiled by the University of Wyoming through cooperation between the BLM and Johnson County Weed and Pest revealed the possible presence of Russian knapweed, leafy spurge, and salt cedar in the project area. Subsequent field investigation by the proposed project proponent also found infestations of cheatgrass.

**3.3. Wildlife**

A habitat assessment and wildlife inventory surveys were performed by Big Horn Environmental Consultants (Big Horn). Big Horn performed surveys for bald eagles, mountain plover, sharp-tailed grouse, greater sage-grouse, raptor nests, prairie dog colonies, and Ute ladies'-tresses orchid according to protocol in 2006.

A BLM Biologist conducted a field visits on December 18 of 2006. During this time, she reviewed the wildlife survey information for accuracy, evaluated impacts to wildlife resources, and provided project adjustment recommendations where wildlife issues arose.

Wildlife species common to the habitat types present are identified in the Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (PRB FEIS 3-114). Species that have been identified in the project area or that have been 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 and mule deer. The WGFD has determined the project area to be Yearlong range for pronghorn antelope and Winter Yearlong range for mule deer.

**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. **Yearlong** use is when a population of animals makes general use of suitable documented habitat sites within the range on a year round basis. Animals may leave the

area under severe conditions.

The project area is part of the Ucross pronghorn antelope and Powder River mule deer herds. There was a 2004 population estimate of 4,145 pronghorn antelope and a population objective of 2,500. The 2004 population estimate for the Powder River mule deer herd was 55,560 and an objective of 52,000 (WGFD 2004).

### 3.3.2. Aquatics

The project area is located within tributaries of Fleetwood and McCray drainages. These drainages are ephemeral and flow mostly in response to precipitation and snowmelt (WWC 2006).

### 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. 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 project area include northern harrier, golden eagle, red-tailed hawk, Swainson’s hawk, ferruginous hawk, American kestrel, prairie falcon, short-eared owl, great horned owl, osprey, bald eagle, rough-legged hawk, merlin, 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 (PRB FEIS 3-145-148).

The BLM database and Big Horn identified 10 raptor nests within 0.5 mile of the Quarter Circle Nine project area in 2006. Table 4 lists the species and activity status of these nests in 2006.

Table 3.3.4.1. Documented raptor nests within the Quarter Circle Nine project area in 2006 (UTM Zone 13, NAD83).

BLM ID	T:R:S	UTM E	UTM N	Species	2006 Activity
2648	51:78:30	397113	4912610	GOEA	Active
2652	51:79:25	396382	4912678	LEOW	Active
	51:78:35	394059	4912053	LEOW	Active
	51:78:36	394992	4912272	LEOW	Active
	51:78:35	394029	4911475	LEOW	Active
	51:78:35	393952	4911915	LEOW	Active
	51:78:25	396078	4912725	LEOW	Active
	51:78:14	393460	4916095	RTHA	Active
	51:78:31	396903	4912314	LEOW	Active
	51:78:23	394060	4914114	AMKE	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 three 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 1988, the WGFD identified four prairie dog complexes (Arvada, Recluse, Thunder Basin National Grasslands, and Midwest) partially or wholly within the BLM Buffalo Field Office administrative area as potential black-footed ferret reintroduction sites (Oakleaf 1988).

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 for survival (USFWS 1989).

Active reintroduction efforts of black-footed ferrets have reestablished populations in Mexico, Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming. In 1988, the WGFD identified four prairie dog complexes (Arvada, Recluse, Thunder Basin National Grasslands, and Midwest) partially or wholly within the BLM BFO administrative area as potential black-footed ferret reintroduction sites (Oakleaf 1988). Today, 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 USFWS has also concluded that black-tailed prairie dog colonies within Wyoming are unlikely to be inhabited by black-footed ferrets (Kelly 2004).

Two active prairie dog colonies were identified within the project area. The colonies total approximately 14 acres.

#### **3.3.5.1.2. Bald eagle**

On February 14, 1978, the bald eagle was federally listed as Endangered in all of the continental United States except for Minnesota, Wisconsin, Michigan, Oregon, and Washington. In these states the bald eagle was listed as Threatened. On July 12, 1995 the eagle's status was changed to Threatened throughout the United States. Species-wide populations are recovering from earlier declines, and the bald eagle was proposed for de-listing in 2000. A decision is expected in June 2007.

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 can be more varied. In addition to prairie dogs, ground squirrels, and lagomorphs, domestic sheep and big game carcasses 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 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.

The Quarter Circle Nine project area is highly suitable for bald eagle roosting and nesting. Bald eagle habitat exists along Crazy Woman Creek and the Powder River. Several bald eagles have been observed within 2 miles of the project area. Surveys conducted in 2006 and 2007 did not identify bald eagle nests or roosts within two miles of the project. However, surveys conducted by the BLM documented the following observations;

Number of Bald Eagles	Year Observed	Distance From POD (miles)
1	2006	1.8
1	2005	1.3
1	2005	2.0
1	2005	1.7

### 3.3.5.1.3. Ute's 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. 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.

The project area is located within tributaries of Fleetwood and McCray drainages. These drainages are ephemeral and flow mostly in response to precipitation and snowmelt (WWC 2006).

### 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. 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. Black-tailed prairie dog

On August 12, 2004, the U.S. Fish and Wildlife Service removed the black-tailed prairie dog's Candidate status. The Buffalo Field Office however will consider prairie dogs as a sensitive species and continue to afford this species the protections described in the FEIS. The black-tailed prairie dog is a diurnal rodent inhabiting prairie and desert grasslands of the Great Plains. Their decline is related to multiple factors including, habitat destruction, poisoning, and Sylvatic plague.

Two active prairie dog colonies were identified within the project area. The table below lists their location and size.

Colony Id	Location (TRS)	Activity	Size (acres)
1	51:79:23	Active	7.8
2	51:79:23	Active	6.1

#### 3.3.5.2.2. Greater sage-grouse

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). Sage-grouse attend traditional courtship areas called leks which are in or adjacent to sagebrush dominated habitat. Several lek sites form clusters defined as a lek complex. Sage-grouse may be expected to interchange within a lek complex, visiting one lek site to another from one day to the next. Lek sites within a complex are usually < 3 km from one another. Lek complexes are clearly spatially separated from adjacent lek complexes by 6 km. (Schroeder et al. 2000)

Habitats within the Quarter Circle Nine project area are highly suited for year round sage-grouse use. Two lek sites influence the project area. The Fleetwood Draw lek site is located 0.75 miles northeast from the project area. The Well lek site is located 0.5 miles from the project area and was discovered in 2006. Additionally, surveys conducted by Big Horn in 2006 and 2007 observed sage-grouse displaying at two previously identified sharp-tailed lek sites.

### **Sharp-tailed grouse**

Sharp-tailed grouse inhabit short and mixed-grass prairie, sagebrush shrublands, woodland edges, and river canyons. In Wyoming, this species is common where grasslands are intermixed with other shrublands, especially wooded draws, shrubby riparian area, and wet meadows (PRB FEIS 3-148).

The Quarter Circle Nine project area is highly suited for year-round sharp-tailed grouse use. There are two documented sharp-tailed lek sites located less than 1.5 miles of the project area. The Dried Pond lek is located 1.0 mile west and the STGR lek is located 1.5 miles east of the project area. Surveys conducted in 2006 observed both sharp-tailed grouse and sage-grouse displaying at the Dried Pond lek and only sage-grouse were observed displaying at the STGR lek site.

### **3.3.5.2.3. Mountain plover**

Mountain plovers, which are a Buffalo Field Office sensitive species, are typically associated with high, dry, short grass prairies containing vegetation typically shorter than four inches tall, and slopes less than 5 degrees (BLM 2003). Mountain plovers are closely associated with heavily grazed areas such as prairie dog colonies and livestock pastures.

Suitable mountain plover habitat is present within two prairie dog colonies. However, no mountain plovers were identified within the project area during surveys conducted in 2006.

### **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](http://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

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 Fleetwood and McCrary Draws drainages of the Crazy Woman Creek drainage system. Fleetwood and McCrary Draws are typified by steep-gradient gully systems intersected by randomly degraded claystone exposures with sparse vegetation. Gullies transition into well-vegetated incised features with narrow channel bottoms as they converge to form the primary tributaries of the drainages.

#### **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.

The BLM has installed shallow groundwater monitoring wells at five impoundment locations throughout the PRB to assess ground-water quality changes due to infiltration of CBNG produced water. The most intensively monitored site has a battery of nineteen wells which have been installed and monitored jointly by the BLM and USGS since August, 2003. Water quality data has been sampled from these wells on a regular basis. That impoundment lies atop approximately 30 feet of unconsolidated deposits (silts and sands) which overlie non-uniform bedrock on a side ephemeral tributary to Beaver Creek and is approximately one and one-half miles from the Powder River. Baseline investigations showed water in two sand zones, the first was at a depth of 55 feet and the second was at a depth of 110 feet. The two water bearing zones were separated by a fifty-foot thick shale layer. The water quality of the two water bearing zones fell in the WDEQ Class III and Class I classifications respectively. Preliminary results from this sampling indicate increasing levels of TDS and other inorganic constituents over a six month period resulting in changes from the initial WDEQ classifications.

The on-going shallow groundwater impoundment monitoring at four other impoundment locations are less intensive and consist of batteries of between 4 and 6 wells. Preliminary data from two of these other sites also are showing an increasing TDS level as water infiltrates while two other sites are not. Approximately 54 borings/monitoring wells are proposed to be installed around the 18 impoundments

approved in the POD.

A search of the Wyoming State Engineer Office (WSEO) Ground Water Rights Database for this area showed 3 registered stock and miscellaneous water wells within the POD boundary with depths ranging from 15 to 325 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 Fleetwood and McCrary Draws drainages which are tributaries to the Crazy Woman Creek watershed. Most of the drainages in the area are ephemeral (flowing only in response to a precipitation event or snow melt) to 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). The channels are primarily well vegetated grassy swales, without defined bed and bank.

The PRB FEIS presents the historic mean Electrical Conductivity (EC, in  $\mu\text{mhos/cm}$ ) 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 near Arvada, WY (PRB FEIS page 3-49).

The operator has identified one natural spring, Grandpa Spring, within the POD boundary at T50N, R79W, Sec.2 in the SWNE. The estimated flow of the spring has been determined to be 5-10 gpm with a water quality of 4,790  $\mu\text{mhos/cm}$  conductivity, 4,230 mg/l TDS and 5.8 SAR.

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 Quarter Circle 9 project prior to on-the-ground project work (BFO project no. 70060249). SWCA Environmental Consultants conducted a Class III cultural resource inventory following the Archeology and Historic Preservation, Secretary of the Interior's Standards and Guidelines (48CFR190) for the project. Rob Wilson and G.L. “Buck” Damone III, BLM Archaeologists, reviewed the report for technical adequacy and compliance with Bureau of Land Management (BLM) standards, and determined it to be adequate. The following cultural resources are located in or near the area of potential effect.

**Table 3.5 Cultural Resources Inventory Results**

Site Number	Site Type	Eligibility
48JO2748	Historic Site	Not Eligible
48JO2749	Prehistoric Site	Unevaluated
48JO3079	Historic Site	Not Eligible
48JO3080	Prehistoric Site	Not Eligible

<b>Site Number</b>	<b>Site Type</b>	<b>Eligibility</b>
48JO3081	Historic Site	Not Eligible
48JO3082	Historic Site	Not Eligible
48JO3083	Historic Site	Not Eligible
48JO3084	Historic Site	Not Eligible
48JO3085	Historic and Prehistoric Site	Not Eligible
48JO3086	Historic and Prehistoric Site	Not Eligible
48JO3087	Historic Site	Not Eligible
48JO3212	Historic Site	Not Eligible

#### **4. ENVIRONMENTAL CONSEQUENCES**

The changes to the proposed action POD, which resulted in development of Alternative C as the preferred alternative, have reduced the potential impact 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**

Overall impacts to vegetation and soils from surface disturbance would be by following the operator's plans and BLM applied mitigation. Of the 35 proposed well locations, 4 can be drilled without a well pad being constructed, 21 will be slotted, and 10 will require a constructed (cut & fill) well pad. The disturbance associated with the slotted pad wells would involve building an average 30 x 120 slot. On the 4 wells where a pad is not necessary, minor digging-out of rig wheel wells (for leveling drill rig on minor slopes) would occur. All wells will require reserve pit construction (estimated approximate size of two pits 32 x 20 feet each. Based on the surface use data summary form submitted by Lance Oil and Gas for the Quarter Circle Nine project, the disturbance associated with the 25 well sites without a constructed pad is 22.96 acres, and the 10 wells requiring cut & fill pad construction would disturb a total of 13.7 acres. The total estimated disturbance for all 35 wells would be 36.66 acres. This would be a short-term impact with expedient, successful reclamation and site-stabilization, as committed to by the operator in their POD MSUP and as required by BLM in COAs.

Approximately 12.1 miles of improved roads would be constructed to provide access to various well locations. Approximately 3.3 miles of new and existing two-track trails would be utilized to access well sites. 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 15.5 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., straw mulch, erosion control blankets, bonded fiber matrix, and waterbars) would ensure land productivity/stability is regained and maximized.

Proposed culverts 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.

## Soils

Under this alternative, 35 federal wells would be drilled (see description of alternatives). The topographical, ecological and soils in this area are diverse. There are many areas which will be reclaimed by traditional methods, reducing the overall impact of the project. However, some areas will be challenging for reclamation due to soil properties and/or site characteristics. The operator planned their project to avoid those areas where possible, however the proposed action will affect some areas of soils with a limited potential for successful reclamation. Disturbances within these areas require the programmatic/standard COA's be complimented with a site specific performance based reclamation related COA.

The following roads and well locations are identified as areas requiring additional reclamation efforts beyond traditional methods.

- The main access road and its branches to the 13-26, 44-27, 31-34, and 24-27 well sites in T 51 N, R 79 W, Sections 26, 27, and 34.
- The access roads to the 31-35, 41-35, and 43-35 well sites in the west half of T 51 N, R 79 W, Section 35.
- The access road to the 24-25 and the 33-25 wells in the south half of Section 25, T 51 N, R 79 W.
- The well pads to be constructed at the 24-22, 11-25, 11-26, 13-26, 31-26, 33-26, 12-27, 14-27, 32-27, 41-27, 43-27, 44-27, 23-34, 31-34, 42-34, 43-34, 11-35, 22-35, 14-35, 34-35, and 43-35 locations.

Direct and indirect effects resulting from well pad, access roads, pipelines, powerlines and other activities may include: soil compaction, mixing of horizons, loss of soil vegetative cover, organic matter and productivity, modification of hillslope hydrology and increased susceptibility of the soil to erosion. Soil productivity would be eliminated along improved roads and severely restricted along two track trails until successful final reclamation is achieved. The majority of proposed pipelines (gas and water) would be located in "disturbance corridors", which involve placing two 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.

Estimated disturbance associated with this Pod is summarized in Table 4.1.

The Bureau of Land Management has an obligation to protect these lands from disturbance which could lead to irretrievable and irreversible impacts. The current BLM policy is for specialists to field verify areas identified as potentially having highly erosive soils and as per the Record of Decision, will be avoided. *"Areas of highly erosive soils will be avoided when drill sites, two-track access routes, and pipeline routes are surveyed and staked in order to substantially reduce the amount of soil loss."*

Soil compaction by vehicle traffic results in the collapse of soil pores reducing the transmissivity of water and air. Compaction decreases infiltration thus increasing runoff and hazard of water erosion. The potential for compaction is greatest when soils are wet. Factors affecting compaction include soil texture, moisture, organic matter, clay content and type, pressure exerted, and the number of passes by vehicle traffic or machinery.

Compaction in these areas may be reduced by remedial action such as plowing or ripping.

Soil horizon mixing may result where construction of roads, pipelines or other activities occur. Mixing of horizons may result in moving organic matter and nutrients at depths out of reach of surface plants or destroyed. Horizon mixing may bring soil texture and structure to the surface that are more susceptible to wind and water erosion. If soil structure is destroyed, surface infiltration by water and air may be affected. Inorganic compounds, such as carbonates and other salts, or unweathered material may be

brought to the surface which effect seed germination, plant health and viability.

Soil erosion would affect soil health and productivity. Erosion rates are site specific and are dependent on soil, climate, topography, and cover. Expedient reclamation of disturbed land with salvaged topsoil, proper seedbed preparation techniques, and appropriate seed mixes, along with use of erosion control measures (e.g., waterbars, water wings, silt fences, culverts, rip-rap, gabions etc.) would ensure soil productivity and stability will be regained in the shortest time frame.

Soil disturbances other than permeate facilities would be short term, and have minor impacts with expedient, successful interim reclamation and site stabilization. Construction activities would be designed following Best Management Practices (BMPs) to control erosion and sedimentation; erosion control measures would be maintained and continued until adequate vegetation cover is re-established; vegetation would be removed only when necessary and reseeded following the BLM seeding policy.

Table 4.1 summarizes the proposed surface disturbance.

**Table 4.1 - SUMMARY OF DISTURBANCE**

<b>Facility</b>	<b>Number or Miles</b>	<b>Factor</b>	<b>Acreage of Disturbance</b>	<b>Duration of Disturbance</b>
Nonconstructed Pad	25	Site Specific	22.96	Long Term
Constructed Pad	10	Site Specific	13.7	
Gather/Metering Facilities	0	Site Specific	0.0	Long Term
Screw Compressors	0	Site Specific	0.0	Long Term
Monitor Wells	54	0.01/acre	0.54	Long Term
Impoundments	18		72.0	Long Term
On-channel	15	Site Specific	52.7	
Off-channel	3	Site Specific	19.3	
Water Discharge Points	18	Site Specific or 0.01 ac/WDP	0.18	
Channel Disturbance				
Headcut Mitigation*		Site Specific		
Channel Modification		Site Specific		
Improved Roads		60' Width or Site Specific		Long Term
No Corridor	1.9		13.77	
With Corridor	10.2		74.38	
2-Track Roads		60' Width or Site Specific		Long Term
Proposed With Corridor	0.3		2.2	
Existing With Corridor	3.0		22.0	
Pipelines	2.8	45' Width or Site Specific	15.5	Short Term
No Corridor				

Facility	Number or Miles	Factor	Acreage of Disturbance	Duration of Disturbance
Buried Power Cable No Corridor	0	12' Width or Site Specific	0	Short Term
Overhead Powerlines	20,300	30' Width	14.0	Long Term
Additional Disturbance		Site Specific	0	
Staging area	1	416' x 416'	4	
Treatment facility	1	416' x 416'	4	

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 which will potentially allow for streambed enhancement through wetland-riparian species establishment.

#### 4.1.2. Invasive Species

Utilization of existing facilities and 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 would reduce potential impacts from noxious weeds and invasive plants.

Lance Oil and Gas has submitted an Integrated Pest Management Plan that outlines several methods of weed and pest control. The company plans to approach the problem using educational, physical, biological, and chemical approaches. LOG’s goal is to use a combination of these methods to control existing infestations, and also to prevent the future spread of noxious weeds. LOG has also committed to preventive practices such as;

- Prompt reseeding and revegetation of areas of disturbed soils with certified weed-free seed
- Cleaning of equipment and vehicles prior to entering and leaving each worksite
- Herbicide application
- Mowing newly revegetated areas during the first season of establishment, prior to seed formation on the weeds of concern to avoid the transport and spread of noxious weeds into the area .

#### 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 anticipated to be within the parameters of 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 0.8% 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 commitment by the operator to monitor the volume of water flowing into Crazy Woman Creek and to construct additional downstream reservoirs, if necessary, to prevent significant volumes of water from flowing into the Watershed.
- The WMP for the Quarter Circle 9 proposes that produced water will not contribute significantly to flows downstream due to all impoundments being full-containment..

No additional mitigation measures are required.

## **4.2. Wildlife**

### **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, well locations, pipelines, discharge points and other water management control structures were moved, modified, mitigated or dropped from the project design in order 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 may provide some habitat value as these areas are reclaimed and native vegetation becomes established. Although, when these reclaimed areas are located along road sides, vehicular collisions may increase.

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 feels 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 not only do mule deer avoid mineral activities, but after three years of drilling activity the deer have not accepted 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. In order to survive 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.

#### **4.2.1.1. 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**

Produced CBNG water from the 35 proposed federal wells will be contained in 17 on-channel and 1 off-channel reservoirs. In order to ensure total containment of produced water, Lance/Anadarko will adjust flow rates between reservoirs, or if necessary, reduce the flow rates and/or construct additional containment facilities (WWC 2006). CBNG water is not expected to reach any fish bearing drainages within the project area. Aquatic species should not be affected by implementation of the Quarter Circle Nine POD.

#### **4.2.2.1. 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 4-247. No additional mitigation measures are required.

#### **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).

Density of breeding Brewer’s sparrows declined by 36% within 100 m of dirt roads within a natural gas field. Effects occurred along roads with light traffic volume (<12 vehicles per day). Findings suggest that indirect habitat losses from energy development may be substantially larger than direct habitat losses (Ingelfinger 2004).

Density of breeding sage sparrows was reduced by 57% within a 100-m buffer of dirt roads regardless of traffic volume. The density of roads constructed in natural gas fields exacerbated the problem and the area of impact was substantial (Ingelfinger 2004).

Overhead power lines may affect migratory birds in several ways. Power poles provide raptors with perch sites and may increase predation on migratory birds. Power lines placed in flight corridors may result in collision mortalities. Some species may avoid suitable habitat near power lines in an effort to avoid predation. Additional direct and indirect effects to migratory birds are discussed in the PRB FEIS (4-231-235).

#### **4.2.3.1. 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.

#### **4.2.4. Raptors Direct and Indirect Effects**

None of the proposed wells are located in direct line of site of the 10 documented nests within 0.5 miles of the project area. Six of the nests are located less than 0.25 miles of wells, proposed roads or proposed corridors adjacent to existing roads. However, due to topography the nests are not visible from the wells or roads.

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 over heating or chilling of eggs or chicks. The 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.

Despite commitments such as telemetry metering to limit well visits, well visits during the nesting season will occur 2 to 3 times per week which may lead to nest failure through nest abandonment, displacement, and increased predation. 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. 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. No additional mitigation measures are required.

#### **4.2.5. Threatened and Endangered and Sensitive Species**

Within the BLM Buffalo Field Office there are three species that are Threatened or Endangered under the Endangered Species Act. Potential project effects on Threatened and Endangered Species are summarized 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 and Sensitive Species**

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

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
<b>Endangered</b>				
Black-footed ferret ( <i>Mustela nigripes</i> )	Black-tailed prairie dog colonies or complexes > 1,000 acres.	NP	NE	Prairie dog colonies present, less than 1000 acres.
<b>Threatened</b>				
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Mature forest cover often within one mile of large water body.	K	LAA	Habitat present, overhead power proposed.
Ute ladies'-tresses orchid ( <i>Spiranthes diluvialis</i> )	Riparian areas with permanent water	NP	NE	No historically perennial water present, habitat not suitable.

**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.

**Effect Determinations**

- LAA** Likely to adversely affect
- NE** No Effect.
- NLAA** May Affect, not likely to adversely effect individuals or habitat.

#### **4.2.5.1.1. Black-footed ferret**

Two small prairie dog colonies are present within the Quarter Circle Nine project area. However, due to the lack of sufficient habitat within the project area, implementation of the proposed development will have “no effect” on the black-footed ferrets.

#### **4.2.5.1.2. Bald eagle**

The proposed project is likely to affect bald eagles due to the presence of proposed powerlines. Lance/Anadarko Energy proposes 3.8 miles of three phase overhead powerlines within the project boundaries.

The presence of overhead power lines may adversely affect foraging bald eagles. Bald eagles forage opportunistically throughout the Powder River Basin, particularly during the winter when migrant eagles join the small number of resident eagles. Power poles provide attractive perch sites in areas where mature trees and other natural perches are lacking. From May 2003, through December 28, 2006, Service Law Enforcement salvage records for northeast Wyoming identified that 156 raptors, including 1 bald eagle, 93 golden eagles, 1 unidentified eagle, 27 hawks, 30 owls and 4 unidentified raptors were electrocuted on power poles within the Powder River Basin Oil and Gas Project area (USFWS 2006a). Of the 156 raptors electrocuted, 31 were at power poles that are considered new construction (post 1996 construction standards). Additionally, two golden eagles and a Cooper’s hawk were killed in apparent mid span collisions with powerlines (USFWS 2006a). Power lines not constructed to APLIC suggestions pose an electrocution hazard for eagles and other raptors perching on them. The Service has developed additional specifications, improving upon the APLIC suggestions. Constructing power lines to the APLIC suggestions and Service standards minimizes, but does not eliminate electrocution risk.

Produced water will flow into 18 reservoirs, which may attract eagles if a reliable prey base is present. The effect of reservoirs on eagles is unknown. The reservoirs could prove to be a benefit (e.g. increased food supply) or an adverse effect (e.g. contaminants, proximity of power lines and/or roads to water). Eagle use of reservoirs should be reported to determine the need for any future management.

The proposed project is “likely to adversely affect” bald eagles due to the presence of proposed and existing overhead powerlines lines.

#### **4.2.5.1.3. Ute’s Ladies Tresses Orchid**

Suitable orchid habitat is not present within the Quarter Circle Nine project area. Reservoir seepage and direct discharge may create suitable habitat if historically ephemeral drainages become perennial, however no historic seed source is present within or upstream of the project area. Additionally, surveys conducted throughout the project area yielded negative results. Implementation of the proposed project should have “no affect” on Ute ladies’- tresses orchid habitat.

#### **4.2.5.2. Sensitive Species Direct and Indirect Effects**

**Table 4.3 Summary of Sensitive Species Habitat and Project Effects.**

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

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Sage sparrow ( <i>Amphispiza billneata</i> )	Basin-prairie shrub, mountain-foothill shrub	S	MIH	Sagebrush cover will be affected.
Sage thrasher ( <i>Oreoscoptes montanus</i> )	Basin-prairie shrub, mountain-foothill shrub	S	MIH	Sagebrush cover will be affected.
Trumpeter swan ( <i>Cygnus buccinator</i> )	Lakes, ponds, rivers	S	MIH	New reservoirs may increase usage during migration.
White-faced ibis ( <i>Plegadis chihi</i> )	Marshes, wet meadows	NP	NI	Permanently wet meadows not present.
Yellow-billed cuckoo ( <i>Coccyzus americanus</i> )	Open woodlands, streamside willow and alder groves	NP	NI	Streamside habitats not present
Fish				
Yellowstone cutthroat trout ( <i>Oncorhynchus clarki bouvieri</i> )	Mountain streams and rivers in Tongue River drainage	NP	NI	Outside species range.
Mammals				
Black-tailed prairie dog ( <i>Cynomys ludovicianus</i> )	Prairie habitats with deep, firm soils and slopes less than 10 degrees.	K	NE	Two prairie dog colonies identified within the project. No disturbance proposed. Habitat not present.
Fringed myotis ( <i>Myotis thysanodes</i> )	Conifer forests, woodland chaparral, caves and mines	NP	NI	Habitat not present.
Long-eared myotis ( <i>Myotis evotis</i> )	Conifer and deciduous forest, caves and mines	NP	NI	Habitat not present.
Spotted bat ( <i>Euderma maculatum</i> )	Cliffs over perennial water.	NP	NI	Cliffs & perennial water not present.
Swift fox ( <i>Vulpes velox</i> )	Grasslands	S	MIH	Grassland habitat will be affected.
Townsend's big-eared bat ( <i>Corynorhinus townsendii</i> )	Caves and mines.	NP	NI	Habitat not present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Plants				
Porter's sagebrush ( <i>Artemisia porteri</i> )	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	NI	Habitat not present.
William's wafer parsnip ( <i>Cymopterus williamsii</i> )	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.
- MIH** 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. Black-tailed prairie dog**

Two prairie dog colonies have been identified within the project area. No disturbance is proposed within the colonies. Black-tailed prairie dogs should not be impacted by the implementation of the project.

#### **4.2.5.2.2. Greater sage-grouse**

##### **Project Modifications Benefiting Sage-Grouse:**

1. The 41-27 well site was relocated to a location with less dense sagebrush.
2. The 43-27 well site was relocated out of sage-grouse habitat and the road width will not exceed 30 feet.
3. The road corridor associated with the 22-26 well will not exceed 20 feet.
4. The 12-26 well was relocated off an erosive ridge top, reducing the length of the road and disturbance to sagebrush. The engineered pad was also reduced to a slotted pad.
5. The road corridor associated with the 33-22 well will not exceed 20 feet.
6. The 31-35 well was relocated approximately 500 feet, reducing the length of the road and disturbance to sagebrush.
7. The temporary access road and monitors wells for the P32-23 pit were relocated out of the CSU of a lek site.

Project activities will result in the direct loss 159 acres of occupied year-round sage-grouse habitat. The proposal would also create extensive habitat fragmentation due to the introduction of new linear features (roads, pipelines, and overhead powerlines). Sage-grouse avoidance of these facilities produces even greater indirect habitat loss. Sage-grouse use of previously suitable habitat may decline. The Wyoming Game and Fish Department (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).

The presence of overhead power lines and roads within the project area may adversely affect sage grouse. Overhead power lines create hunting perches for raptors, thus increasing the potential for predation on sage-grouse. Increased predation from overhead power near leks may cause a decrease in lek attendance and possibly lek abandonment. Overhead power lines are also a collision hazard for sage grouse flying through the area. Increased roads and mineral related traffic can affect grouse activity and reduce survival (Braun et al. 2002). Activity along roads may cause nearby leks to become inactive over time (WGFD 2003).

Noise can affect sage grouse by preventing vocalizations that influence reproduction and other behaviors (WGFD 2003). Sage grouse attendance on leks within one mile of compressors is lower than for sites farther from compressors locations (Braun et al. 2002).

Another concern with CBNG is that reservoirs created for water disposal provide habitat for mosquitoes associated with West Nile virus (Oedekoven 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). Powder River Basin 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 Buffalo Field Office (BFO) Resources 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), which includes the WGFD, 1977 sage-grouse guidelines (Bennett 2004). Under pressure for standardization BLM Wyoming adopted the two-mile recommendation in 1990, and

instructed the field offices to incorporate the measure into their land use plans (Bennett 2004, Murkin 1990).

The two-mile recommendation was based on research which indicated between 59 and 87 percent of sage-grouse nests were located within two-miles of a lek (Bennett 2004). These studies were conducted within prime, contiguous sage-grouse habitat such as Idaho's Snake River plain.

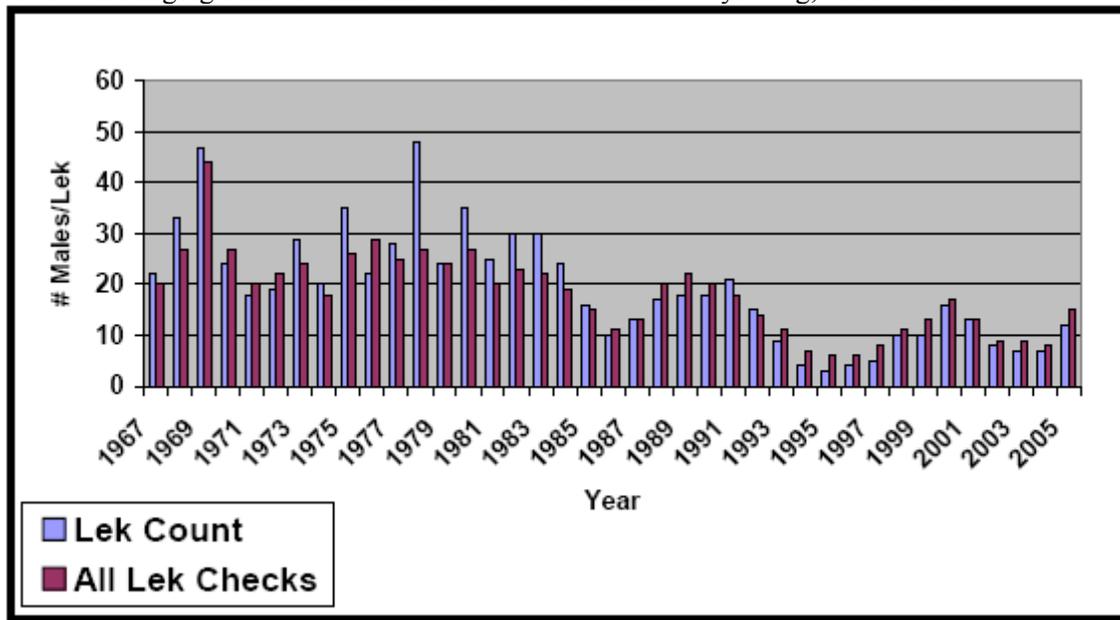
Additional studies, across more of the sage-grouse's range, indicate that many populations nest much farther than two miles from the lek of breeding (Bennett 2004). Holloran and Anderson (2005), in their Upper Green River Basin study area, reported only 45% of their sage grouse hens nested within 3 km (1.86 mi) of the capture lek. Moynahan and Lindberg (2004) found 36% of their grouse nesting within 3 km of the capture leks. 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. In press).

Percentage of sage-grouse nesting within a certain distance from their breeding lek is unavailable for the Powder River Basin. The Buffalo and Miles City field offices through the University of Montana with assistance from other partners including the U.S. Department of Energy and industry are currently researching nest location and other sage-grouse questions and relationships between grouse and coalbed natural gas development. Habitat conditions and sage grouse biology within the Buffalo Field Office is probably most similar to Moynahan's north-central Montana study area.

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. Without contiguous habitat available to nesting grouse it is likely a smaller percentage of grouse nest within two-miles of a lek within the PRB than grouse within those areas studied in the development of the 1977 WAFWA recommendations and even the Holloran and Moynahan study areas. Holloran and Moynahan both studied grouse in areas of contiguous sagebrush habitats without large scale fragmentation and habitat conversion (Moynahan et al In press, Holloran and Anderson 2005). A recent sagebrush cover assessment within Wyoming basins estimated sagebrush coverage within Holloran and Anderson's Upper Green River Basin study area to be 58% with an average patch size greater than 1200 acres; meanwhile Powder River Basin sagebrush coverage was estimated to be 35% with an average patch size less than 300 acres (Rowland et al. 2005). The Powder River Basin patch size decreased by more than 63% in forty years, from 820 acre patches and an overall coverage of 41% in 1964 (Rowland et al. 2005). Recognizing that many populations live within fragmented habitats and nest much farther than two miles from the lek of breeding WAFWA revised their sage grouse management guidelines (Connelly et. al. 2000) and now recommends the protection of suitable habitats within 5 km (3.1 mi) of leks where habitats are not distributed uniformly such as the Powder River Basin.

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

Figure 1. Male sage-grouse lek attendance within northeastern Wyoming, 1967-2005.



Sage-grouse populations within the PRB are declining independent of coalbed natural gas development. 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 (Oedekoven 2004). The Powder River Basin Oil and Gas Project Final Environmental Impact Statement estimated 51,000 additional CBNG wells to be drilled over a ten year period beginning in 2003 (BFO 2003). Impacts from CBNG development are likely to be significant and additive to the long-term impacts afflicting the sage-grouse population (Oedekoven 2004). In other terms, CBNG development is expected to accelerate the downward sage-grouse population trend.

A two-mile timing limitation given the long-term population decline and that less than 50% of grouse are expected to nest within the limitation area is likely 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. 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. As stated earlier, a well density of eight wells per section creates sage-grouse avoidance zones which overlap creating contiguous avoidance areas (WGFD 2004).

An integrated approach including habitat restoration, grazing management, temporal and spatial mineral limitations etc. is necessary to reverse the population decline. The Wyoming Game and Fish Department (WGFD) has initiated such a program within the Buffalo Field Office area (Jellison 2005). The WGFD program is modeled after a successful program on the Deseret Ranch in southwestern Wyoming and northeastern Utah. The Deseret Ranch has demonstrated a six-fold increase in their sage-grouse population while surrounding areas exhibited decreasing populations (Danvir 2002).

**4.2.5.2.3. Mountain plover**

Suitable mountain plover habitat is present within the two prairie dog colonies identified. Surveys conducted within the project area in 2006 did not identify mountain plovers. Mountain plovers should not be impacted by the implementation of this project.

### **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**

The PRB FEIS and ROD included a programmatic mitigation measure that states, “The BLM will consult with appropriate state agencies regarding WNV. If determined to be necessary, a COA will be applied at the time of APD approval to treat mosquitoes for any CBM discharge waters that become stagnant.” 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. Based on current information, we determined that no significant impacts in the spread of WNV would occur from the implementation of this project.

#### **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 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), should minimize project area and downstream potential impacts from proposed water management strategies as a result of all impoundments being full-containment. Additional water which cannot be contained in the proposed reservoirs will either be treated in the Bear Draw Unit Beta reverse osmosis facility currently under construction or Lance may transport water via the Salt Creek Pipeline to an area near Midwest, Wyoming, where it would be re-injected into the Madison or Tensleep formations.

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 or 525 gpm (1.17cfs or 84.67 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 drainage, the projected volume produced

within the watershed area was 21,135 acre-feet in 2006 which is the maximum estimated production. As such, the volume of water resulting from the production of these wells is 0.4% of the total volume projected for 2006. This volume of produced water is 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 drainage area (PRB FEIS pg 4-5). For this action, it may be assumed that a maximum of 225.75 gpm will infiltrate at or near the discharge points and impoundments (36.4 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 15 to 325 feet compared to 1,950-2,350 feet to the Big George, which should not impact domestic or stock water production in the relatively shallower wells. 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 (1/2 mile) 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 - Tongue River sand 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.

In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed a guidance document, “Compliance Monitoring for Ground Water Protection Beneath

Unlined Coalbed Methane Produced Water Impoundments” (June 14, 2004) which can be accessed on their website. This guidance document became effective August 1, 2004, and is currently being revised as the “Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments” which should be approved by June, 2006. Approximately 800 new impoundments have been investigated to date with 102 impoundments in 52 permits that have gone into compliance monitoring. The Wyoming DEQ has established an Impoundment Task Force which is in the process of drafting an “Impoundment Monitoring Plan” to investigate the potential for existing impoundments to have impacted shallow groundwater. Drilling at selected existing impoundments should begin in the spring of 2006. For WYPDES permits received by DEQ after the August 1<sup>st</sup> effective date, the BLM will require that operators comply with the requirements outlined in the current approved 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 CBM 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 – Tongue River sands and coals (nearly 750 million acre-feet, from Table 3-5). All of the groundwater projected to be removed during reasonably foreseeable CBM 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 gaging 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 Quality**

Predicted Values	TDS, mg/l	SAR	EC, μmhos/cm
Most Restrictive Proposed Limit –		2	1,000
Least Restrictive Proposed Limit		10	3,200
Primary Watershed at Arvada Gauging station			
Historic Data Average at Maximum Flow		1.29	1,066
Historic Data Average at Minimum Flow		2.26	1,937
WDEQ Quality Standards for Wyoming			
Groundwater (Chapter 8)			
Drinking Water (Class I)	500		
Agricultural Use (Class II)	2,000	8	
Livestock Use (Class III)	5,000		
Predicted Produced Water Quality			
Coal Zone 1	1,220	35.7	1,980

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 1,220 mg/l TDS which is within the WDEQ criteria for agricultural use (2000 mg/l TDS). However direct land application is not included in this proposal. If at any future time the operator entertains the possibility of irrigation or land application with the water produced from these wells, the proposal must be submitted as a sundry notice for separate environmental analysis and approval by the BLM.

The quality for the water produced from the 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 these 35 wells, for a total of 525 gpm for the POD. See Table 4.4 .

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

There are 18 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, 18 impoundments (277.8 acre-feet of storage) would potentially be constructed within the project area. These impoundments will disturb approximately 72 acres including the dam structures. Of these water impoundments, 15 would be on-channel reservoirs disturbing 52.7 acres, and 3 would be off-channel ponds disturbing 19.3 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) will be 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). Existing impoundments will be upgraded and proposed impoundments will be constructed to meet the requirements of the WSEO, WDEQ and the needs of the operator and the landowner. 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 0.18 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. Sedimentation will occur in the impoundments, but would be controlled through a concerted monitoring and maintenance program. 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 of 3 cfs (PRB FEIS pg 4-86). The predicted maximum discharge rate from these 35 wells is anticipated to be a total of 15 gpm or 1.17 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 (0.18 cfs) may add a maximum 0.14 cfs to the flows, or 4.7% of the predicted total CBNG produced water contribution. This incremental volume is statistically below the measurement capabilities for the volume of flow of the Crazy Woman Creek (refer to Statistical Methods in Water Resources U.S. Geological Survey, Techniques of Water-Resources Investigations Book 4,

Chapter A3 2002, D.R. Helsel and R.M. Hirsch authors). 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 obtained a Wyoming Pollutant Discharge Elimination System (WYPDES) permit # WY0052639 for the discharge of water produced from this project from the WDEQ.

Permit effluent limits were set at (WYPDES, Attachment A):

pH	6.5 to 9
TDS	5000 mg/l max
Specific Conductance	7500 mg/l max
Dissolved iron	1,000 µg/l max
Total Barium	1800 µg/l max
Total Recoverable Arsenic	7 µg/l max
Chlorides	150 mg/l

The WYPDES permit also addresses existing downstream concerns, such as irrigation use, in the COA for the permit.

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 (page 27) for the Quarter Circle 9 POD prepared by Western Water Consultants for Lance Oil and Gas Company, Inc.

#### **4.4.2.1. Surface Water Cumulative Effects**

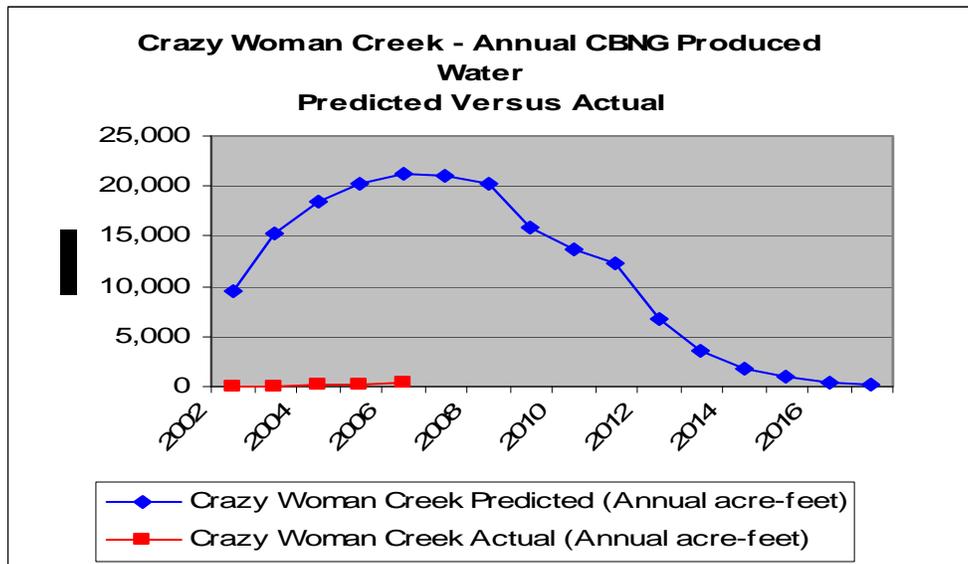
The analysis in this section includes cumulative data from Fee, State and Federal CBNG development in the watershed. These data were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC).

As of March 2007, all producing CBNG wells in the watershed have discharged a cumulative volume of 635 acre-ft of water compared to the predicted 84,427 acre-ft disclosed in the PRB FEIS (Table 2-8 page 2-26). These figures are presented graphically in Figure 4.1 and Table 4.6 following. This volume is 0.8% of the total predicted produced water analyzed in the PRB FEIS for the watershed.

**Table 4.6 Actual vs predicted water production in the Crazy Woman Creek watershed *2006 Data Update 3-16-07***

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				
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				
<b>Total</b>	<b>181,383</b>		<b>635</b>			

**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. 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 anticipated to be within the parameters of the PRB FEIS for the following reasons:

1. They are proportional to the actual amount of cumulatively produced water in the drainage, which is approximately 0.8% 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 Crazy Woman Creek drainage.

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 watershed and page 117 for cumulative effects common to all sub-watersheds.

#### 4.5. Cultural Resources

There are no eligible sites within the APE of the proposed project. Following the Wyoming State Protocol Section VI (A)(1) the Bureau of Land Management electronically notified the Wyoming State Historic Preservation Officer (SHPO) on 2/8/07 that no historic properties exist within the APE.

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).

### 5. CONSULTATION/COORDINATION

Contact	Title	Organization	Present at Onsite
Ethan Jahnke	Federal Permit Coordinator	LOG (Anadarko)	no
Joy Kennedy	Permitting Specialist	LOG (Anadarko)	yes
Liz Hunter	Civil Engineer	Kadrmass, Lee, & Jackson	yes
Brian Venn	Project Engineer	WWC Engineering	yes
Mary Hopkins	Acting SHPO	Wyoming SHPO	no

## 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.

## 7. REFERENCES AND AUTHORITIES

AHPIS, Animal and Plant Health Inspection Service. 2002. General information available online at <http://www.aphis.usda.gov/lpa/issues/wnv/wnv.html>.

Avian Power Line Interaction Committee. 1996. Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996. Edison Electric Institute. Washington, D.C. 125pp.

Bennett, Robert A. 2004. Instruction Memorandum No. WY-2005-057: Statement of Policy Regarding Sage-Grouse Management Definitions, and Use of Protective Stipulations, and Conditions of Approval. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

Bills, Thomas E. 2004. Powder River Basin Oil & Gas Project Semi-Annual Report: May 1, 2003 – October 31, 2003. BLM Buffalo Field Office. Buffalo, WY. 8pp.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and Gas Development in Western North America: Effects on Sagebrush Steppe Avifauna with Particular Emphasis on Sage Grouse. In: Transactions of the 67<sup>th</sup> North American Wildlife and Natural Resources Conference. pp337-349.

Buffalo Field Office. 2003. Record of Decision and Resource Management Plan Amendments for the Powder River Oil and Gas Project. USDI Bureau of Land Management, Buffalo Field Office. Buffalo, WY.

Buffalo Field Office. 1999. Wyodak Coal Bed Methane Project: Final Environmental Impact Statement. USDI Bureau of Land Management, Buffalo Field Office. Buffalo, WY.

### Code of Federal Regulations (CFR)

1. 40 CFR All Parts and Sections inclusive Protection of Environment Revised as of July 1, 2001.
2. 43 CFR All Parts and Sections inclusive - Public Lands: Interior. Revised as of October 1, 2000.

Cornish, Todd; Terry Creekmore; Walter Cook; and Elizabeth Williams. 2003. "West Nile Virus - Wildlife Mortality in Wyoming 2002-2003". In: The Wildlife Society Wyoming Chapter Program and Abstracts for the Annual Meeting at the Inn in Lander, WY November 18-21, 2003. Wildlife Society Wyoming Chapter. 17pp.

Canfield, J. E., L. J. Lyon, J. M. Hillis, and M. J. Thompson. 1999. Ungulates. Chapter 6 in Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana, coordinated by G. Joslin and H. Youmans. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Cornish, Todd. Personal Communication. Wyoming State Veterinary Laboratory, University of Wyoming. Laramie, WY. (307) 742-6638. [tcornish@uwyo.edu](mailto:tcornish@uwyo.edu).

Danvir, Rick E. 2002. Sage Grouse Ecology and Management in Northern Utah Sagebrush-Steppe: A Deseret Land and Livestock Wildlife Research Report. Deseret Land and Livestock Ranch and the Utah Foundation for Quality Resource Management. Woodruff, UT.

- Grenier, Martin. 2003. An Evaluation of Black-footed Ferret Block Clearances in Wyoming: Completion Report. Wyoming Game and Fish Department. Lander, WY. 16pp
- Geist, V. 1978. Behavior. Big Game of North America; ecology and management. Stackpole Books, Harrisburg, Pennsylvania.
- Grenier, Martin. 2003. An Evaluation of Black-footed Ferret Block Clearances in Wyoming: Completion Report. Wyoming Game and Fish Department. Lander, WY. 16pp
- Holloran, Matthew J.; Brian J. Heath; Alison G. Lyon; Steven J. Slater; Jarren L. Kuppiers; and Stanley H. Anderson. 2005. Greater sage-grouse nesting habitat selection and success in Wyoming. *J. Wildl. Manage.* 69(2):638-649.
- Jellison, Bert. 2005. Sage-Grouse Restoration Project: Lake DeSmet Conservation District. Wyoming Game and Fish Department. Sheridan, WY.
- Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Arc Wildlife Services Ltd., Calgary, Alberta, Canada.
- Kelly Brian T. 2004. Letter to interested parties: Black-footed ferret clearance surveys. U.S. Fish and Wildlife Service (February 2, 2004). Cheyenne, WY. 4pp.
- Litzel, R. 2004. Personal communication [ January 6 phone conversation with Jim Sparks]. Johnson County Weed and Pest District.
- Lowham, H.W. Streamflows in Wyoming WRIR 88-4045 U.S. Geological Survey 1988
- Lustig, Thomas D., March. 2003. Where Would You Like the Holes Drilled into Your Crucial Winter Range? Transactions of the 67<sup>th</sup> North American Wildlife and Natural Resources Conference.
- Meachtle, Tom. June 2006. Quarter Circle Nine POD, Wildlife Survey and Habitat Report. Sheridan, WY. 12 pp.
- Moynahan, Brendan J.; Mark S. Lindberg; Jay J. Rotella; and Jack Ward Thomas. In Press. Factors Affecting Nest Survival of Greater Sage-Grouse in North central Montana. *J. Wildl. Manage.*
- Moynahan, Brendan J. and Mark S. Lindberg. 2004. Nest Locations of Greater Sage-Grouse in Relation to Leks in North-Central Montana. *Presented at Montana Sage-Grouse Workshop*, Montana Chapter of The Wildlife Society, Billings.
- Murkin, James W. 1990. Instruction Memorandum No. WY-90-564: Resource Management Plan Action and Wyoming BLM Standard Mitigation Guidelines for Surface Disturbing Activities. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.
- Marra PP, Griffing SM, McLean RG. West Nile virus and wildlife health. *Emerg Infect Dis* [serial online] 2003 Jul. Available from: URL: <http://www.cdc.gov/ncidod/vol9no7/03-0277.htm>.
- Miller, K.A Peak-Flow Characteristics of Wyoming Streams WRIR 03-4107 U.S. Geological Survey 2003

- Mooney, A. 2004. Personal Communication [January 6 phone conversation with Jim Sparks]. Campbell County Weed and Pest District.
- Naugle, David E.; Cameron L. Aldridge; Brett L. Walker; Todd E. Cornish; Brendan J. Moynahan; Matt J. Holloran; Kimberly Brown; Gregory D. Johnson; Edward T. Schmidtman; Richard T. Mayer; Cecilia Y. Kato; Marc R. Matchett; Thomas J. Christiansen; Walter E. Cook; Terry Creekmore; Roxanne D. Falise; E. Thomas Rinkes; and Mark S. Boyce. 2004. West Nile virus: Pending Crisis of Greater Sage-grouse. *Ecology Letters*. 7:704-713.
- Oakleaf, Bob. January 13, 1988. Letter to BFAT: Preliminary BFF Reintroduction Site Analysis, Meeteetse Management Plan Assignments. Wyoming Game and Fish Department. Lander, WY. 10pp.
- Oedekoven, Olin O. 2004. Sheridan Region Wyoming Game and Fish Department: Annual Sage-Grouse Completion Report for 2004. Wyoming Game and Fish Department. Gillette, WY.
- Patterson, Craig T. and Stanley H. Anderson. 1985. Distributions of Eagles and a Survey for Habitat Characteristics of Communal Roosts of Bald Eagles (*Haliaeetus leucocephalus*) Wintering in Northeastern Wyoming. Wyoming Cooperative Fishery and Wildlife Research Unit. University of Wyoming. Laramie, WY.
- Rinkes, T. 2003. Personal communication [Draft notes from Annual Sage-Grouse and Sagebrush Species of Concern Meeting]. Bureau of Land Management Wildlife Biologist/Sage Grouse Coordinator.
- Rogers, Brad. Personal Communication. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Cheyenne Field Office. Cheyenne, WY.
- Romin, Laura A., and Muck, James A. May 1999. Utah Field Office Guidelines For Raptor Protection From Human And Land Use Disturbances. U.S. Fish and Wildlife Service, Salt Lake City, Utah
- Rowland, M. M., M. Leu, S. P. Finn, S. Hanser, L. H. Suring, J. M. Boyd, C. W. Meinke, S. T. Knick, and M. J. Wisdom. 2005. Assessment of threats to sagebrush habitats and associated species of concern in the Wyoming Basins. Version 1.1, June 2005, unpublished report on file at USGS Biological Resources Discipline, Snake River Field Station, 970 Lusk St., Boise, ID 83706.
- Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. 1999. The Scientific Basis for Lynx Conservation: Qualified Insights. Ch16. USDA Forest Service Technical Report RMRS-GTR-30.
- The National Environmental Policy Act of 1969 (NEPA), as amended (Pub. L. 91-90, 42 U.S.C. 4321 et seq.).
- Thiele, Dan. 2005. Northeast Wyoming Local Working Group Area: Annual Sage-Grouse Completion Report for 2005. Wyoming Game and Fish Department. Buffalo, WY. 42pp.
- U.S. Fish and Wildlife Service (USFWS). 1989. Black-footed ferret Survey Guidelines for Compliance with the Endangered Species Act. Denver, CO and Albuquerque, NM.
- U.S. Fish and Wildlife Service. 2002. Final Biological and Conference Opinion for the Powder River Oil and Gas Project, Campbell, Converse, Johnson, and Sheridan Counties (WY6633). U.S. Fish and Wildlife Service. December 17, 2002. Cheyenne, WY. 58pp.
- U.S. Department of the Interior, Bureau of Land Management and Office of the Solicitor (editors). 2001. The Federal Land Policy and Management Act, as amended. Public Law 94-579.

U.S. Department of the Interior, Bureau of Land Management, Buffalo Field Office, Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office April 2001.

U.S. Department of the Interior, Bureau of Land Management, Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment. April 30, 2003.

Walker B, Naugle D, Rinkes T. 2003. The Response of Sage Grouse to Coal-bed Methane Development and West Nile virus in the Powder River Basin: Is There a Link ? Page 6 in: Program and Abstracts for the Annual Wildlife Society Meeting, Wyoming Chapter.

WDEQ, June 14, 2004. Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments

Wyoming Game and Fish Department (WGFD). 2004. Minimum Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats on BLM Lands. WGFD. Cheyenne, WY

WGFD. 2003. Wyoming Greater Sage-Grouse Conservation Plan. WGFD. Cheyenne, WY

WWC Engineering. June 2006. Water Management Plan for the Quarter Circle Nine POD

## **8. LIST OF INTERDISCIPLINARY TEAM PREPARERS AND REVIEWERS**

Melanie Hunter, Natural Resource Specialist  
Randy Nordsvan, Supervisory Natural Resource Specialist  
Mike McKinley, Hydrologist  
Dane Geyer, Petroleum Engineer  
Becky Wilkerson, Legal Instruments Examiner  
Rob Wilson and G.L. "Buck" Damone III, Archaeologists  
Arlene Kosic, Wildlife Biologist  
Gerald Queen, Geologist  
Buddy Green, Assistant Field Manager, Resources  
Paul Beels, Assistant Field Manager, Minerals & Lands  
Chris E. Hanson, Field Manager

Interdisciplinary Team Lead : Melanie Hunter