**BUREAU OF LAND MANAGEMENT**
**BUFFALO FIELD OFFICE**
**ENVIRONMENTAL ASSESSMENT (EA)**
**FOR**
**ANADARKO PETROLEUM CORPORATION**
**TABLE MOUNTAIN PHASE 4**
**COALBED NATURAL GAS PLAN OF DEVELOPMENT**
**WY 070-EA10-258**

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µmhos/cm | micromhos per centimeter |
| Anadarko | Anadarko Petroleum Corporation |
| AO | Authorized Officer |
| APC | Anadarko Petroleum Corporation |
| APD | Application for a Permit to Drill |
| BACT | Best Available Control Technology |
| BCC | Bird of Conservation Concern |
| BGEPA | Bald and Golden Eagle Protection Act (1940) |
| bgs | below ground surface |
| BHEC | Big Horn Environmental Consultants |
| BLM | Bureau of Land Management |
| BMP | best management practices |
| CBM | Coalbed Natural Gas |
| CBNG | Coalbed Natural Gas |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| COA | Conditions of Approval |
| COGEMA | Cogema Mining, Inc. |
| CRUP | Cultural Resource Use Permitee |
| dB | decibels |
| dBA | decibels on the A-weighted scale |
| EA | Environmental Assessment |
| EC | Electrical Conductivity |
| ESA | Endangered Species Act |
| FEIS | Final Environmental Impact Statement |
| FLPMA | Federal Land Policy and Management Act (1976) |
| FO | Field Office |
| gpm | gallons per minute |
| HWA | Hayden-Wing Associates, LLC |
| ID team | Interdisciplinary team |
| ISL | in-situ leaching |
| ISR | in-situ recovery |
| $L_{dn}$ | average day/night noise level |
| $L_{eq}$ | equivalent sound level |
| MBTA | Migratory Bird Treaty Act (1918) |
| mg/l | milligrams per liter |
| MMRP | Monitoring, Mitigation, and Reporting Plan |
| MOU | Memorandum of Understanding |
| MSUP | Multi-Point Surface Use and Operations Plan |
| NEPA | National Environmental Policy Act (1969) |

| | |
|---|---|
| NOI | Notice of Intent |
| $NO_X$ | nitrogen oxide |
| NPDES | National Pollution Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| NWIS | National Water Information Service |
| PA | Programmatic Agreement |
| POD | Plan of Development |
| PRB | Powder River Basin |
| R | Range |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| SAR | Sodium Adsorption Ratio |
| SGCN | Species of Greatest Conservation Need |
| SSURGO | Soil Survey Geographic Database |
| T | Township |
| TCP | Traditional Cultural Property |
| TDS | Total Dissolved Solids |
| UIC | Underground Injection Control |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| WDEQ | Wyoming Department of Environmental Quality |
| WGFD | Wyoming Game and Fish Department |
| WMP | Water Management Plan |
| WOGCC | Wyoming Oil and Gas Conservation Commission |
| WSEO | Wyoming State Engineer's Office |
| WSGS | Wyoming State Geological Survey |
| WYPDES | Wyoming Pollutant Discharge Elimination System |

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**DECISION RECORD**
**FOR**
**ANADARKO PETROLEUM CORPORATION**
**TABLE MOUNTAIN PHASE 4**
**ENVIRONMENTAL ASSESSMENT – WY-070-EA10-258**

## DECISION

BLM's decision is to approve Anadarko Petroleum Corporation's (Anadarko or APC) Table Mountain Phase 4 Coal Bed Natural Gas (CBNG) POD Alternative C of the attached Environmental Assessment (EA). Alternative C is the Modified Proposed Action and is the result of collaboration between the Bureau of Land Management and APC. Alternative C has been analyzed in the attached EA and found to have no significant impacts on the human environment beyond those described in the *Powder River Basin Oil and Gas Project Final Environmental Impact Statement and Resource Management Plan Amendment* (PRB FEIS); thus, an EIS is not required.

Details of the approval are summarized below. The project description, including specific changes made at the onsite field reviews, and site-specific mitigation measures, is included in the attached EA, Section 2 and Appendix B.

### Well Sites

The following 52 Applications for Permit to Drill (APDs) and associated infrastructure are authorized:

**Approved Wells – Alternative C**

| No. | Well Name | Well No. | Qtr/Qtr | Section | Township | Range | Federal Lease No. |
|---|---|---|---|---|---|---|---|
| 1 | TM-CBM Fed | 4476 5-14 | SW¼/SW¼ | 05 | 44N | 76W | WYW-128456 |
| 2 | TM-CBM Fed | 4476 5-23 | NE¼/SW¼ | 05 | 44N | 76W | WYW-128456 |
| 3 | TM-CBM Fed | 4476 5-34 | SW¼/SE¼ | 05 | 44N | 76W | WYW-128456 |
| 4 | TM-CBM Fed | 4476 5-43 | NE¼/SE¼ | 05 | 44N | 76W | WYW-128456 |
| 5 | TM-CBM Fed | 4476 6-14 | SW¼/SW¼ | 06 | 44N | 76W | WYW-112963 |
| 6 | TM-CBM Fed | 4476 6-32 | SW¼/NE¼ | 06 | 44N | 76W | WYW-128456 |
| 7 | TM-CBM Fed | 4476 6-43 | NE¼/SE¼ | 06 | 44N | 76W | WYW-128456 |
| 8 | TM-CBM Fed | 4476 7-12 | SW¼/NW¼ | 07 | 44N | 76W | WYW-41486 |
| 9 | TM-CBM Fed | 4476 7-23 | NE¼/SW¼ | 07 | 44N | 76W | WYW-41478 |
| 10 | TM-CBM Fed | 4476 7-34 | SW¼/SE¼ | 07 | 44N | 76W | WYW-112963 |
| 11 | TM-CBM Fed | 4476 8-12 | SW¼/NW¼ | 08 | 44N | 76W | WYW-128456 |
| 12 | TM-CBM Fed | 4476 8-21 | NE¼/NW¼ | 08 | 44N | 76W | WYW-128456 |
| 13 | TM-CBM Fed | 4476 8-23 | NE¼/SW¼ | 08 | 44N | 76W | WYW-128456 |
| 14 | TM-CBM Fed | 4476 8-32 | SW¼/NE¼ | 08 | 44N | 76W | WYW-128456 |
| 15 | TM-CBM Fed | 4476 8-41 | NE¼/NE¼ | 08 | 44N | 76W | WYW-128456 |
| 16 | TM-CBM Fed | 4476 18-32 | SW¼/NE¼ | 18 | 44N | 76W | WYW-128461 |
| 17 | TM-CBM Fed | 4477 1-14 | SW¼/SW¼ | 01 | 44N | 77W | WYW-603 |
| 18 | TM-CBM Fed | 4477 1-21 | NE¼/NW¼ | 01 | 44N | 77W | WYW-0311396A |
| 19 | TM-CBM Fed | 4477 1-23 | NE¼/SW¼ | 01 | 44N | 77W | WYW-603 |
| 20 | TM-CBM Fed | 4477 1-41 | NE¼/NE¼ | 01 | 44N | 77W | WYW-0311396A |
| 21 | TM-CBM Fed | 4477 2-21 | NE¼/NW¼ | 02 | 44N | 77W | WYW-0311396A |
| 22 | TM-CBM Fed | 4477 2-41 | NE¼/NE¼ | 02 | 44N | 77W | WYW-0311396A |
| 23 | TM-CBM Fed | 4477 3-41 | NE¼/NE¼ | 03 | 44N | 77W | WYW-0311396A |
| 24 | TM-CBM Fed | 4477 10-12 | SW¼/NW¼ | 10 | 44N | 77W | WYW-128462 |
| 25 | TM-CBM Fed | 4477 10-14 | SW¼/SW¼ | 10 | 44N | 77W | WYW-128462 |
| 26 | TM-CBM Fed | 4477 10-21 | NE¼/NW¼ | 10 | 44N | 77W | WYW-128462 |
| 27 | TM-CBM Fed | 4477 10-23 | NE¼/SW¼ | 10 | 44N | 77W | WYW-128462 |

| No. | Well Name | Well No. | Qtr/Qtr | Section | Township | Range | Federal Lease No. |
|---|---|---|---|---|---|---|---|
| 28 | TM-CBM Fed | 4477 10-32 | SW¼/NE¼ | 10 | 44N | 77W | WYW-128462 |
| 29 | TM-CBM Fed | 4477 10-34 | SW¼/SE¼ | 10 | 44N | 77W | WYW-128462 |
| 30 | TM-CBM Fed | 4477 10-41 | NE¼/NE¼ | 10 | 44N | 77W | WYW-128462 |
| 31 | TM-CBM Fed | 4477 10-43 | NE¼/SE¼ | 10 | 44N | 77W | WYW-128462 |
| 32 | TM-CBM Fed | 4477 11-14 | SW¼/SW¼ | 11 | 44N | 77W | WYW-128462 |
| 33 | TM-CBM Fed | 4477 11-22 | SE¼/NW¼ | 11 | 44N | 77W | WYW-603 |
| 34 | TM-CBM Fed | 4477 11-23 | NE¼/SW¼ | 11 | 44N | 77W | WYW-128462 |
| 35 | TM-CBM Fed | 4477 11-32 | SW¼/NE¼ | 11 | 44N | 77W | WYW-64500 |
| 36 | TM-CBM Fed | 4477 11-34 | SW¼/SE¼ | 11 | 44N | 77W | WYW-603 |
| 37 | TM-CBM Fed | 4477 11-41 | NE¼/NE¼ | 11 | 44N | 77W | WYW-128630 |
| 38 | TM-CBM Fed | 4477 12-14 | SW¼/SW¼ | 12 | 44N | 77W | WYW-64500 |
| 39 | TM-CBM Fed | 4477 12-23 | NE¼/SW¼ | 12 | 44N | 77W | WYW-64500 |
| 40 | TM-CBM Fed | 4477 12-34 | SW¼/SE¼ | 12 | 44N | 77W | WYW-35222 |
| 41 | TM-CBM Fed | 4477 12-43 | NE¼/SE¼ | 12 | 44N | 77W | WYW-35222 |
| 42 | TM-CBM Fed | 4477 13-12 | SW¼/NW¼ | 13 | 44N | 77W | WYW-64500 |
| 43 | TM-CBM Fed | 4477 14-41 | NE¼/NE¼ | 14 | 44N | 77W | WYW-140155 |
| 44 | TM-CBM Fed | 4477 15-32 | SW¼/NE¼ | 15 | 44N | 77W | WYW-140155 |
| 45 | TM-CBM Fed | 4576 34-12 | SW¼/NW¼ | 34 | 45N | 76W | WYW-112371 |
| 46 | TM-CBM Fed | 4576 34-14 | SW¼/SW¼ | 34 | 45N | 76W | WYW-144537 |
| 47 | TM-CBM Fed | 4576 34-21 | NE¼/NW¼ | 34 | 45N | 76W | WYW-112371 |
| 48 | TM-CBM Fed | 4576 34-23 | NE¼/SW¼ | 34 | 45N | 76W | WYW-144537 |
| 49 | TM-CBM Fed | 4576 34-32 | SW¼/NE¼ | 34 | 45N | 76W | WYW-112371 |
| 50 | TM-CBM Fed | 4576 34-34 | SW¼/SE¼ | 34 | 45N | 76W | WYW-144537 |
| 51 | TM-CBM Fed | 4576 34-41 | NE¼/NE¼ | 34 | 45N | 76W | WYW-112371 |
| 52 | TM-CBM Fed | 4576 34-43 | NE¼/SE¼ | 34 | 45N | 76W | WYW-144537 |

**Water Management**

The following water management proposal is approved for use in association with this POD:
Disposal of water via pipeline and pump station for eventual reinjection into the Madison Formation near Midwest in Natrona County, Wyoming. No water impoundments are proposed for use in association with this POD.

**Rights-of-Way**

The following rights-of-way are authorized with the approval of this POD:

| | Serial Number | Project Component Description | Length (miles) | Width (feet) | Section | Township | Range |
|---|---|---|---|---|---|---|---|
| 1 | WYW-170047 | Template access road | 3.203 | 50 | 10<br>11<br>14<br>15<br>23<br>34 | T44N<br><br><br><br><br>T45N | R77W<br><br><br><br><br>R77W |
| | | Water pipeline | 1.925 | 20 | | | |
| | | Buried power line | 1.925 | 15 | | | |
| 2 | WYW-170048 | Natural gas pipeline | 1.925 | 35 | 10<br>11<br>14<br>15<br>34 | T44N<br><br><br><br>T45N | R77W<br><br><br><br>R77W |

**Denials**
The following 2 APDs and associated infrastructure are denied:

**Wells Recommended for Removal – Alternative C**

| | Well Name | Well No. | Environmental Issue/Justification |
|---|---|---|---|
| 1 | TM-CBM Fed | 4477 13-21 | Well within 0.25 mile radius of confirmed raptor nest in line-of-sight. No alternative location apparent to mitigate effects. |
| 2 | TM-CBM Fed | 4476 8-43 | Well within 0.25 mile radius of confirmed raptor nest in line-of-sight. Alternative location possible to mitigate effects, but not viable to Anadarko due to spacing restrictions. |

**Deferrals**
No APDs and associated infrastructure are deferred.
Wellhead compression is not authorized.

**Operator Committed Measures**
The operator has incorporated several measures to alleviate resource impacts including design features, construction practices, and water management strategies described in the Master Multi-Point Surface Use and Operations Plan (MSUP), POD maps, Master Drilling Prognosis (Drilling Plan), Integrated Weed and Pest Management Plan, Wildlife Mitigation Tab, and Water Management Plan and individual APDs. Refer to these documents submitted to the BLM between the dates of October 24, 2008, and August 18, 2010, for complete details.

**Site-specific Mitigation Measures**
Site-specific Conditions of Approval (COAs) have been applied to this project, in addition to the programmatic mitigation measures, and standard COAs identified in the PRB FEIS, to mitigate the site-specific impacts described in the Environmental Consequences section of the attached EA. For a complete description of all site-specific COAs associated with this approval, refer to Appendix B in the attached EA.

**COMPLIANCE WITH LAWS, REGULATIONS, LAND USE PLANS, AND POLICIES**
This approval is in compliance with all Federal laws, regulations, and policies. This includes, but is not limited to, the Federal Land Policy and Management Act, the National Historic Preservation Act, the Threatened and Endangered Species Act, the Migratory Bird Treaty Act, the Clean Water Act, the Clean Air Act, and the National Environmental Policy Act.

Approval of this alternative is in conformance with the *Powder River Basin Oil and Gas Project Final Environmental Impact Statement and Proposed Plan Amendment* (PRB FEIS), *Record of Decision and Resource Management Plan Amendments for the Powder River Basin Oil and Gas Project* (PRB FEIS ROD), and the Approved Resource Management Plan (RMP) for the Public Lands Administered by the Bureau of Land Management, Buffalo Field Office (BFO) (1985, 2001).

This approval is subject to adherence with all of the operating plans, design features, and mitigation measures contained in the MSUP, Drilling Plan, Water Management Plan, information in individual APDs, and other supporting documents. This approval also is subject to operator compliance with all mitigation and monitoring requirements contained within the PRB FEIS approved April 30, 2003.

**RATIONALE**
The decision to authorize the selected alternative, as summarized above, is based on the following:

1. Mitigation measures were included to reduce environmental impacts below the level of significance (FONSI) while still meeting the project's purpose and need. Mitigation is discussed in the environmental consequences section (4.3) of the attached EA. For a complete description of all site-specific COAs associated with this approval, see Appendix B in the attached EA.

2. The selected alternative will not result in any undue or unnecessary environmental degradation as discussed in the attached EA (sections 4.2 and 4.3).

3. The selected alternative will help meet the nation's energy needs, and help stimulate local economies by maintaining workforce stability.

4. The Operator, in their POD, has committed to:
   - Comply with all applicable Federal, State, and Local laws and regulations (MSUP page 30).
   - 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 (MSUP page 30).
   - Offer water well agreements to the owners of record for permitted water wells within 0.5 mile of a federal CBNG producing well in the POD (MSUP page 29).
   - Provide water analysis from a designated reference well in each coal zone (Water Management Plan, pages 12-13).

5. The Operator has certified that a Surface Use Agreement has been reached with the Landowners (MSUP page 30).

6. The selected alternative incorporates components of the Wyoming Governor's Sage Grouse Implementation Team's "core population area" strategy, the Governor's executive order, and local research to provide mitigation for sage-grouse, while meeting the purpose and need for the Table Mountain Phase 4 CBNG Project.

**ADMINISTRATIVE REVIEW AND APPEAL:** Under BLM regulations, this decision is subject to administrative review in accordance with 43 Code of Federal Regulations (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: 9/30/10

**FINDING OF NO SIGNIFICANT IMPACT**
**FOR**
**ANADARKO PETROLEUM CORPORATION**
**TABLE MOUNTAIN PHASE 4**
**ENVIRONMENTAL ASSESSMENT – WY-070-EA10-258**

**FINDING OF NO SIGNIFICANT IMPACT:**
On the basis of the information contained in the EA, and all other information available to me, it is my determination that: 1) the implementation of Alternative C will not have significant environmental impacts beyond those already addressed in PRB FEIS to which the EA is tiered; 2) Alternative C is in conformance with the Buffalo Field Office Resource Management Plan (1985, 2001); and 3) Alternative C does not constitute a major federal action having a significant effect on the human environment. Therefore, an environmental impact statement or a supplement to the existing environmental impact statement is not necessary and will not be prepared.

This finding is based on my consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), both with regard to the context and to the intensity of the impacts described in the EA.

**CONTEXT:**
Mineral development (e.g., coal, oil and gas, bentonite, uranium, sand, gravel, scoria, building stone) is a long-standing and common land use within the Powder River Basin. More than one fourth of the nation's coal production comes from the Powder River Basin. The PRB FEIS reasonably foreseeable development predicted and analyzed the development of 51,000 CBNG wells and 3,200 oil wells (PRB FEIS ROD page 2). The additional CBNG development described in Alternative C is insignificant within the national, regional, and local context.

**INTENSITY:**
The implementation of Alternative C will result in beneficial effects in the forms of energy and revenue production; however, there also will be adverse effects to the environment (EA, section 4). Design features and mitigation measures have been included within Alternative C to prevent significant adverse environmental effects (EA, Appendix B).

The preferred alternative does not pose a significant risk to public health and safety. The geographic area of the POD does not contain unique characteristics identified within the 1985 RMP, 2001 RMP update, 2003 PRB FEIS, or other legislative or regulatory processes.

Relevant scientific literature and professional expertise were used in preparing the EA. The scientific community is reasonably consistent with their conclusions on environmental effects relative to oil and gas development. Research findings on the nature of the environmental effects are not highly controversial, highly uncertain, or involve unique or unknown risks.

CBNG development of the nature proposed with this POD and similar PODs was predicted and analyzed in the PRB FEIS; the selected alternative does not establish a precedent for future actions with significant effects.

There are no cultural or historical resources present that will be adversely affected by the selected alternative (EA , section 4.3.6). No species listed under the Endangered Species Act or their designated critical habitat will be adversely affected (EA, section 4.3.3). The selected alternative will not have any anticipated effects that would threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment

Field Office Manager: _____ Date: 9/30/10

**BUREAU OF LAND MANAGEMENT**
**BUFFALO FIELD OFFICE**
**ENVIRONMENTAL ASSESSMENT**
**FOR**
**ANADARKO PETROLEUM CORPORATION**
**TABLE MOUNTAIN PHASE 4**
**COALBED NATURAL GAS PLAN OF DEVELOPMENT**
**WY-070-EA10-258**

# 1. 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 Final Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS), #WY-070-02-065 (approved April 30, 2003), pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21 (Bureau of Land Management [BLM] 2003). This document is available for review at the BLM Buffalo, Wyoming, Field Office (FO). This project environmental assessment (EA) addresses site-specific resources and impacts that were not disclosed within the PRB FEIS.

## 1.1. Background

Anadarko Petroleum Corporation (Anadarko or APC) submitted the Table Mountain Phase 4 Coalbed Natural Gas (CBNG or CBM) Plan of Development (POD) on October 24, 2008, to the Buffalo FO with 52 Federal Applications for a Permit to Drill (APDs) to develop and produce natural gas resources within coal-bearing formations of the Powder River Basin area (PRB). One additional Federal APD was submitted by APC on March 12, 2010, and a second additional Federal APD was submitted by APC on May 14, 2010, bringing the total to 54 Federal APDs.

Onsite field visits were conducted in 2010 on April 27, April 29, May 3, May 4, May 18, and May 19, to evaluate and modify the proposal as necessary to alleviate environmental impacts. BLM sent a post-onsite deficiency letter to APC on June 8, 2010. The project proposal and APDs were considered complete when BLM received the operator's response to the post-onsite deficiencies on July 19, 2010, along with supplemental clarifying filings received August 4 and 5, 2010, and revised project component information received August 18, 2010. Proposed Conditions of Approval (COAs) were shared with the operator on May 28, 2010, during the post-onsite notes review meeting.

## 1.2. Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to explore, develop, and produce oil and gas reserves conducted under the rights granted by a Federal oil and gas lease, as required in 43 CFR Part 3160, all Onshore Orders, and the Mineral Leasing Act, as amended and supplemented in 30 United States Code (USC) 181 et seq.

The need for the action is the requirement to obtain approval for the development of an Oil and Gas Lease through an APD on public lands managed by the BLM under Onshore Order Number 1, pursuant to the authority of the Mineral Leasing Act, as amended and supplemented (30 USC 181 et seq.), and as prescribed in 43 CFR Part 3160.

## 1.3. Decision to be Made

BLM will decide whether to approve the proposed development of oil and gas resources on the Federal leasehold, and if so, under what terms and conditions.

### 1.4. Conformance with Land Use Plan and Other Applicable Laws, Regulations, and Policies

The Proposed Action conforms to the terms and the conditions of the 1985 Buffalo Resource Management Plan (RMP) (BLM 1985), the 2001 Buffalo RMP update (BLM 2001), and the PRB FEIS (including RMP Amendment). The Proposed Action is in compliance with all Federal laws, regulations, and policies. This includes, but is not limited to, the following Acts as amended: Federal Land Policy and Management Act (FLPMA) (1976), Mineral Leasing Act (1920), National Historic Preservation Act (1966), Endangered Species Act (ESA) (1973), Migratory Bird Treaty Act (MBTA) (1918), Bald and Golden Eagle Protection Act (BGEPA) (1940), Clean Water Act (1972), Clean Air Act (1970), and National Environmental Policy Act (NEPA) (1969).

An existing main access road and utility corridor in Sections 33 and 34, Township 45 North (T45N), Range 76 West (R76W) are analyzed in this Table Mountain Phase 4 CBNG POD. The forthcoming Table Mountain Phase 2 CBNG POD EA also analyzes facilities in these Sections; therefore, careful delineation of the respective project components was completed to avoid duplication of disturbance acres.

### 1.5. Scoping and Issues

External scoping was not conducted for this EA. Extensive external scoping was conducted for the PRB FEIS and is discussed beginning on page 15 of the PRB FEIS Record of Decision (ROD) and beginning on page 2-1 of the PRB FEIS. This action is similar in scope to numerous other CBNG PODs that Buffalo FO has analyzed; external scoping would be unlikely to identify new issues, as was verified by the few POD EAs that were externally scoped including the Clabaugh POD (WY-070-EA08-134) and Hollcroft/Stotts Draw POD (WY-070-EA07-021).

The BLM interdisciplinary team (ID team) conducted internal scoping by reviewing the proposed development and project location to identify potentially affected resource and land uses. **Appendix A** identifies those resources and land uses present and affected by the Proposed Action; those resources and land uses that are either not present, not affected, or were adequately covered by the PRB FEIS are not discussed in this EA. Based on these criteria, the ID team identified important issues for the affected resources to further focus the analysis. This EA addresses site-specific impacts not disclosed within the PRB FEIS to help make a reasoned decision (i.e., whether or not to approve the proposed development) and to identify any potentially significant effects of the proposed development. Issues for this project include:

- Geology and Land Use: locatable and leasable minerals, including potential conflicts with uranium mining;
- Soils and Vegetation: erosion hazard, slope hazards, reclamation potential, riparian and wetland communities, and weed species;
- Wildlife: potential impacts to Federally listed species including blowout penstemon and Ute ladies'-tresses orchid, potential impacts to Federally proposed and candidate species including mountain plover and greater sage-grouse lek occupancy and persistency, potential impacts to BLM sensitive species, migratory bird conservation, and raptor productivity;
- Water: quality and quantity of produced water;
- Social and Economic: revenue potential; and
- Cultural Resources: Native American religious concerns and Traditional Cultural Properties.

## 2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

Three alternatives, A, B, and C, were evaluated. A brief description of each alternative is included in the following sections. Programmatic Mitigation Measures, as determined in PRB FEIS ROD apply to all alternatives, including the No Action Alternative (Alternative A), and are included in Appendix B. Operator committed measures, Standard COAs, and Site-Specific COAs would apply only to action alternatives (Alternatives B and C) and also are included in Appendix B.

### 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 - Operator Proposed Action

Alternative B contains complete APDs and is based on the operator and BLM working to reduce environmental impacts. This alternative summarizes the POD as it was submitted to the BLM by Anadarko on July 19, 2010, after site visits, along with supplemental clarifying filings received August 4 and 5, 2010, and on August 18, 2010.

Proposed Action Title/Type: Anadarko's Table Mountain Phase 4 CBNG POD

Proposed Well Information: There are 54 wells proposed within this POD; the wells would be vertical bores proposed on an 80-acre spacing pattern with 1 well per location. Each well would produce from one coal seam. Proposed dimensions of a single well and associated facilities located on a skid is approximately 8 feet wide, 8 feet long, and 8 feet high. Twenty-seven wells are proposed to utilize wellhead compression, which would not appreciably increase the well site footprint. Well house color is Covert Green, selected to blend with the surrounding vegetation. A list of proposed wells is included in Table 2.1.

**Table 2.1 Proposed Wells – Alternative B**

| No. | Well Name | Well No. | Qtr/Qtr | Section | Township | Range | Federal Lease No. |
|---|---|---|---|---|---|---|---|
| 1 | TM-CBM Fed | 4476 5-14 | SW¼/SW¼ | 05 | 44N | 76W | WYW-128456 |
| 2 | TM-CBM Fed | 4476 5-23 | NE¼/SW¼ | 05 | 44N | 76W | WYW-128456 |
| 3 | TM-CBM Fed | 4476 5-34 | SW¼/SE¼ | 05 | 44N | 76W | WYW-128456 |
| 4 | TM-CBM Fed | 4476 5-43 | NE¼/SE¼ | 05 | 44N | 76W | WYW-128456 |
| 5 | TM-CBM Fed | 4476 6-14 | SW¼/SW¼ | 06 | 44N | 76W | WYW-112963 |
| 6 | TM-CBM Fed | 4476 6-32 | SW¼/NE¼ | 06 | 44N | 76W | WYW-128456 |
| 7 | TM-CBM Fed | 4476 6-43 | NE¼/SE¼ | 06 | 44N | 76W | WYW-128456 |
| 8 | TM-CBM Fed | 4476 7-12 | SW¼/NW¼ | 07 | 44N | 76W | WYW-41486 |
| 9 | TM-CBM Fed | 4476 7-23 | NE¼/SW¼ | 07 | 44N | 76W | WYW-41478 |
| 10 | TM-CBM Fed | 4476 7-34 | SW¼/SE¼ | 07 | 44N | 76W | WYW-112963 |
| 11 | TM-CBM Fed | 4476 8-12 | SW¼/NW¼ | 08 | 44N | 76W | WYW-128456 |
| 12 | TM-CBM Fed | 4476 8-21 | NE¼/NW¼ | 08 | 44N | 76W | WYW-128456 |
| 13 | TM-CBM Fed | 4476 8-23 | NE¼/SW¼ | 08 | 44N | 76W | WYW-128456 |
| 14 | TM-CBM Fed | 4476 8-32 | SW¼/NE¼ | 08 | 44N | 76W | WYW-128456 |
| 15 | TM-CBM Fed | 4476 8-41 | NE¼/NE¼ | 08 | 44N | 76W | WYW-128456 |
| 16 | TM-CBM Fed | 4476 8-43 | NE¼/SE¼ | 08 | 44N | 76W | WYW-128456 |
| 17 | TM-CBM Fed | 4476 18-32 | SW¼/NE¼ | 18 | 44N | 76W | WYW-128461 |
| 18 | TM-CBM Fed | 4477 1-14 | SW¼/SW¼ | 01 | 44N | 77W | WYW-603 |

**Table 2.1 Proposed Wells – Alternative B**

| No. | Well Name | Well No. | Qtr/Qtr | Section | Township | Range | Federal Lease No. |
|---|---|---|---|---|---|---|---|
| 19 | TM-CBM Fed | 4477 1-21 | NE¼/NW¼ | 01 | 44N | 77W | WYW-0311396A |
| 20 | TM-CBM Fed | 4477 1-23 | NE¼/SW¼ | 01 | 44N | 77W | WYW-603 |
| 21 | TM-CBM Fed | 4477 1-41 | NE¼/NE¼ | 01 | 44N | 77W | WYW-0311396A |
| 22 | TM-CBM Fed | 4477 2-21 | NE¼/NW¼ | 02 | 44N | 77W | WYW-0311396A |
| 23 | TM-CBM Fed | 4477 2-41 | NE¼/NE¼ | 02 | 44N | 77W | WYW-0311396A |
| 24 | TM-CBM Fed | 4477 3-41 | NE¼/NE¼ | 03 | 44N | 77W | WYW-0311396A |
| 25 | TM-CBM Fed | 4477 10-12 | SW¼/NW¼ | 10 | 44N | 77W | WYW-128462 |
| 26 | TM-CBM Fed | 4477 10-14 | SW¼/SW¼ | 10 | 44N | 77W | WYW-128462 |
| 27 | TM-CBM Fed | 4477 10-21 | NE¼/NW¼ | 10 | 44N | 77W | WYW-128462 |
| 28 | TM-CBM Fed | 4477 10-23 | NE¼/SW¼ | 10 | 44N | 77W | WYW-128462 |
| 29 | TM-CBM Fed | 4477 10-32 | SW¼/NE¼ | 10 | 44N | 77W | WYW-128462 |
| 30 | TM-CBM Fed | 4477 10-34 | SW¼/SE¼ | 10 | 44N | 77W | WYW-128462 |
| 31 | TM-CBM Fed | 4477 10-41 | NE¼/NE¼ | 10 | 44N | 77W | WYW-128462 |
| 32 | TM-CBM Fed | 4477 10-43 | NE¼/SE¼ | 10 | 44N | 77W | WYW-128462 |
| 33 | TM-CBM Fed | 4477 11-14 | SW¼/SW¼ | 11 | 44N | 77W | WYW-128462 |
| 34 | TM-CBM Fed | 4477 11-22 | SE¼/NW¼ | 11 | 44N | 77W | WYW-603 |
| 35 | TM-CBM Fed | 4477 11-23 | NE¼/SW¼ | 11 | 44N | 77W | WYW-128462 |
| 36 | TM-CBM Fed | 4477 11-32 | SW¼/NE¼ | 11 | 44N | 77W | WYW-64500 |
| 37 | TM-CBM Fed | 4477 11-34 | SW¼/SE¼ | 11 | 44N | 77W | WYW-603 |
| 38 | TM-CBM Fed | 4477 11-41 | NE¼/NE¼ | 11 | 44N | 77W | WYW-128630 |
| 39 | TM-CBM Fed | 4477 12-14 | SW¼/SW¼ | 12 | 44N | 77W | WYW-64500 |
| 40 | TM-CBM Fed | 4477 12-23 | NE¼/SW¼ | 12 | 44N | 77W | WYW-64500 |
| 41 | TM-CBM Fed | 4477 12-34 | SW¼/SE¼ | 12 | 44N | 77W | WYW-35222 |
| 42 | TM-CBM Fed | 4477 12-43 | NE¼/SE¼ | 12 | 44N | 77W | WYW-35222 |
| 43 | TM-CBM Fed | 4477 13-12 | SW¼/NW¼ | 13 | 44N | 77W | WYW-64500 |
| 44 | TM-CBM Fed | 4477 13-21 | NE¼/NW¼ | 13 | 44N | 77W | WYW-64500 |
| 45 | TM-CBM Fed | 4477 14-41 | NE¼/NE¼ | 14 | 44N | 77W | WYW-140155 |
| 46 | TM-CBM Fed | 4477 15-32 | SW¼/NE¼ | 15 | 44N | 77W | WYW-140155 |
| 47 | TM-CBM Fed | 4576 34-12 | SW¼/NW¼ | 34 | 45N | 76W | WYW-112371 |
| 48 | TM-CBM Fed | 4576 34-14 | SW¼/SW¼ | 34 | 45N | 76W | WYW-144537 |
| 49 | TM-CBM Fed | 4576 34-21 | NE¼/NW¼ | 34 | 45N | 76W | WYW-112371 |
| 50 | TM-CBM Fed | 4576 34-23 | NE¼/SW¼ | 34 | 45N | 76W | WYW-144537 |
| 51 | TM-CBM Fed | 4576 34-32 | SW¼/NE¼ | 34 | 45N | 76W | WYW-112371 |
| 52 | TM-CBM Fed | 4576 34-34 | SW¼/SE¼ | 34 | 45N | 76W | WYW-144537 |
| 53 | TM-CBM Fed | 4576 34-41 | NE¼/NE¼ | 34 | 45N | 76W | WYW-112371 |
| 54 | TM-CBM Fed | 4576 34-43 | NE¼/SE¼ | 34 | 45N | 76W | WYW-144537 |

Water Management Proposal: There are no water impoundments proposed for use in association with this POD. The water management plan for this POD describes disposal of water via pipeline and existing pump station for eventual reinjection into the Madison Formation near Midwest in Natrona County, Wyoming.

Counties: Campbell and Johnson

Operator: Anadarko Petroleum Company

Surface Owners: John Christensen; Edwin J. Streeter et al.; and United States (U.S.) Department of the Interior, BLM

Drilling and Construction:

- Drilling of 54 wells in the Big George coal zone to depths of approximately 1,910 feet. Co-located wells are not proposed; co-mingling production is not applicable to this POD.
- Drilling and construction activities are anticipated to be completed within 2 years, the term of an APD. Drilling and construction occurs year-round in the PRB. Weather may cause delays lasting several days but rarely do delays last multiple weeks. Timing limitations in the form of COAs and/or agreements with surface owners impose longer temporal restrictions on portions of this POD, but rarely do these restrictions affect an entire POD.
- Well metering shall be accomplished by individual well telemetry. No central metering facility is proposed. Visits would be as needed depending on feedback from data collection. APC anticipates a minimum of three visits per well per month.
- A Water Management Plan (WMP) that involves the following strategy: Water disposal via pipeline and existing pump station to the Madison Formation for reinjection in Natrona County as authorized by Wyoming Department of Environmental Quality Underground Injection Control permit 05-231. No other water disposal infrastructure is planned.
- A road network consisting of existing and proposed improved (i.e., template or engineered) roads and primitive roads, including use of appropriately sized culverts.
- An aboveground power line network is in place that would supply power to the wells via transformers and underground power installation in proposed or existing roads/utility corridors. Power would be available to the wells before CBNG wells are producing, negating the need for temporary diesel generators.
- Utility corridors including buried gas, water, and power line networks; a majority of the utility corridors are within or immediately adjacent to roadways.

For a detailed description of design features, construction practices, and water management strategies associated with the Proposed Action, refer to Anadarko's Master Multi-Point Surface Use and Operations Plan (MSUP), Master Drilling Prognosis (Drilling Plan), Integrated Weed and Pest Management Plan, site-specific reclamation plans, and WMP in the POD and individual APDs. Also refer to the subject POD for maps showing the proposed well locations and associated facilities described above (APC 2010). More information on CBNG well drilling, production, and standard practices also is available in the PRB FEIS, Volume 1, pages 2-9 through 2-40.

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

Right-of-Way Grants: Additionally, the operator has requested two right-of-way grants. This includes WYW-170047, granted under the FLPMA of 1976, for a template access road, water pipeline, and buried power line for the Table Mountain 4 POD on public lands described as follows:

6th PM, Johnson County, Wyoming
T44N, R77W
Section 10: lot 7
Section 11: lots 12, 13
Section 14: lots 4, 5, 12, 13
Section 15: lot 2
Section 23: lot 10

T45N, R77W,
Section 34: lots 11 and 14

The right-of-way area granted herein would contain:

- Template road – 50 feet wide, 3.203 miles long, and contains 19.414 acres, more or less;
- Water pipeline – 20 feet wide, 1.925 miles long, and contains 4.666 acres, more or less; and
- Buried power line – 15 feet wide, 1.925 miles long, and contains 3.500 acres, more or less.

The total right-of-way area would contain 27.58 acres, more or less. The maximum combined surface disturbance width of the template road, water pipeline, and buried power line under this right-of-way and the gas pipeline under WYW-170048 (described below) will not exceed 50 feet as a road/utility corridor.

The second requested right-of-way, WYW-170048, would be granted under the Mineral Leasing Act of 1920, for a gas pipeline for the Table Mountain 4 POD on public lands described as follows:

6th PM, Johnson County, Wyoming
T44N, R77W
Section 10: lot 7
Section 11: lots 12, 13
Section 14: lots 4, 5
Section 15: lot 2
T45N, R77W
Section 34: lots 11 and 14

The right-of-way area granted herein would be 35 feet wide, 1.925 miles long, and contain 8.166 acres, more or less. The maximum combined surface disturbance width of the gas pipeline under this right-of-way and the template road, water pipeline, and buried power line under WYW-170047 will not exceed 50 feet as a road/utility corridor.

### 2.3. Alternative C – Modified Action

Alternative C represents a modification of Alternative B based on BLM changing design features and developing mitigation measures that the operator chose not to include in their project proposal. The purpose of these changes is to further reduce environmental effects. The description of Alternative C is the same as Alternative B, with the addition of the following project modifications.

BLM recommended the following two APDs and/or associated infrastructure shown in Table 2.2 be removed from the project; therefore, they are not considered within this alternative.

**Table 2.2 Project Components Recommended for Removal – Alternative C**

| | Well Name | Well No. | Environmental Issue/Justification |
|---|---|---|---|
| 1 | TM-CBM Fed | 4477 13-21 | Well location is within 0.25 mile radius of a confirmed raptor nest and in line-of-sight. No alternative location is apparent to mitigate effects. |
| 2 | TM-CBM Fed | 4476 8-43 | Well location is within 0.25 mile radius of a confirmed raptor nest and in line-of-sight. An alternative location is possible to mitigate effects, but is not viable to Anadarko due to spacing restrictions. |

Anadarko and BLM discussed these wells in detail at the onsite meetings and follow-up meetings. It was determined by both parties that an alternative location for Well No. 4476 8-43 could not be found that would mitigate impacts to nesting raptors without infringing on the spacing requirement and placement of the other well(s) within that section.

### 2.4. Alternatives Considered but Not Analyzed in Detail

The original POD for the Table Mountain Phase 4 CBNG POD was submitted by Anadarko on October 24, 2008, with 52 Federal APDs. This original POD submittal is not analyzed in detail in this EA. One additional Federal APD was submitted by APC on March 12, 2010, and a second additional Federal APD was submitted by APC on May 14, 2010, bringing the total to 54 Federal APDs. A series of discussions and onsite visits occurred between BLM and Anadarko based on the initial project POD between April and August 2010. As a result of these discussions, the following adjustments were made to the initially proposed project:

- 14 wells were relocated to:
  - Reduce overall and/or sensitive resource surface disturbance (e.g., well site moved closer to existing road, well site moved to area of former disturbance, wells site moved out of dense sagebrush);
  - Increase operational reliability (i.e., buffer the well site from existing headcuts);
  - Reduce impacts to nesting raptors (i.e., move the well site out of the line-of-site of nests); and
  - Increase safety and reliability (e.g., move the well site away from existing underground and overhead utilities).
- The number of well sites that would require a pad was reduced from 33 to 21 (i.e., from constructed pads to slots or from constructed pads to sites without a pad or slot) to limit surface disturbance.
- The number of well sites that would not require a pad or a slot was increased from 6 to 18 sites to limit surface disturbance.
- 47 wells were planned to be drilled and/or operated outside of raptor and/or sage-grouse nesting or breeding seasons and/or timing windows.
- 3 wells were determined to benefit from the application of enhanced site-specific restoration plans due to steep slopes and erosion potential.
- 37 wells were planned for a 30-day stabilization requirement to ensure successful reclamation.
- 12 wells were determined to require application of the Pumpkin Buttes Traditional Cultural Properties Programmatic Agreement mitigation requirements.
- Roads were relocated or engineered to:
  - Reduce overall surface disturbance;
  - Limit soil erosion; and
  - Reduce impacts to a sensitive cultural resource site.
- Almost 3 miles of overhead power lines were redesigned to include buried power within combined road/utility corridors.
- Water pump jacks were eliminated from well pads in favor of submersible pumps.
- Use of temporary electric generators was eliminated from the project description.

The above changes as documented in a revised project description provided as Anadarko's response to BLM's deficiency letter (including supplemental filings), resulted in a refined proposed project, which is discussed in this document as Alternative B. The initial POD, the post-onsite deficiency letter, the company's response to the deficiency letter, and supplemental filings are included in the Project Administrative Record, available for review at the BLM Buffalo FO.

### 2.5. Summary of Alternatives

A summary of the infrastructure currently existing within the POD area (Alternative A), the infrastructure proposed by the operator (Alternative B), and the infrastructure recommended by the BLM (Alternative C) are presented in Table 2.3. There are no existing or proposed central gathering/metering facilities, compressors, or monitoring wells within the POD; therefore, these facilities are not detailed in Table 2.3. Likewise, communications facilities and stock tanks are not listed because Anadarko does not propose use of these components for this POD. Furthermore, there is no difference between Alternatives B and C relative to water disposal methodology (both alternatives propose water disposal via reinjection outside of the POD boundary).

**Table 2.3 Summary of the Alternatives**

| Facility | Alternative A<br>No Action<br>Existing Number<br>or Miles (acres) | Alternative B [1]<br>Operator Proposal<br>Proposed Number<br>or Miles (acres) | Alternative C [1]<br>Modified Alternative<br>Revised Number<br>or Miles (acres) |
|---|---|---|---|
| Total CBNG Wells<br>Well Locations [2]<br>Constructed Pads<br>Slotted<br>Nonconstructed | 128<br>(25.6 acres) | 54<br>(31.6 acres)<br>21<br>15<br>18 | 52<br>(30.4 acres)<br>20<br>14<br>18 |
| Uranium Development [3] | (127.0 acres) | 0 | 0 |
| Conventional Oil Wells [4] | 7<br>(7.0 acres) | 0 | 0 |
| Injection Wells [5] | 7<br>(7.0 acres) | 0 | 0 |
| Ancillary Facilities<br>(Staging/Storage Areas) [6] | 1<br>(5.0 acres) | 2<br>(10.0 acres) | 2<br>(10.0 acres) |
| Water Impoundments [7] | 2<br>(4.0 acres) | 0 | 0 |
| Roads-Engineered<br>*Without Utility Corridor*<br>*With Utility Corridor* | 23.6 miles [8]<br>(1,428.5 acres) | 0 mile<br>(0 acre)<br>0.2 mile<br>(1.4 acres) | 0 mile<br>(0 acre)<br>0.2 mile<br>(1.4 acres) |
| Roads-Template/Spot Upgrade<br>*Without Utility Corridor*<br>*With Utility Corridor* | Included with above<br>(roads-engineered) | 2.6 miles<br>(14.7 acres)<br>13.3 miles<br>(80.8 acres) | 2.6 miles<br>(14.7 acres)<br>12.8 miles<br>(77.3 acres) |
| Roads-Primitive<br>*Without Utility Corridor*<br>*With Utility Corridor* | 12.4 miles [9]<br>(601.4 acres) | 0.1 mile<br>(0.6 acre)<br>0.9 mile<br>(5.6 acres) | 0.1 mile<br>(0.6 acre)<br>0.9 mile<br>(5.6 acres) |

**Table 2.3 Summary of the Alternatives**

| Facility | Alternative A No Action Existing Number or Miles (acres) | Alternative B [1] Operator Proposal Proposed Number or Miles (acres) | Alternative C [1] Modified Alternative Revised Number or Miles (acres) |
|---|---|---|---|
| Power lines-Overhead | 9.6 miles (34.8 acres) | 0 | 0 |
| Utility Corridors (water, gas, and buried power) [10] | Not available | 21.6 miles (117.2 acres) | 21.6 miles (117.2 acres) |
| **TOTAL ACRES DISTURBANCE** | **2,240.3** | **261.9** | **257.2** |

[1] Acres or mileage within the action alternatives represent additional facilities and do not include the existing facilities.

[2] Data not available for well site type for existing wells; assume 0.2 acre of disturbance per CBNG well.

[3] This number reflects land surface currently associated with disturbance from uranium exploration well development. Approved leases for uranium mines represents over half of the surface area within the POD.

[4] Assumes 1.0 acre of disturbance per conventional oil well.

[5] Assumes 1.0 acre of disturbance per injection well.

[6] Data limited to Anadarko's proposal only, which includes use of one existing staging area and two new staging areas. Anadarko also proposes use of existing oil well pads as staging areas; this acreage is not included in the table.

[7] Two water impoundments are present within the POD boundary (Christensen # 43-5 and Grover #16489S) according to the Wyoming State Engineer's Office. Surface acreage was approximated from aerial photography interpretation.

[8] Data provided for existing improved roads does not differentiate between with and without utility corridor; existing width assumed to be 50 feet wide.

[9] Data provided for existing Primitive roads does not differentiate between with and without utility corridor; existing width assumed to be 40 feet wide.

[10] Includes utility corridors proposed along existing primitive roads, along existing improved roads, and independent of roads.

## 3. DESCRIPTION OF AFFECTED ENVIRONMENT

This chapter describes the environment that would be affected by implementation of the alternatives described in Chapter 2. Aspects of the affected environment described in this section focus on relevant major issues. A screening of all resources and land uses potentially affected is included in Appendix A. Resources that would be unaffected or not affected beyond the level analyzed within the PRB FEIS are not discussed within the EA.

Applications to drill were received on July 19, 2010, and supplemental clarifying filings received August 4, 5, and 18, 2010. Field inspections of the proposed Table Mountain Phase 4 CBNG POD project were conducted on April 27, April 29, May 3, May 4, May 18, May 19, and August 5, 2010. Personnel attending the field inspections are identified in Chapter 5, Consultation and Coordination.

### 3.1. Project Area Description

The POD would be developed within an area of approximately 11,400 acres within Johnson and Campbell counties. The topography in the area is relatively rugged terrain, particularly to the west and northwest. Elevations range from 4,520 to 5,180 feet above sea level. Surficial deposits consist of alluvium and colluvium, consisting primarily of dissected alluvial fan and gradational fan deposits mixed with scattered deposits of slopewash, and residuum (BLM 2009). The underlying bedrock within the project area consists of the main body of the Wasatch Formation of the Eocene Epoch. Within the vicinity of the project area, the Wasatch Formation is primarily variegated mudstone and sandstone with conglomeratic lenses (Love and Christensen 1985). Additional minor bedrock within the vicinity of the project area includes that of the White River formation of the Oligocene Epoch. The White River Formation consists of claystone and siltstone with beds of sandstone and conglomerate (Love and

Christensen 1985). Erosional remnants of the White River Formation comprise the Pumpkin Buttes, which are prominent topographic features in the area.

The Wasatch Formation is underlain by the Fort Union Formation, which is subdivided into three different members. The upper member of the Fort Union Formation, the Tongue River Member, is known to contain thick, continuous coal beds, including the Anderson-Wyodak coal zone (Bartos and Ogle 2002). The Big George coal seam is considered a deeper equivalent to the Anderson-Wyodak coal zone within the Fort Union Formation (Bartos and Ogle 2002). Within the project area, the Big George coal seam ranges from 800 to greater than 1,000 feet deeper than the Wasatch Formation (Cogema Mining, Inc. [COGEMA] 2008).

### 3.1.1. Geologic Features and Mineral Resources

Three intermittent streams are located within the eastern portion of the project area: Willow Creek, Del Gulch, and North Prong Willow Creek. Del Gulch Creek and North Prong Willow Creek junction with Willow Creek in the eastern portion of the project area. Willow Creek generally runs from southeast to northwest within the eastern portion of the project area. The syncline axis of the PRB is located within approximately 20 miles southwest of the project area; a series of faults lie within 5 miles west of the PRB Axis (BLM 2009). The nearest faults to the east of the RPB Axis are in excess of 25 miles from the project area (BLM 2009). Table Mountain is located in the far northwest corner of the project area.

Several commercially viable minerals exist within or surrounding the project area, including coal, uranium, oil and gas, and sand and gravel. Uranium, a locatable mineral, is regulated under the General Mining Law of 1872 and is explored for and commercially produced in Campbell and Johnson counties. Fluid leasable minerals within the project area include oil and gas; currently, 280 oil and gas fields exist in Campbell County, and 42 exist in Johnson County (BLM 2010a). Commercially viable salable minerals that are explored, developed, and disposed of under the Materials Act of 1947 include sand and gravel (BLM 2010a). Currently, no oil and gas or sand and gravel development other than the proposed project are anticipated within the POD boundary.

Uranium-bearing deposits typically are formed in fine-grained sandstones where reducing conditions dominate. Wasatch Formation sandstones have been identified as uranium-bearing within the project area (BLM 2009). Open-pit uranium mining has not occurred in Wyoming since 1991; the current method of uranium mining used is in-situ recovery (ISR) (Wyoming State Geological Survey [WSGS] 2010a). The ISR method involves the injection of oxygenated water into the subsurface for solubilization of the uranium, creating a uranium-bearing groundwater that is then pumped to the surface. At the surface, the uranium is extracted from the water via ion exchange (Uranium Producers of America 2010). As of 2006, active uranium leases covered over half of the surface within the project area (BLM 2006). In addition, under administrative review in the BLM Buffalo FO, Anadarko has identified approximately 127 acres within the project area currently associated with disturbance from uranium exploration.

### 3.1.2. Land Ownership

The majority of the land surface ownership within the project area is privately owned land. The BLM manages the surface lands within Section 34, T45N, R77W, and portions within Sections 10, 11, 14, and 15, T44N, R77W (BLM 2009).

### 3.1.3. Land Use

The project and surrounding area is predominantly undeveloped grass and shrub covered land. Use is predominantly for mineral development and grazing. Approximately 20 percent of the land surface represents facilities associated with mineral exploration and development (e.g., oil and gas wells, roads, utilities).

## 3.2. Soils, Vegetation, and Ecological Sites

### 3.2.1. Soils

The PRB is composed of relatively young soils that have developed in alluvium and residuum derived from the Wasatch Formation. Lithology consists of light to dark yellow and tan siltstone and sandstones with minor coal seams. Surface and subsurface textures of area soils include silt loam and fine sandy loam. Soil depths vary from deep on lesser slopes to shallow and very shallow on steeper slopes. Soils generally are productive, though productivity varies with texture, slope, and other characteristics. Soils differ with topographic location, slope, and elevation. Topsoil depths to be salvaged for reclamation range from 0 to 4 inches on ridges to 10 or more inches in bottomland.

The map unit symbols for the soils found within the POD boundary are listed in **Table 3.1**.

**Table 3.1 Dominant Soils within the Project Area**

| Map Unit | Map Unit Name | Approximate Acres[1] | % of Project Area |
|---|---|---|---|
| SNe | Shingle-Tassel association | 4,400 | 39 |
| SNb | Shingle-Cushman association | 1,050 | 9 |
| CV | Cushman-Briggsdale association | 1,020 | 9 |
| MP | Maysdorf-Pugsley association | 540 | 5 |
| STd | Stoneham-Cushman association | 490 | 4 |
| SNc | Shingle-Kim association | 380 | 3 |
| 233 | Ustic Torriorthents, gullied | 340 | 3 |
| 146 | Forkwood-Cushman loams, o to 6 percent slopes | 300 | 3 |

[1] The remaining approximately 25 percent of area soils are comprised of soil types that cover less than 3 percent of the project area each.

Source: Natural Resources Conservation Service (NRCS) 2010.

Soils within the project area were identified from the South Johnson County Survey Area, Wyoming (WY619), and South Campbell County Survey Area, Wyoming (WY605).

The soil survey was performed by the NRCS according to National Cooperative Soil Survey standards. Pertinent information for analysis was obtained from the published soil survey (SCS 1993) and the Soil Survey Geographic Database (SSURGO), which is linked to the National Soils Information System database (NRCS 2010) for the area.

#### 3.2.1.1. Soils Susceptible to Erosion

Loss in productivity is likely to occur on most soils if erosion is not monitored and mitigated. Because soil formation is a very slow process, most soils cannot renew their eroded surface while erosion continues. The development of a favorable rooting zone by the weathering of parent rock is much slower than development of the surface horizon. One estimate of this renewal rate is 0.5 ton per acre per year for unconsolidated parent materials and much less for consolidated materials. These very slow renewal rates support the philosophy that any soil erosion is too much. Loss of organic matter, resulting from erosion and tillage, is one of the primary causes for reduction in production yields. As organic matter decreases, soil aggregate stability, soil moisture holding capacity, and cation exchange capacity decline (NRCS 1998).

The Shingle-Tassel association, which has moderate erosion hazard ratings, covers approximately 4,403 acres (39 percent) of the project area with a topsoil depth 10 inches or less. This complex consists of components that occur at an approximate proportion of 40, 25, and 15 percent of the map unit. The Shingle is loamy, the Tassel soil is comprised of sandy-loams, and Kim soils have a loam surface and silt

loam subsoil. On the surface, vegetation cover is good on level areas and sparse or barren on slopes. The map unit is highly dissected and gullied with active erosion ranging from slight to severe. The Kim soils are gently sloping to sloping.

The dominant components of the complex (Shingle and Tassel soils) have a poor rating as a source of topsoil or reclamation material. Paralithic (soft) bedrock occurs 8 to 10 inches from the soil surface. The Kim soils have a fair rating as a source of topsoil or reclamation material and are deep. Table 3.2 and Figure 3.1 shows the relative erosion potential, based on the site-specific information discussed above.

**Table 3.2 Erosion Potential within the Project Area**

| Erosion Potential | Approximate Acres | Percent of Project Area |
|---|---|---|
| High | 1,160 | 10 |
| Moderate | 7,850 | 69 |
| Low | 2,260 | 20 |

Source: NRCS 2010.

#### 3.2.1.2. Slope Hazard

A soil's stability is greatly affected by the slope on which it occurs. In general, the greater the slope, the greater the potential for slumping, landslides, and water erosion. Approximately 13 percent of the project area has slopes of 25 percent or more. Slopes greater than 25 percent are shown on Figure 3.2.

Soils with slopes of less than 25 percent also may be prone to high erosion because of the soil type, particle size, texture, or amount of organic matter. Soil types in the POD area with severe erosion potential and slopes 25 percent or greater, as defined by the NRCS (NRCS 2010), are listed in Tables 3.2 and 3.3, respectively, along with the number of acres and percentage of the project area.

**Table 3.3 Percent Slope within the Project Area**

| Percent Slope | Approximate Acres | Percent of Project Area |
|---|---|---|
| 0-24 | 9,920 | 87 |
| Greater than or Equal to 25 | 1,480 | 13 |

Source: NRCS 2010.

Other contributing factors to slope stability include slope length, slope aspect, and colluvium. Slope length has considerable control over runoff and potential accelerated water erosion. Slope aspect is the direction that the surface of the soil faces. Slope aspect may affect soil temperature, evapotranspiration, wind contact, and soil moisture. Colluvium is poorly sorted debris that has accumulated at the base of slopes, in depressions, or along small streams through gravity, soil creep, and local wash. It consists largely of material that has rolled, slid, or fallen down the slope under the influence of gravity. The rock fragments in colluvium usually are angular, in contrast to the rounded, water-worn cobbles and stones in alluvium and glacial outwash (SCS 1993). These factors in combination with slope determine soil stability and the potential for mass soil movement.

#### 3.2.1.3. Miscellaneous Areas

Shale rock lands are similar to badlands and are moderately steep to very steep barren land dissected by many intermittent drainage channels. They occur on steep slopes and ridge tops, but may occur on all slopes that include landforms such as hillsides, ridges, and escarpments. They consist of slightly to moderately weathered shale and may be high in salts and sodium. Potential runoff is very high, and erosion is active (SCS 1993). These areas are prone to slumps and mass movement in addition to gully erosion. Alluvial land occurs on floodplains, is generally flat, and is occasionally to frequently flooded. Areas associated with alluvial land and shale outcrops are listed in Table 3.4.

**Table 3.4 Miscellaneous Areas within the Project Area**

| Miscellaneous Area | Approximate Acres | Percent of Project Area |
|---|---|---|
| Alluvial land | 87 | <1 |
| Shale rock land | 10 | <1 |

Source: NRCS 2010.

#### 3.2.1.4. Reclamation Potential

Soils with poor reclamation and revegetation potential occur throughout the project area as shown in Table 3.5. Currently, soil conditions in the project area are being impacted by CBNG development as well as traditional activities, including livestock grazing and wildlife use. Much of the area is covered with soils that are easily damaged by use or disturbance or are difficult to re-vegetate or otherwise reclaim. Soil impacts (e.g., roads, linear pipeline scars, and artificial wet areas) can readily be observed in the area. This high erosion potential could result in higher suspended sediment and turbidity levels in the Powder River.

**Table 3.5 Reclamation Potential within the Project Area**

| Reclamation Potential | Approximate Acres[1] | Percent of Project Area |
|---|---|---|
| Fair | 5,090 | 45 |
| Poor | 5,750 | 51 |

[1] The remaining 4 percent (approximately 560 acres) of soils in the project area are considered to have acceptable soil reclamation potential.

Source: NRCS 2010.

In the absence of recoverable topsoil as is common throughout the project area, the surface organic matter in the form of vegetation, litter, and biological crust are critical to maintaining the integrity and viability of the soil.

Reclamation potential of soils varies throughout the project area. The main soil limitations in the project area include depth to bedrock, low organic matter content, and high erosion potential. These limitations occur most frequently in areas of steep slopes. Many of the soils and landforms of this area present distinct challenges for development. Approximately 15 percent of the area within the boundary of the Proposed Action contains soil mapping units with a named component identified as being a highly susceptible water erosion and approximately 13 percent of the area has slopes greater than 25 percent, making stabilization of disturbance and reclamation challenging and possibly unachievable.

### 3.2.2. Vegetation

#### 3.2.2.1. General Description

According to the PRB FEIS, the predominant vegetation community types in the project area are mixed-grass prairie and sagebrush shrubland. Species typical of the mixed-grass prairie community type consist of western wheatgrass (*Pascopyrum smithii),* blue grama (*Bouteloua gracilis*), needle-and-thread (*Hesperostipa comata*), and Wyoming big sagebrush (*Artemisia tridentate* var. *wyomingensis*), while species typical of the sagebrush shrubland include Artemisia spp. (*Chrysothamnus* spp.), western wheatgrass, prairie junegrass (*Koeleria macrantha*), and plains pricklypear (*Opuntia* spp.).

With the exception of blue grama, the typical species of the two vegetation community types noted above were confirmed during the onsite field review. In addition, other native graminoid species observed included bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg's bluegrass (*Poa secunda*), green needlegrass (*Nassella viridula*), threadleaf sedge (*Carex filifolia*), and prairie sandreed (*Calamovilfa longifolia*). Non-native graminoids present included crested wheatgrass (*Agropyron cristatum*) and cheatgrass (*Bromus tectorum*). Native forbs included phlox (*Phlox* spp.), death camus (*Zigadenus*

*venenosus*), wild onion (*Alliums textile*), primrose (*Oenothera caespitosa*), wild parsley (*Musineon divaricatum*), and milkvetch (*Astragalus* spp.). Additional shrubs included birdsfoot sage (*Artemisia pedatifida*), rubber rabbitbrush (*Ericameria nauseosa*), and yucca (*Yucca* spp.). Scattered cottonwood trees (*Populus deltoides*) occur along the ephemeral drainage bottoms and juniper trees (*Juniperus* spp.) are found in the upland habitats throughout the project area.

#### 3.2.2.2. Wetlands/Riparian Areas

The project area is comprised of steep drainages, eroded draws, ridgelines, and some rocky outcrops. Riparian habitat is found along and intermittent streams in the project area (e.g., Willow Creek). Cottonwood trees are found in some of the ephemeral drainages in the project area. Based on National Wetland Inventory data available for the project area (USFWS 2009), both herbaceous wetlands and ponds are mapped within the project area (Table 3.6). Three intermittent streams are located within the eastern portion of the project area, Willow Creek, Del Gulch, and North Prong Willow Creek.

**Table 3.6 Wetlands and Riparian Areas within the Project Area**

| Wetland Type | Approximate Acres | Percent of Project Area |
|---|---|---|
| Herbaceous wetlands | 9 | <1 |
| Pond | 11 | <1 |
| Other | <1 | <1 |

Source: USFWS 2009.

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

#### 3.2.2.3. Invasive and Noxious Weed Species

Noxious weeds have continued to be a growing concern in the western U.S. based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. The State of Wyoming has defined noxious weeds as weeds, seeds, or other plant parts that are considered detrimental, destructive, injurious or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within the state, and are on the designated list (by the Wyoming Statutes (Title 11, Chapter 5, Section 102.a.xi). In addition to the state designated list of noxious weeds, Campbell and Johnson counties have declared weeds of concern specific to each county under the authority of the Wyoming Weed and Pest Control Act. The state-listed noxious weeds are listed in PRB FEIS Table 3-21 (page 3-104) and the Weed Species of Concern are listed in Table 3-22 (page 3-105). Since the PRB FEIS was published, Russian Olive (*Elaeagnus angustifolia*), Common St. Johnswort (*Hypericum perforatum*), and Common Tansy (*Tanacetum vulgare*) have been added to the State of Wyoming noxious weed list. The current list of Johnson and Campbell County weeds of concern are listed in Table 3.7. While not a state-designated noxious weed or County Weed Species of Concern, cheatgrass (*Bromus tectorum*) is found extensively throughout the project area and is of concern.

Additionally, the operator or BLM confirmed the following infestations and/or documented additional weed species during field investigations:

- Russian knapweed (*Centaurea repens)*
- Saltcedar (*Tamarix ramosissima)*
- Leafy spurge (*Euphorbia esula)*
- Hoary cress (*Cardaria draba)*
- Scotch thistle (*Onopordum acanthiuim)*

- Canada thistle (*Cirsium arvense)*
- Common cocklebur (*Xanthium stumarium)*
- Buffalo bur (*Solanum rostratum)*

**Table 3.7 County Weeds of Concern**

| Common Name | Scientific Name | Johnson County | Campbell County |
|---|---|---|---|
| Tall mountain larkspur | *Delphinium occidentale* | x | |
| Wild licorice | *Glycyrrhiza lepidota* | x | |
| Black Henbane | *Hyoscyamus niger* | | x |
| Buffalobur | *Solanum rostratum* | x | x |
| Puncturevine | *Tribulus terrestris* | x | |
| Common mullein | *Verbascum thapsus* | x | |
| Common Cocklebur | *Xanthium strumarium* | x | x |

Source: Wyoming Department of Agriculture 2010.

### 3.2.3. Ecological Sites

Ecological Site Descriptions (Table 3.8) are soil and vegetation community descriptions compiled by the NRCS for the purpose of resource identification, and for providing management and reclamation recommendations. To determine the appropriate Ecological Sites for the area contained within this Proposed Action, BLM specialists analyzed data from onsite field reconnaissance and NRCS published soil survey soils information.

**Table 3.8 Dominant Ecological Sites and Dominant Soils Map Units within the Project Area**

| Ecological Site | Soils Map Units | Percent of Project Area |
|---|---|---|
| Shallow Loamy (10-14NP) | SNe, SNb | 51 |
| Loamy (10-14NP) | CV, MP, STd, SNc | 33 |

Source: NRCS 2010.

Dominant Ecological Sites and Plant Communities identified in this POD and its infrastructure are Loamey (10-14NP) and Shallow Loamey (10-14NP) sites. Refer to Section 3.2.2., Vegetation, for a description of vegetation species observed during the onsite field review.

The Loamy (10-14NP) ecological site (covering approximately 33 percent of the POD) is a rangeland site type, found in the Southern Part of the Northern Rolling High Plains. The topography is composed of gently undulating rolling lands. Annual precipitation is 10 to 14 inches a year, and the soils are well drained, moderately permeable, and deep to moderately deep. Major soil types associated with this ecological site include Bidman, Cambria, Cushman, Forkwood, Kishona, Parmleed, Theedle, and Zigweid. The historic plant community on this ecological site is rhizomatous wheatgrasses, needle-and-thread grass, and blue grama. This plant community is dominated by cool season mid-grasses that are well adapted to grazing by large herbivores. The dominant species found in this ecological site include western wheatgrass, needle-and-thread, green needlegrass, Cusick's bluegrass (*Poa cusickii*), Sandberg's bluegrass, bluebunch wheatgrass, and blue grama. Wyoming big sagebrush is typically 15 percent of the vegetative community. Disturbances such as overgrazing and changes in the fire regime lead to changes in the vegetative community. Overgrazing would increase the Wyoming big sagebrush and blue grama, and decrease cool season grasses. The absence of fire can increase the cover and percentage of Wyoming big sagebrush on the site, until it becomes the dominant species. Disturbances also can lead to the increase in cheatgrass, western wheatgrass, and plains pricklypear.

The Shallow Loamy (10-14NP) ecological site (covering approximately 51 percent of the POD) is a rangeland site type, found in the Cool Central Desertic Basins and Plateaus. This ecological site usually is found on south and west facing slopes, in an upland position, but it can be found on all slopes and positions. Annual precipitation is 10 to 14 inches a year, and the soils are well drained (10 to 20 inches deep), and are found on all types of bedrock except igneous or volcanic bedrock. Textures range from very fine sandy loams to clay loam. The historic plant community is bluebunch wheatgrass, and rhizomatous wheatgrass. The dominant species include bluebunch wheatgrass, western wheatgrass, needle-and-thread, and Indian ricegrass (*Achnatherum hymenoides*). The typical shrubs are black sagebrush (*Artemisia nova*), Wyoming big sagebrush, and rabbitbrush (*Ericameria* spp). Disturbances such as overgrazing can lead to increases in threadleaf sedge, prairie junegrass, Sandberg bluegrass and low growing forbs, and can lead to decreases in bluebunch wheatgrass and needle-and-thread.

A summary of the ecological sites within the project area are listed in Table 3.9 along with the individual acreage and the percentage of the total area identified within the POD boundary.

**Table 3.9 Summary of all Ecological Sites within the Project Area**

| Ecological Site | Approximate Acres | Percent of Project Area |
|---|---|---|
| Shallow Loamy (10-14NP) | 5,800 | 51 |
| Loamy (10-14NP) | 3,810 | 33 |
| Sandy (10-14NP) | 640 | 6 |
| Clayey (10-14NP) | 440 | 4 |
| Not assigned | 410 | 4 |
| Lowland (10-14NP) | 200 | 2 |
| Sands (10-14NP) | 90 | < 1 |
| Shallow Clayey (10-14NP) | 10 | < 1 |

Source: NRCS 2010.

## 3.3. Wildlife and Protected Species

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

WGFD is the agency responsible for management of wildlife populations in the state of Wyoming. WGFD has developed several guidance documents that BLM Buffalo FO wildlife staff relies upon in evaluating impacts to wildlife and wildlife habitats. WGFD documents used to analyze the proposed project under the current analysis are referenced in this section.

The current environmental setting and the Proposed Action alternatives are described in Table 2.3, including disclosure of the acreage of existing development within the POD (approximately 20 percent of the overall POD area).

### 3.3.1. Habitat Types

A habitat assessment and wildlife inventory surveys were performed by Big Horn Environmental Consultants (BHEC) for APC in 2010. BHEC performed surveys for greater sage-grouse, sharp-tailed grouse, mountain plover, bald eagle nests and winter roost sites, raptor nests, prairie dog colonies, and habitat for Ute ladies'-tresses orchid and blowout penstemon.

According to the *Table Mountain Phase 4 Wildlife Survey and Habitat Report* (BHEC 2010), the dominant habitat type is sagebrush grasslands consisting of sagebrush interspersed with short native

grasses including blue grama, western wheatgrass, needle-and-thread, cheatgrass, and various forbs. Yucca also is common and juniper stands are prevalent in many draws throughout the project area. Mature cottonwoods exist along Willow Creek and isolated mature cottonwood trees are common in smaller draws (BHEC 2010). More detailed information regarding the vegetation communities can be found in Section 3.2.2 (Vegetation).

### 3.3.2. Federally Threatened, Endangered, Proposed, and Candidate Species

Threatened, Endangered, Candidate, and Proposed species that would be impacted beyond the level analyzed within the PRB FEIS are described in the following sections.

#### 3.3.2.1. Threatened and Endangered Species

##### 3.3.2.1.1. Blowout Penstemon

Blowout penstemon is listed as Endangered under the ESA. It is a regional endemic species with documented populations in the Sand Hills of west-central Nebraska and the northeastern Great Divide Basin of Carbon County, Wyoming. Suitable blowout penstemon habitat consists of sparsely vegetated, early successional, shifting sand dunes and blowout depressions created by wind. In Wyoming, the habitat is typically found on sandy aprons or the lower half of steep sandy slopes deposited at the base of granitic or sedimentary mountains or ridges. As these habitat characteristics are not found in the project area, blowout penstemon does not occur in the project area.

##### 3.3.2.1.2. Ute Ladies'-tresses Orchid

The Ute ladies'-tresses orchid is listed as Threatened under the ESA. The affected environment for Ute ladies'-tresses is discussed in the PRB FEIS on page 3-175. The PRB FEIS reported four orchid populations in Wyoming. Since the writing of the PRB FEIS, at least five additional sites have been discovered in the same drainages as the original populations (BLM 2010b). These drainages include Wind Creek and 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. There are no known populations of the Ute ladies'-tresses in the project area, and the soils are too clayey to meet the habitat requirements of the Ute ladies'-tresses.

#### 3.3.2.2. Proposed Species

##### 3.3.2.2.1. Mountain Plover

The affected environment for mountain plover is discussed in the PRB FEIS on pages 3-177 to 3-178. At the time the PRB FEIS was written, the mountain plover was proposed for listing as a threatened species under the ESA. In 2003, the U.S. Fish and Wildlife Service (USFWS) withdrew the proposal, finding that the population was larger than had been thought and was no longer declining. On June 29, 2010, the USFWS reinstated the portion of the 2002 proposed rule that concerns the listing of the mountain plover as threatened under the ESA of 1973, as amended. In addition, the mountain plover is a Wyoming BLM sensitive species, and mountain plovers are a WGFD Species of Greatest Conservation Need (SGCN) with a rating of NSS4 because population status and trends are unknown but are suspected to be stable, habitat is vulnerable without ongoing loss, and the species is sensitive to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a Bird of Conservation Concern (BCC) for Region 17.

Surveys for nesting mountain plover were conducted in 2010 following the USFWS guidelines for mountain plover surveys (USFWS 2002). Mountain plover were not observed during those surveys. Additionally, no mountain plover observations have occurred during surveys conducted from 2006 through 2010 (BHEC 2010).

#### 3.3.2.3. Candidate Species

##### 3.3.2.3.1. Greater Sage-grouse

In 2010, USFWS determined that the sage-grouse is warranted for Federal listing across its range, but listing is precluded by other higher priority listing actions. In addition to being listed as a Wyoming BLM sensitive species, sage-grouse are listed as a WGFD species of greatest conservation need, because populations are declining and they are experiencing ongoing habitat loss. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a BCC for Region 17.

Greater sage-grouse is a sage brush obligate species, meaning this species requires sage brush habitat as a primary component for individual survival and population viability. Currently, greater sage-grouse occupy approximately 56 percent of their historical range, which includes 11 States and 3 Canadian provinces—Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, South Dakota, North Dakota, British Columbia, Alberta, and Saskatchewan (USFWS 2010a). The sage-grouse population within northeast Wyoming has been exhibiting a steady long-term downward trend, as measured by lek attendance (WGFD 2008).

Within the project area, sage-grouse habitat is present. Portions of the POD provide valuable habitat for sage-grouse as verified by the onsite inspections and observation of sage-grouse sign (e.g., feathers, scat). However, the area also supports intensive existing developments (Table 2.3).

The *State Wildlife Agencies' Ad Hoc Committee for Consideration of Oil and Gas Development Effects to Nesting Habitat* (2008) recommends that impacts be considered for leks within 4 miles of oil and gas developments. Records indicate that 14 sage-grouse leks occur within 4 miles of the project area. These 14 lek sites are identified in Table 3.10.

**Table 3.10 Sage-grouse Leks within 4 miles of the Project Area**

| Lek Name | Legal Description | | | | | Status |
|---|---|---|---|---|---|---|
| | Qtr | Qtr | Section | Township | Range | |
| Beecher Draw | NE¼ | SW¼ | 2 | 43 | 77 | Occupied |
| Beecher Draw N | NW¼ | NE¼ | 34 | 44 | 77 | Occupied |
| Christensen Ranch 1 | SW¼ | SW¼ | 19 | 44 | 76 | Occupied |
| Christensen Ranch 2 | NE¼ | NE¼ | 24 | 44 | 77 | Occupied |
| Christensen Ranch 3 | NE¼ | NE¼ | 12 | 44 | 77 | Occupied |
| Christensen Ranch 4 | SE¼ | NE¼ | 19 | 45 | 76 | Occupied |
| Christensen Ranch 5 | NE¼ | NW¼ | 32 | 45 | 76 | Occupied |
| Christensen Ranch 7 | SW¼ | NW¼ | 11 | 44 | 77 | Occupied |
| Dry Willow | NW¼ | NE¼ | 34 | 44 | 76 | Occupied |
| Irigaray | NE¼ | SE¼ | 29 | 45 | 77 | Occupied |
| Irigaray II | SW¼ | SE¼ | 28 | 45 | 77 | Occupied |
| Mengel | SW¼ | NE¼ | 19 | 44 | 77 | Occupied |
| North Butte | SE¼ | NW¼ | 18 | 44 | 75 | Occupied |
| Willow Creek | NE¼ | SW¼ | 23 | 45 | 76 | Occupied |

Source: BLM 2010c.

### 3.3.3. BLM Sensitive Species

Wyoming BLM has prepared a list of sensitive species on which management efforts should be focused towards maintaining habitats under a multiple use mandate. The goals of the policy are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems;
- Ensure sensitive species are considered in land management decisions;

- Prevent a need for species listing under the ESA; and
- Prioritize needed conservation work with an emphasis on habitat.

The authority for the sensitive species policy and guidance comes from the ESA of 1973, as amended; Title II of the Sikes Act, as amended; the FLPMA of 1976; and the Department Manual 235.1.1A. BLM Wyoming sensitive species that would be impacted beyond the level analyzed within the PRB FEIS are described below.

#### 3.3.3.1. Bald Eagle

The affected environment for bald eagles is described in the PRB FEIS on page 3-175. At the time the PRB FEIS was written, the bald eagle was listed as a threatened species under the ESA. Due to successful recovery efforts, it was removed from the ESA on August 8, 2007. The bald eagle remains under the protection of the BGEPA and the MBTA. In order to avoid violation of these laws and uphold the BLM's commitment to avoid any future listing of this species, the BLM shall continue to comply with all conservation measures and terms and conditions identified in the Powder River Basin Oil and Gas Project Biological Opinion (PRB Oil & Gas Project BO #WY07F0075) (USFWS 2007).

In addition to being listed as a Wyoming BLM sensitive species, bald eagles are a WGFD SGCN with a NSS2 rating, due to populations being restricted in numbers and distribution, ongoing loss of habitat, and sensitivity to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a BCC for Region 17.

Surveys were conducted for bald eagle winter roost sights and nests from 2006 through 2010 (BHEC 2010; Hayden-Wing Associates, LLC [HWA] 2008). During the December 2007 winter roost survey, two adult bald eagles were observed at two different locations within 1 mile of the Table Mountain Phase 4 CBNG POD (HWA 2008). No bald eagle winter roosts or nests were located during those surveys.

According to Buffalo FO database, there is one recorded observation of a potential bald eagle winter roost located in the northeastern portion of the POD. The USFWS defines bald eagle winter roosting habitat as any mature conifer or deciduous trees where bald eagles consistently perch during winter. Consistent use is defined as a location where bald eagles are observed on more than one occasion within a single winter (at least 1 week apart) over multiple winters. This single record does not constitute confirmed, consistent use and therefore, does not qualify as a bald eagle winter roost site.

#### 3.3.3.2. Brewer's Sparrow

The affected environment for Brewer's sparrow is discussed in the PRB FEIS on page 3-200. In addition to being listed as a BLM Wyoming sensitive species, Brewer's sparrows are a WGFD SGCN, with a rating of NSS4 because populations are declining, habitat is vulnerable with no ongoing loss, and the species is not sensitive to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a BCC for Region 17.

#### 3.3.3.3. Ferruginous Hawk

The affected environment for ferruginous hawk is discussed in the PRB FEIS on page 3-183. In addition to being listed as a Wyoming BLM sensitive species, ferruginous hawks are a WGFD SGCN, with a rating of NSS3 because the species is widely distributed, population status and trends are unknown but are suspected to be stable, they are experiencing ongoing loss of habitat, and they are sensitive to human

disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a BCC for Region 17.

#### 3.3.3.4. Loggerhead Shrike

The affected environment for loggerhead shrike is discussed in the PRB FEIS on page 3-187. In addition to being listed as a Wyoming BLM sensitive species, loggerhead shrikes are listed by USFWS as a BCC for Region 17. The Wyoming Bird Conservation Plan rates them as a Level II species, indicating they are in need of monitoring.

#### 3.3.3.5. Sage Sparrow

The affected environment for sage sparrow is discussed in the PRB FEIS on pages 3-200 to 3-201. Sage sparrows are a WGFD SGCN, with a rating of NSS3, because populations are restricted in distribution, habitat is restricted but not undergoing substantial loss, and they are sensitive to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. They also are listed by USFWS as a BCC for Region 17.

#### 3.3.3.6. Sage Thrasher

The affected environment for sage thrasher is discussed in the PRB FEIS on pages 3-199 to 3-200. In addition to being listed as a Wyoming BLM sensitive species, sage thrashers are a WGFD SGCN, with a rating of NSS4, because populations are declining, habitat is vulnerable but not undergoing loss and the species is not sensitive to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level II species, indicating the action and focus should be on monitoring and because Wyoming has a high percentage of and responsibility for the breeding population. They also are listed by USFWS as a BCC for Region 17.

#### 3.3.3.7. Western Burrowing Owl

The affected environment for western burrowing owl (burrowing owl) is discussed in the PRB FEIS on page 3-186. In addition to being listed as a Wyoming BLM sensitive species, burrowing owls are a WGFD SGCN, with a rating of NSS4 because the species is widely distributed, population status and trends are unknown but are suspected to be stable, habitat is restricted or vulnerable without substantial recent or on-going loss, and it may be sensitive to human disturbance. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action, and they also are a USFWS BCC in Region 17.

Wildlife surveys were conducted in the project area to locate raptor nests and delineate black-tailed prairie dog towns in 2010 (BHEC 2010). No observations of burrowing owls were documented during the surveys.

#### 3.3.3.8. Black-tailed Prairie Dog

The affected environment for black-tailed prairie dogs is discussed in the PRB FEIS (page 3-179). At the time the PRB FEIS was written, the black-tailed prairie dog was added to the list of candidate species for Federal listing in 2000 (USFWS 2000). It was removed from the list in 2004. Wyoming BLM considers black-tailed prairie dogs a sensitive species and continues to afford this species the protections described in the PRB FEIS. The black-tailed prairie dog is a WGFD SGCN, with a rating of NSS3, because populations are declining, and habitat is vulnerable but not undergoing significant loss.

The black-tailed prairie dog is considered a keystone species, meaning numerous other animal species occupy the same habitat and rely on the black-tailed prairie dog for survival. For example, the black-footed ferret, swift fox, golden eagle, and ferruginous hawk use prairie dogs as a food source; the mountain plover, prairie rattlesnake, and western burrowing owl occupy habitat created by prairie dogs.

The black-tailed prairie dog is considered common in Wyoming, although its abundance fluctuates with activity levels of Sylvatic plague and the extent of control efforts by landowners. Comparisons with 1994 aerial imagery indicated that black-tailed prairie dog acreage remained stable from 1994 through 2001, but aerial surveys conducted in 2003 indicated that approximately 47 percent of the prairie dog acreage was impacted by Sylvatic plague and/or control efforts (Grenier et al. 2004). Due to human-caused factors, black-tailed prairie dog populations are now highly fragmented and isolated (Miller et al. 1994). Most colonies are small and subject to potential extirpation due to inbreeding, population fluctuations, and other problems that affect long-term population viability, such as landowner poisoning and disease (Primack 1993; Meffe and Carroll 1994; Noss and Cooperrider 1994). BHEC (2010) delineated the black-tailed prairie dog colonies within 0.25 mile of the POD (Table 3.11).

**Table 3.11 Black-tailed Prairie Dog Colonies within the Project Area**

| Qtr/Qtr | Section(s) | Township | Range | Size (acres) |
|---|---|---|---|---|
| SE¼/NE¼ | 33 | 45N | 77W | 8.60 |
| NW¼/SW¼ | 34 | 45N | 77W | |
| NW¼/SW¼ | 1 | 44N | 77W | 9.80 |
| NE¼/NE¼ | 12 | 44N | 77W | 3.70 |
| SW¼/SE¼ | 17 | 44N | 76W | 42.50 |
| NE¼/SE¼ | 18 | 44N | 76W | 0.27 |
| NE¼/SW¼ | 5 | 44N | 76W | 0.63 |
| NE¼/SE¼ | 33 | 45N | 76W | 36.00 |
| SW¼/SE¼ | 33 | 45N | 76W | 35.50 |
| NW¼/NE¼ | 4 | 44N | 76W | |
| SE¼/SE¼ | 33 | 45N | 76W | 22.50 |
| NW¼/NE¼ | 4 | 44N | 76W | |

Source: BHEC 2010.

#### 3.3.3.9. Swift Fox

The affected environment for swift fox is discussed in the PRB FEIS on page 3-189. In addition to being listed as a BLM Wyoming sensitive species, swift fox also is listed as a WGFD SGCN, with a rating of NSS4, because population status and trends are unknown but are suspected to be stable, and habitat is vulnerable but is not undergoing substantial loss.

### 3.3.4. Big Game

WGFD data indicate that the project area contains yearlong range and winter yearlong range for mule deer and pronghorn (WGFD 2006). Yearlong use is mapped when a population of animals makes general use of habitat within the range on a year-round basis; animals may leave the area under severe conditions. Winter yearlong use also occurs when animals make general use of habitat on a year-round basis. However, in these mapped areas, there is a significant influx of additional animals into the area from other seasonal ranges during the winter months. No crucial big game habitat is known to occur in the area. The affected environment for pronghorn and mule deer is discussed in the PRB FEIS on pages 3-117 to 3-122 and pages 3-127 to 3-132, respectively.

### 3.3.5. Migratory Birds

The affected environment for migratory birds is discussed in the PRB FEIS (pages 3-150 to 3-153). On April 12, 2010, the BLM and USFWS signed a Memorandum of Understanding (MBTA MOU) to promote the conservation of migratory birds. The MOU does not authorize the take of migratory birds and is intended to strengthen migratory bird conservation by identifying and implementing strategies that

promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the Parties, in coordination with state, tribal, and local governments.

Sagebrush communities are the primary vegetation type (i.e., migratory bird habitat) in the project area. Migratory birds most dependent on sagebrush ecosystems for survival are considered obligates (e.g., sage thrasher, brewer's sparrow, sage sparrow) (Rowland et al. 2006). Many of these species are socially and/or ecologically important, including several Wyoming BLM sensitive species.

#### 3.3.6. Raptors

The affected environment for raptors is discussed in the PRB FEIS on pages 3-141 to 3-148. Raptor surveys were conducted within the project area in 2008 and 2010. Thirty-four raptor nest sites have been documented within 0.5 mile of the project area (Table 3.12). Of the 34 raptor nests documented as potentially active within the POD, only two nests (both red-tailed hawks) were confirmed as active within the POD as observed during the onsite field review.

### 3.4. Water Resources

The project area is within the Upper Powder River drainage system (Hydrologic Unit Code 10090202), and is located primarily within the Lower Willow Creek subwatershed. Smaller portions of the project area also occur within the subwatersheds of Upper Willow Creek, the Dry Fork of the Powder River, and other Powder River tributaries (Figure 3.3). The region is characterized by unglaciated semi-arid rolling plains and dissected river breaks, with soils derived mainly from shale, sandstone, or related alluvium, valley fills, or fan remnants (Chapman et al. 2004). The project area reflects this regional setting, and has numerous ephemeral draws and gullies dissecting the upland surface. Buttes and badlands are scattered on the landscape, such as North Butte and Dome Butte east of the project area. Regionally, the vegetation is dominated by mixed-grass prairie (Chapman et al. 2004) and sagebrush steppe.

Willow Creek and Little Willow Creek are the main tributaries to the upper Powder River in the project area. A USGS stream gage (Site 06313500) measures flows in the Powder River upstream of these tributaries, at Sussex, Wyoming. The river has a drainage area of about 3,090 square miles there. The nearest USGS river gage downstream is about 18 miles north of the mouth of Willow Creek, near Burger Draw (Site 06313590). The river there has a drainage area of about 4,290 square miles (USGS-National Water Information Service [NWIS] 2010). Although there is a drainage area increase of about 39 percent between these gages, recent USGS data (July 2003 through September 2009) indicate that yearly flows only increase about 10 to 12 percent through the river reach. This may be due to evapotranspiration, seepage into the channel and banks, or other factors. On an average annual basis, the intervening contribution is a flow of about 16 cubic feet per second (cfs). Assuming that tributary watersheds are similar between the gages, the 266.4 square miles of tributary basins around the project area (mainly Willow Creek; see Figure 3.3) would proportionally contribute about 3.6 cfs to the Powder River annually. On a similar drainage-area basis, the project area itself (18.4 square miles) would contribute approximately 0.25 cfs to the river during an average year. The greater part of the tributary flow likely occurs during the spring runoff than during the rest of the year.

The Wyoming Department of Environmental Quality (WDEQ) has assumed primacy from U.S. Environmental Protection Agency (USEPA) for maintaining the water quality in the waters of the state. The Wyoming State Engineer's Office (WSEO) has authority for regulating water rights issues and permitting impoundments for the containment of surface waters of the state. The Wyoming Oil and Gas Conservation Commission (WOGCC) has authority for permitting and bonding off channel pits that are located over State and fee minerals.

**Table 3.12 Documented Raptor Nests within 0.5 mile of the Project Area**

| Nest ID | UTM_E | UTM_N | Substrate[1] | Species[2] | Status | Nest Condition |
|---|---|---|---|---|---|---|
| 10359 | 420174 | 4854680 | CTL | Unknown | Inactive | Good |
| 10363 | 418751 | 4853821 | BOX | Unknown | Inactive | Poor |
| 10364 | 418944 | 4853724 | CTD | Unknown | Inactive | Fair |
| 10366 | 417792 | 4852973 | JUN | Unknown | Inactive | Fair |
| 10369 | 414195 | 4851994 | ROK | Unknown | Inactive | Good |
| 10370 | 413939 | 4851940 | CKB | Unknown | Inactive | Good |
| 10371 | 413921 | 4851925 | JUN | Unknown | Inactive | Fair |
| 10372 | 414275 | 4851867 | CLF | Unknown | Inactive | Remnants |
| 10375 | 417484 | 4850262 | CLF | Unknown | Inactive | Poor |
| 10379 | 413721 | 4849440 | CKB | Unknown | Inactive | Poor |
| 10381 | 414434 | 4849278 | CTL | RTHA | Active | Good |
| 10665 | 413673 | 4849309 | CKB | Unknown | Inactive | Poor |
| 3706 | 422775 | 4852393 | POL | Unknown | Inactive | Poor |
| 3993 | 420675 | 4854855 | CTL | Unknown | Inactive | Fair |
| 4018 | 422855 | 4852571 | JUN | Unknown | Inactive | Good |
| 4088 | 415194 | 4853121 | CLF | Unknown | Inactive | Poor |
| 4208 | 411195 | 4853055 | CTL | Unknown | Inactive | Good |
| 5024 | 411333 | 4852913 | CKB | Unknown | Inactive | Poor |
| 5318 | 420269 | 4851711 | ROK | Unknown | Inactive | Unknown |
| 5319 | 419385 | 4850773 | CTL | Unknown | Inactive | Good |
| 5547 | 414596 | 4852028 | CTL | Unknown | Inactive | Fair |
| 5548 | 415457 | 4852570 | CTL | RTHA | Active | Good |
| 6376 | 419562 | 4848261 | CTL | Unknown | Inactive | Fair |
| 6377 | 418991 | 4850207 | CTL | Unknown | Inactive | Poor |
| 6381 | 417515 | 4850244 | CLF | Unknown | Inactive | Fair |
| 6383 | 416136 | 4851707 | CTL | Unknown | Inactive | Good |
| 6384 | 417685 | 4848012 | CTL | Unknown | Inactive | Good |
| 6385 | 415747 | 4847911 | CTL | Unknown | Inactive | Fair |
| 6386 | 416118 | 4847961 | CTL | Unknown | Inactive | Good |
| 6387 | 418950 | 4850165 | CTL | Unknown | Inactive | Fair |
| 6492 | 414629 | 4848292 | CTL | Unknown | Inactive | Good |
| 8373 | 413676 | 4848502 | CKB | Unknown | Inactive | Fair |
| 8393 | 419009 | 4853652 | CTL | Unknown | Inactive | Fair |
| 8394 | 418942 | 4853728 | CTL | Unknown | Inactive | Fair |

[1] JUN – Juniper; CTL – Cottonwood Live; BOX – Boxelder Tree; CTD – Cottonwood Dead; ROK – Rock Outcrop; CKB – Creek Bottom; CLF – Cliff; POL – Ponderosa Pine Live; WIL – Willow.

[2] RTHA – Red-tailed hawk.

Source: BLM 2010c.

### 3.4.1. Groundwater

The groundwater in this project area historically has been used for stock water or domestic purposes. A search of the WSEO Ground Water Rights Database for this area showed 31 registered stock and domestic water wells within a 1-mile radius of the POD project area (Figure 3.4). Depths to water range from -1 (flowing aboveground) to 290 feet, and constructed well depths range from -1 to 1,010 feet below the ground surface. For additional information on groundwater, please refer to the PRB FEIS, pages 3-1 through 3-36.

WDEQ water quality parameters for groundwater classifications (Chapter 8 – Quality Standards for Wyoming Groundwater) define the following general limits for Total Dissolved Solids (TDS): 500 milligrams per liter (mg/l) TDS for Drinking Water (Class I); 2,000 mg/l for Agricultural Use

(Class II); and 5,000 mg/l for Livestock Use (Class III) (WDEQ 1985). For additional water quality limits for groundwater, please refer to the WDEQ website.

The ROD for the PRB FEIS 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 FEIS. 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 would 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 CBNG impoundments; and
- Shallow groundwater wells would be installed and monitored where necessary.

The production of CBNG necessitates the removal of some degree of the water saturation in the coal zones to temporarily reduce the hydraulic head in the coal. According to WOGCC, 128 CBNG wells exist within the POD boundary. As a result, the target coal zone pressure may have been reduced through off set water production. In the project locale, existing development consists of in-situ uranium leaching and solution piping. A small wellfield and the associated plant and processing facilities for this purpose are located in the project area.

The Buffalo FO has been monitoring coal zone pressures in the PRB as expressed in depth to water from the land surface since the early 1990s (Figure 3.5). The closest groundwater monitoring well (Kingsbury) was installed by Williams Production RMT Company as a part of the BLM deep groundwater monitoring program; installation of that well was completed in October 2007. The most recent measurement, dated March 4, 2010, recorded the water level at 199.3 feet below ground level, for a decline of 199.3 feet since the well was completed. This level of depressurization is within the potential predicted in the PRB FEIS which was determined through the Regional Groundwater Model for that document. For additional information, please refer to the PRB FEIS Chapter 4 Groundwater and the Wyoming State Geological Survey's Open File Report 2009-10 titled "1993-2006 Coalbed Natural Gas (CBNG) Regional Groundwater Monitoring Report: Powder River Basin, Wyoming," which is available on their website at http://www.wsgs.uwyo.edu.

Additional groundwater monitoring wells are located in the nearby region of the project. Information for these sites is summarized in Table 3.13. With the exception of the Dry Willow well, all of the wells listed in the table are completed in the Big George Coal.

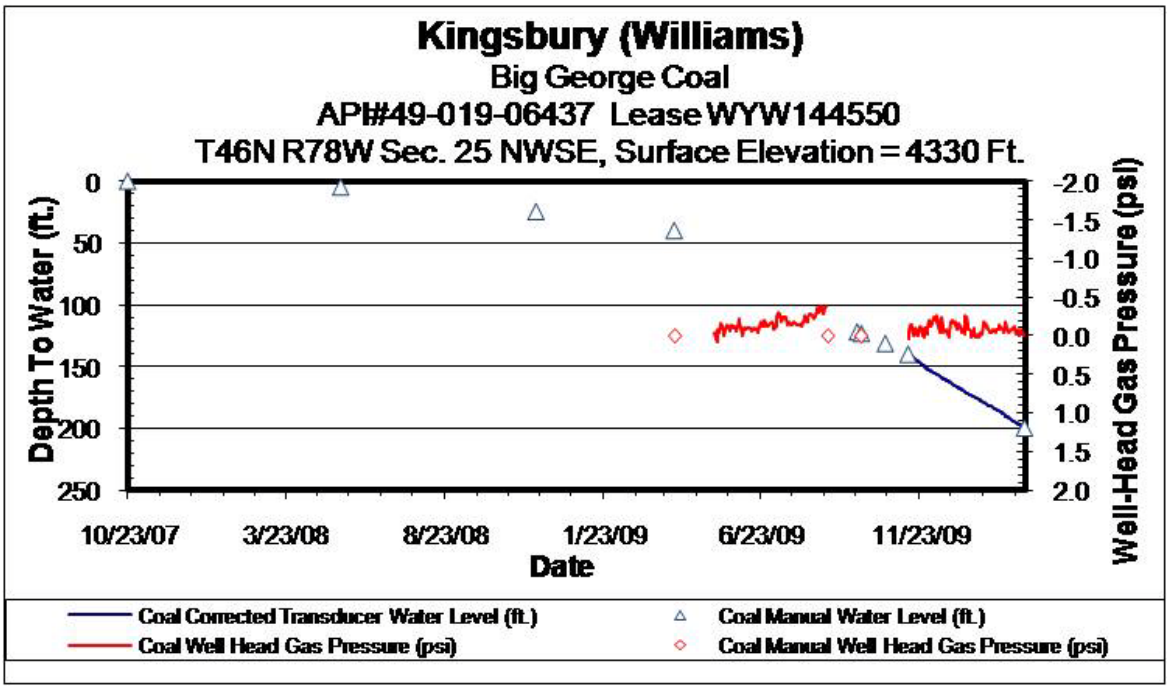


**Figure 3.5 Depth to Water from Surface**

**Table 3.13 Existing Groundwater Monitoring Wells Nearest the Project Area**

| Monitoring Well Name | Legal Description | Approx. Distance from Table Mountain POD (miles, direction) | Initial Coal Water Level (feet bgs)[1] | Recent Coal Water Level (feet bgs)[1] | Ground Surface Elevation (feet) |
|---|---|---|---|---|---|
| Kingsbury | Section 25, T46N, R78W | 8, NW | 0.00 (10/07) | 199.3 (03/10) | 4,328.7 |
| Wormwood | Section 14, T46N, R76W | 11, NE | 262.0 (12/06) | 951.62 (03/10) | 4,574.2 |
| Pistol Point | Section 31, T45N, R75W | 9, E | 456.63 (02/97) | 1,268.6 (06/10) | 5,106 |
| Streeter Rd | Section 22, T43N, R78W | 12, SW | 158.8 (08/04) | 304.82 (03/10) | 4,761 |
| Dry Willow[2] | Section 35, T44N, R76W | 9, SE | 93.8 (09/99) | 92.9 (06/10) | 4,944 |

[1] Below ground surface (bgs), with month and year of measurement.

[2] The Dry Willow well is completed in sands only; data are for the sands.

Source: WSGS 2010b.

From the data in Table 3.13, it can be seen that water level declines in the Big George Coal ranged from about 146 feet (at the Streeter Road well) to about 812 feet (at Pistol Point). At the Dry Willow well, water level data for the sands occasionally range widely, but are for the most part fairly steady. At two locations (Wormwood, Streeter Road), monitoring also has been conducted in overlying sand zones as well as the coal. At Wormwood, the water level in the shallow sand above the coal has remained fairly steady at about 73 feet bgs since December 2006. This suggests little or no hydraulic connection to the Big George Coal. At Streeter Road, water levels in the overlying Wasatch sand initially declined from about 213.5 feet bgs in August 2004, to reach a fairly stable level between 221 and 223 feet bgs from September 2005 to the present.

### 3.4.2. Surface Water

The project area is within the Willow Creek drainage, which is tributary to the Upper Powder River 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]). Drainage features consist of narrow ephemeral draws, steep-sided gullies in various stages of stability or active erosion, and broader meandering streams in alluvial valleys. The latter include Willow Creek and its major tributaries, which may have intermittent flows supported by groundwater contributions for part of the summer. Stratified alluvial deposits of silts and sands occur along the major streams, supporting sagebrush and grasses. Vegetation contributes to stabilizing the drainage network in many parts of the project area and surrounding locale. However, actively eroding, nearly vertical streambanks do occur in some locations. Headcuts, where the stream and gully system is actively migrating upstream into valley deposits, also are present in the project area and the region overall.

The PRB FEIS presents the historic mean Electrical Conductivity (EC, in micromhos per centimeter [µmhos/cm]) and Sodium Adsorption Ratio (SAR) by watershed at selected USGS Gauging Stations in Table 3-11 in the 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 of this EA 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 Upper Powder River, the EC ranges from 1,797 µmhos/cm at maximum monthly flow to 3,400 µmhos/cm at low monthly flow. The SAR ranges from 4.76 at Maximum monthly flow to 7.83 at Low monthly flow. These values were determined at the USGS station located at Arvada, Wyoming (PRB FEIS page 3-49). The agricultural uses of the Powder River in the region are impaired due to selenium (USEPA 2010), a naturally occurring water quality constituent from geologic sources.

The USGS has recently monitored Willow Creek approximately 7 miles north of the project area (Site 06313540), using instantaneous samples taken monthly (USGS-NWIS 2010). Based on available data from March 2008 through May 2010, the maximum measured streamflow was 1.6 cfs, and the minimum was 0.0 cfs. The average recorded flow was approximately 0.34 cfs. Periods of no measurable flow occurred mostly in the winter or late summer. Comparatively greater flows were most common in March or April.

Surface water quality in Willow Creek generally reflects the conditions described above for lower flow conditions in the Powder River. The EC ranged overall from 3,140 to 4,700 µmhos/cm, with an average for the entire data set of 3,690 µmhos/cm. The SAR ranged from 8.5 to 25.0 overall, with an average of approximately 14.0 for the data set. TDS concentrations ranged from 2,530 to 3,210 mg/l, with an average of 2,870 mg/l for the entire data set (USGS-NWIS 2010).

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

## 3.5. Economics and Recovery of CBNG Resources

Development of this project would have effects on the local, state, and national economies. Based on the estimates in the BLM's 2009 Reasonably Foreseeable Development Scenario, the drilling of the 54 (Alternative B) or 52 (Alternative C) proposed wells in the Table Mountain Phase 4 CBNG POD would generate approximately 0.23 billion cubic feet of gas per well, over the life of the well. Actual revenue from this amount of gas is difficult to calculate, as there are several variables contributing to the price of gas at any given time. Regardless of the actual dollar amount, the royalties from the gas produced in the Table Mountain Phase 4 CBNG POD would have several benefits. The Federal government collects

12.5 percent of the royalties from all Federal wells, which helps offset the costs of maintaining the Federal agencies that oversee permitting. In addition to generating Federal income, approximately 49 percent of the royalties from the Table Mountain Phase 4 CBNG POD wells would return to the State of Wyoming. This revenue from mineral development contributes to Wyoming's economy, and allows for improvements in state-funded programs such as infrastructure and education. The development of the Table Mountain Phase 4 CBNG POD project also would provide local revenue by employing workers in the area to build the roads and project infrastructure, drill the wells, and maintain and monitor the project area. This pool of individuals employed to work on the Table Mountain Phase 4 CBNG POD project also would result in an increase in demand for goods and services from nearby communities, primarily those of Casper and Gillette.

### 3.6. Cultural Resources

Class III cultural resource inventory was performed for the Table Mountain Phase 4 POD prior to on-the-ground project work (Buffalo FO Project Number 70090018). Arcadis conducted a block Class III cultural resource inventory following the Archaeology and Historic Preservation, Secretary of the Interior's Standards and Guidelines (48 CFR 190) and the Wyoming State Historic Preservation Office Format, Guidelines, and Standards for Class II and III Reports. Seth Lambert, BLM Archaeologist, reviewed the report for technical adequacy and compliance with BLM standards and determined it to be adequate. Previously reviewed and accepted cultural reports 65930028, 65950070, 65980177 also cover portions of the project area. The sites listed in Table 3.14 are located in or near the project area.

Some of the project area analyzed in this EA occurs on deep alluvial deposits. Alluvial deposits typically have a high potential for buried cultural resources, which are nearly impossible to locate during a Class III inventory.

The Pumpkin Buttes (48CA268) Traditional Cultural Property (TCP) is eligible for the National Register of Historic Places for its association with significant historical events, for its association significant historic individuals, for its ability to provide significant historic and prehistoric information, as a location associated with the traditional beliefs of numerous Native American groups about their cultural history, and as a location where Native American religious practitioners have historically gone to perform ceremonial activities in accordance with traditional cultural rules of practice. Although there is currently ongoing energy development in the vicinity, the setting of the site is considered to be intact and contributes to its eligibility.

**Table 3.14 Cultural Resource Inventory Sites In or Near the Project Area**

| Site Number | Site Type | National Register Eligibility |
|---|---|---|
| 48CA268 | Historic and Prehistoric TCP | Eligible |
| 48CA2352 | Prehistoric Site | Eligible |
| 48CA2362 | Prehistoric Site | Not Eligible |
| 48CA6364 | Prehistoric Site | Not Eligible |
| 48CA6365 | Prehistoric Site | Eligible |
| 48CA6366 | Prehistoric Site | Eligible |
| 48CA6593 | Prehistoric Site | Not Eligible |
| 48CA6594 | Prehistoric Site | Not Eligible |
| 48CA6595 | Prehistoric Site | Not Eligible |
| 48CA6596 | Prehistoric Site | Unevaluated |
| 48CA6597 | Prehistoric Site | Not Eligible |
| 48CA6598 | Prehistoric Site | Not Eligible |
| 48CA6599 | Prehistoric Site | Not Eligible |
| 48JO237 | Prehistoric Site | Not Eligible |
| 48JO963 | Prehistoric Site | Eligible |

**Table 3.14 Cultural Resource Inventory Sites In or Near the Project Area**

| Site Number | Site Type | National Register Eligibility |
|---|---|---|
| 48JO1068 | Prehistoric Site | Not Eligible |
| 48JO1073 | Historic and Prehistoric Site | Not Eligible |
| 48JO1076 | Prehistoric Site | Not Eligible |
| 48JO1077 | Prehistoric Site | Not Eligible |
| 48JO3665 | Historic Linear Resource | Not Eligible |
| 48JO3706 | Prehistoric Site | Not Eligible |
| 48JO3731 | Prehistoric Site | Eligible |
| 48JO3732 | Prehistoric Site | Eligible |
| 48JO3733 | Prehistoric Site | Not Eligible |
| 48JO3734 | Prehistoric Site | Not Eligible |
| 48JO3735 | Prehistoric Site | Not Eligible |
| 48JO3736 | Prehistoric Site | Not Eligible |
| 48JO3737 | Prehistoric Site | Not Eligible |
| 48JO3738 | Prehistoric Site | Not Eligible |
| 48JO3739 | Historic and Prehistoric Site | Eligible |
| 48JO3740 | Prehistoric Site | Not Eligible |
| 48JO3764 | Historic and Prehistoric Site | Not Eligible |
| 48JO4107 | Historic Site | Not Eligible |

## 4. ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental consequences of the No Action Alternative, the Proposed Action (Alternative B), and Alternative C. The effects analysis addresses the direct and indirect effects of implementing Alternatives B or C, the cumulative effects of Alternatives B or C combined with reasonably foreseeable Federal and non-Federal actions, identifies and analyzes mitigation measures (including COAs), and discloses any residual effects remaining following mitigation.

The changes to the originally Proposed Action submitted in 2008 resulted in development of Alternatives B and C. These changes have reduced impacts to the environment that would result from this action; therefore, only the environmental consequences of Alternative B and Alternative C are described below.

### 4.1. Alternative A

The No Action Alternative was analyzed as Alternative 3 in the PRB FEIS and is incorporated by reference into this EA. Information specific to resources for this alternative is included within the PRB FEIS on pages listed in Table 4.1.

**Table 4.1 Location of Discussion of the No Action Alternative in the PRB FEIS**

| Resource | | Type of Effect | Page(s) of PRB FEIS |
|---|---|---|---|
| Project Area Description | Geologic Features and Mineral Resources | Direct and Indirect Effects | 4-129 and 4-134 |
| | | Cumulative Effects | 4-129 and 4-134 |
| Soils, Vegetation, and Ecological Sites | Soils | Direct and Indirect Effects | 4-150 |
| | | Cumulative Effects | 4-152 |
| | Vegetation | Direct and Indirect Effects | 4-163 |
| | | Cumulative Effects | 4-164 |
| | Wetlands/Riparian | Direct and Indirect Effects | 4-178 |
| | | Cumulative Effects | 4-178 |
| Wildlife | Sensitive Species - Greater Sage-Grouse | Direct and Indirect Effects | 4-271 |
| | | Cumulative Effects | 4-271 |

**Table 4.1 Location of Discussion of the No Action Alternative in the PRB FEIS**

| Resource | | Type of Effect | Page(s) of PRB FEIS |
|---|---|---|---|
| | Migratory Birds | Direct and Indirect Effects | 4-234 |
| | | Cumulative Effects | 4-235 |
| | Big Game | Direct and Indirect Effects | 4-186 |
| | | Cumulative Effects | 4-211 |
| | Raptors | Direct and Indirect Effects | 4-224 |
| | | Cumulative Effects | 4-225 |
| Water | Groundwater | Direct and Indirect Effects | 4-63 |
| | | Cumulative Effects | 4-69 |
| | Surface Water | Direct and Indirect Effects | 4-77 |
| | | Cumulative Effects | 4-69 |
| Economics and Recovery of CBNG Resources | | Direct and Indirect Effects | 4-362 |
| | | Cumulative Effects | 4-370 |
| Cultural Resources | | Direct and Indirect Effects | 4-286 |
| Air Quality | | Direct and Indirect Effects | 4-386 |
| | | Cumulative Effects | 4-386 |
| Visual Resources | | Direct and Indirect Effects | 4-313 |
| | | Cumulative Effects | 4-314 |

## 4.2. Alternative B

### 4.2.1. Project Area Description

#### 4.2.1.1. Geologic Features and Mineral Resources

Only resources identified in Section 3.1.1 with potential for impact are addressed in this section; therefore, only activities associated with uranium are addressed here. The potential effects for all minerals associated with Alternative B, with the exception of uranium, are within the analysis parameters and impacts described in the PRB FEIS.

##### 4.2.1.1.1. Direct and Indirect Effects

A potential effect to uranium deposits may include the modification of existing groundwater chemistry, which may result in the oxidation of uranium. Oxidation of uranium results in mobilization, which could lead to depletion of deposits prior to possible ISR activities. Any changes to groundwater chemistry would be dependent on the method of produced water disposal and the geochemistry of the recharged groundwater. Because produced water will not be reinjected within the project area, changes to groundwater chemistry as a result of water disposal are not anticipated.

An additional potential effect could be drawdown of the water table in uranium-rich zones due to pumping of groundwater within the underlying aquifer. Because ISR involves the solubilization of uranium in the subsurface, extensive drawdown in aquifers that share hydraulic connections may inhibit the extraction of uranium deposits due to insufficient water volumes. Uranium deposits suitable for in-situ leaching (ISL) recovery within the POD are within the Wasatch formation, with relatively shallow aquifers confined by relatively impermeable stratigraphic units (COGEMA 2008). There are approximately 800 to over 1,000 feet of shale between the base of the Wasatch Formation and the targeted Big George coal seam in the project area. This is sufficient thickness to reasonably ensure that a restrictive shale layer occurs between the two recovery zones (COGEMA 2008). While artificial hydraulic connections could be created through CBNG well development, the potential could be avoided by proper well construction. The possible direct and indirect effects associated with drawdown are discussed in further detail in Section 4.2.4.

Inhibition of aboveground access for subsurface uranium extraction also may be considered a potential effect of project construction activities. However, because the current method of uranium mining is ISR, limitations to aboveground access for uranium extraction are anticipated to be short-term.

##### 4.2.1.1.2. Cumulative Effects

Direct or indirect impacts to in-situ uranium recovery are anticipated to be insignificant. Development of any future uranium extraction will be assessed and disclosed through permitting, and therefore, impacts to uranium recovery will continue to be addressed. Cumulative impacts on uranium recovery are not anticipated from the proposed project or alternatives.

##### 4.2.1.1.3. Mitigation Measures

COAs, mitigation measures, and operator committed measures discussed in Appendix B would avoid, minimize, and/or mitigate the impacts described above. Additional measures to minimize groundwater drawdown, uranium-bearing groundwater extraction, and changes to groundwater geochemistry due to water mixing include following drilling and well completion procedures in accordance with WOGCC and BLM guidelines. Implementation of operator committed measures and standard COAs (Appendix B, Section B.3) would help avoid negative impacts to groundwater or mitigate impacts if they occurred. This would ensure isolation of groundwater from differing formations during drilling and completion activities.

##### 4.2.1.1.4. Residual Effects

A potential residual effect may include the depletion of groundwater within uranium-bearing units as a result of pumping drawdown. However, as described above, because CBNG and uranium-bearing zone aquifers are not hydraulically connected, residual effects are not anticipated.

#### 4.2.1.2. Land Ownership

The proposed project would not result in any direct or indirect effects to land ownership. Therefore, cumulative effects analysis is not applicable. Likewise, mitigation measures would not be warranted and residual effects would not be applicable.

#### 4.2.1.3. Land Use

##### 4.2.1.3.1. Direct and Indirect Effects

Short-term direct effects would exist for land use within or adjacent to the project area due to construction activities, including land access due to the construction of access roads and wells pads, dust generation, and noise associated with heavy equipment operation. These effects would continue until reclamation of the areas temporarily used for construction of the wells.

Indirect effects include geologic hazards triggered by well development and CBNG production activities. Geologic hazards associated with CBNG production activity are discussed in the PRB FEIS. For details on geologic hazards, refer to the PRB FEIS.

##### 4.2.1.3.2. Cumulative Effects

Because land use within the project area would only be affected on a short-term basis; cumulative effects are not anticipated.

##### 4.2.1.3.3. Mitigation Measures

COAs, mitigation measures, and operator committed measures discussed in Appendix B would avoid, minimize, and mitigate the impacts described above**.**

#### 4.2.1.3.4. Residual Effects

Land use at the wells and along the roads and utility corridors would be converted either permanently or for the duration of the well operation to a mineral development use. During this timeframe, the proposed lands would no longer offer grazing potential.

### 4.2.2. Soils, Vegetation, and Ecological Sites

#### 4.2.2.1. Soils

##### 4.2.2.1.1. Direct and Indirect Effects

The impacts listed below, singly or in combination, would increase the potential for valuable soil loss due to increased water and wind erosion, invasive plant establishment, and increased sedimentation and salt loads to the watershed system.

Impacts anticipated to occur include soil rutting and mixing, compaction, increased erosion potential, and loss of soil productivity. The most notable impacts to soils would occur in association with the construction of well pads, staging areas, and roads. Grading and leveling would be required to construct these facilities with the greatest level of effort required on more steeply sloping areas. During construction, the soil profiles would be mixed with a corresponding loss of soil structure. Mixing may result in removal, dilution, or relocation of organic matter and nutrients to depths where it would be unavailable for vegetative use. Less desirable inorganic compounds such as carbonates, salts, or weathered materials may be relocated and have a negative impact on revegetation.

Construction of wells with no pad and no slot would result in less soil disturbance to the soil resource. No soil would be removed or graded. Where reserve pits are constructed for these wells, soil productivity and soil quality would be altered if subsoil is spread on the surface of the soil.

Soils would be compacted as a result of the construction of well and associated facilities, with compaction maintained, at least in part, by continued vehicle and foot traffic as well as operational activities. 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 leads to a loss of soil structure; decreased infiltration, permeability, and soil aeration; as well as increased runoff and erosion. Increased erosion can lead to a decrease in soil fertility and an increase in sedimentation. The duration and intensity of these impacts would vary according to the type of construction activity to be completed and the inherent characteristics of the soils to be impacted.

The potential for erosion would increase through the loss of vegetation cover and soil structure as compared to an undisturbed state. Soil productivity would decrease, primarily as a result of profile mixing and compaction along with the loss in vegetative cover. A decrease in soil productivity also would occur in association with planned soil salvage and stockpiling activities as microbial action is curtailed, at least to some degree, in the constructed long-term stockpiles. These impacts would begin immediately as the soils would be subjected to grading and construction activities and impacts would continue for the term of operations. The impacts on soils would move to a steady state as construction activities were completed and well production/maintenance operations begin.

Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting physically severs roots and reduces the aeration and infiltration of the soil, thereby degrading the rooting environment. Rutting may result in mixing of topsoil and subsoil, thereby reducing soil productivity. Rutting also disrupts natural surface water hydrology by diverting and concentrating water flows creating accelerated erosion. Soil mixing typically results in a decrease in soil fertility and a disruption of soil structure.

Additional effects to soils resulting from well pad, access roads, and pipeline construction include:

- Loss of soil vegetation cover, biologic crusts, organic matter, and productivity.
- Soil erosion would affect soil health and productivity. Erosion rates are site-specific and are dependent on soil, climate, topography, and cover.
- An important component of soils in Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type, are biological soil crusts, or cryptogamic soils that occupy ground area not covered with vascular plants. Biological soil crusts are important in maintaining soil stability, controlling erosion, fixing nitrogen, providing nutrients to vascular plants, increasing precipitation infiltration rates, and providing suitable seed beds (Belnap et al. 2001). They are adapted to growing in severe climates; however, they take many years to develop (20 to 100) and can be easily damaged or destroyed by surface disturbances associated with construction activities.

None of the proposed staging areas are located on highly erodible soils or low reclamation potential soils. Proposed project roads are primarily located on low to moderate erosion potential soils. Fifteen proposed wells are located on low reclamation potential soils, while 8 wells are located on highly erodible soils. Approximately 8,093 feet of proposed road are on severely erodible soils, while 13,627 feet are poor reclamation potential. Approximately 814 feet of utility and road corridor occur on alluvial land or shale rock land. Four headcuts (erosional drop-offs at the upstream end of active gullies) are known to exist near proposed access roads in the project area. These would not be directly impacted by project development. If headcut migration (which may occur from existing conditions) threatens project roads or well sites, the headcuts would be remediated as described in the WMP and as addressed in the COAs included in Appendix B, Section B.1.1.

Anadarko would take a number of actions to lessen the impacts to soils and maintain soil productivity potential to the degree possible. Operator committed measures and BLM COAs would be implemented to mitigate or reduce the impacts associated with construction and operation. Anadarko has committed to site-specific reclamation plans for areas of concern to reduce site impacts. The topsoil would be salvaged, stockpiled, and returned to graded surfaces as an integral part of the construction of all project elements, thereby reducing the impacts to soil productivity status. Well pads and associated facility disturbances would be re-graded to match existing topography and revegetated following project termination. Appendix B, Section B.1.1 details the revegetation, site stabilization, and reclamation actions Anadarko would take to reduce the impacts to the soil resource. These actions would notably reduce intensity of the impacts to soils as well as the time it would take to return the disturbed soils to a stable and productive state.

Potential erosion and runoff resulting from project activities could lead to sedimentation to surface water. A Wyoming Pollutant Discharge Elimination System (WYPDES) storm water pollution prevention permit for construction activities would address potential surface water impacts from storm water runoff. Appendix B includes typical practices and procedures common to storm water permits for construction activities. The potential for in-channel impacts, and proposed measures to avoid or mitigate them, are addressed in the WMP for the Table Mountain Phase 4 CBNG POD prepared by WWC Engineering, Inc. of Sheridan, Wyoming, for Anadarko. The WMP identifies the locations and peak discharge capacities of proposed culverts draining areas of 5 acres or more. Additional relief and minor culverts serving smaller drainage areas also would be placed. All culverts would be designed and installed in accordance with BLM guidelines. One low water crossing would be constructed on the North Prong of Willow Creek, to reinforce and stabilize the channel and banks. Durable riprap and filter fabric would be used to construct the low water crossing, which would be built so as not to interfere with the natural streamflow or require cross-section modifications (APC 2010). Based on the project proposal, including the WMP and operator committed measures, negligible impacts to stream channels or banks would result from road crossings.

#### 4.2.2.1.2. Cumulative Effects

The designation of the duration of disturbance is defined in the PRB FEIS (pages 4-1 and 4-151). Most soil disturbances would result in short-term impacts with expedient interim reclamation and site stabilization, as committed to by the operator in their MSUP and as required by the BLM in COAs.

Geomorphic effects of roads and other surface disturbance range from chronic and long-term contributions of sediment into waters of the state to catastrophic effects associated with mass failures of road fill material during large storms. Roads can affect geomorphic processes primarily by accelerating erosion from the road surface and prism itself through mass failures and surface erosion processes; directly affecting stream channel structure and geometry; altering surface flow paths, leading to diversion or extension of channels onto previously unchannelized portions of the landscape; and causing interactions among water, sediment, and debris at road-stream crossings.

These impacts, singly or in combination, could increase the potential for valuable soil loss due to increased water and wind erosion, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system.

#### 4.2.2.1.3. Mitigation Measures

COAs, mitigation measures, and operator committed measures discussed in Appendix B would help to mitigate or reduce the impacts noted at well sites as described above.

In addition to the operator committed measures and procedures identified in the WMP, channel crossings by road and pipelines would be constructed perpendicular to the flow. Culverts would 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 would be crossed perpendicular to flow, where possible, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by the BLM. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 feet below the channel bottom.

#### 4.2.2.1.4. Residual Effects

Residual effects were identified in the PRB FEIS at page 4-408 such as the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established.

Construction and operation of roads and drainage crossings could degrade surface drainages from erosion or by increased surface flow. Increased flows could cause downcutting and lateral bank migration in fluvial environments, resulting in increased channel capacity over time within surface drainages. Implementation of the operator committed measures, along with procedures identified in the WMP and additional mitigation measures identified above, would reduce impacts to water resources to negligible levels.

### 4.2.2.2. Vegetation

#### 4.2.2.2.1. General Vegetation

##### 4.2.2.2.1.1. Direct and Indirect Effects

Direct and indirect effects to vegetation are discussed in the PRB FEIS (pages 4-153 to 4-164). Direct effects to vegetation would occur from ground disturbance caused by construction of well pads, compressor stations, ancillary facilities, associated pipelines, and roads. Short-term effects would occur where vegetated areas are disturbed but later reclaimed within 1 to 3 years of the initial disturbance. Long-term effects would occur where well pads, compressor stations, roads, water-handling facilities, or other semi-permanent facilities would result in loss of vegetation and prevent reclamation for the life of the project.

Indirect effects, as described in the PRB FEIS, would include the spread and/or establishment of noxious weeds, the alteration in surface water flows affecting vegetation communities, alteration in ecosystem biodiversity, and changes in wildlife habitat. Changes in surface flow would be mitigated by the transporting of the discharged produced CBNG water to Midwest, Wyoming, where it would be reinjected into the Madison aquifer.

Complete restoration of sagebrush shrubland after disturbance can often take decades. Studies of Wyoming big sagebrush post fire recovery intervals, indicated that post fire regeneration of this species can take 50 to 120 years to regenerate naturally (Cooper et al. 2007; Baker 2006). Wyoming big sagebrush took approximately 17 years to re-establish after chemical removal in Wyoming (Johnson 1969) and sagebrush species can take only 3 to 7 years to begin to spread in locations where seed drilling or transplant of seedlings occurred (Tirmenstein 1999).

##### 4.2.2.2.1.2. Cumulative Effects

Cumulative effects to vegetation from oil and gas development are discussed in the PRB FEIS (pages 4-164 and 4-172). Most surface disturbances would be short-term impacts related to construction activities that would be reclaimed through interim reclamation and site stabilization, as committed to by the operator and as required by the BLM in COAs. The proposed project is planned in an area already heavily impacted by mineral development, which currently represents approximately 20 percent of the land surface within the POD boundary. By comparison, the proposed project represents an additional 2 percent of land surface disturbance within the POD boundary.

Cumulative effects from the discharged produced CBNG water from the Proposed Action would be avoided through transportation of the water via the Salt Creek Pipeline to Midwest, Wyoming, where it would be reinjected into the Madison aquifer.

##### 4.2.2.2.1.3. Mitigation Measures

Impacts to vegetation from surface disturbance would be reduced through the implementation of the mitigation measures in Appendix B; the Table Mountain Phase 4 CBNG POD and its associated plans including the Integrated Weed and Pest Management Plan, the site-specific reclamation plans for well pads and access roads for wells 4475 6-14, 4445 8-32, and 4477 10-21, the WMP, the sage-grouse best management practices (BMPs), and the MSUP.

In addition, the operator would follow the guidance provided in the Wyoming Policy on Reclamation (Instruction Memorandum WY-90-231). The Wyoming Reclamation Policy applies to all surface-disturbing activities. Authorizations for surface-disturbing actions are based upon the assumptions that an area can and ultimately would be successfully reclaimed. BLM reclamation goals emphasize eventual ecosystem reconstruction, which means returning the land to a condition approximate to an approved “Reference Site” or NRCS Ecological Site Transition State. Final reclamation measures are used to achieve this goal. BLM reclamation goals also include the short-term goal of quickly stabilizing disturbed areas to protect both disturbed and adjacent undisturbed areas from unnecessary degradation. Interim reclamation measures are used to achieve this short-term goal.

##### 4.2.2.2.1.4. Residual Effects

Residual effects identified in the PRB FEIS on page 4-408 include the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established.

#### 4.2.2.2.2. Wetlands/Riparian Areas

Effects to wetland and riparian areas from CBNG development are disclosed in the PRB FEIS pages 4-173 to 4-179, including a discussion of direct and indirect impacts, cumulative impacts, and residual impacts. Construction and operation of the proposed wells are not anticipated to directly impact

wetlands or riparian areas. However, operator committed measures referred to in Appendix B and mitigation measures identified in Appendix B, Section B.2.6, would serve to avoid, minimize, and mitigate effects to wetlands and riparian areas.

One low water crossing is planned along a proposed road wherein direct impacts to riparian features would occur in Section 34, T45N, R76W (North Prong of Willow Creek). Unavoidable impacts from linear features crossing wetlands and riparian areas would be mitigated through application of the measures in described in the operator's WMP and the measures included in Appendix B, Section B.2.6.

The produced CBNG water from the Proposed Action would be transported via the Salt Creek Pipeline to Midwest, Wyoming, where it would be reinjected into the Madison aquifer. This would avoid the impacts to wetlands and riparian areas from discharged produced CBNG water in the project area.

##### 4.2.2.2.3. Invasive and Noxious Weed Species

###### 4.2.2.2.3.1. Direct and Indirect Effects

Direct and indirect effects resulting from invasive and/or noxious species are discussed in the PRB FEIS (pages 4-158 to 4-162). The use of existing facilities along with the surface disturbance associated with construction of proposed access roads, pipelines, water management infrastructure, produced water discharge points, and related facilities would present opportunities for weed invasion and spread. Following surface disturbance activities, weeds may readily colonize areas that typically lack or have minimal vegetation cover. As stated in the PRB FEIS, weeds have the ability to displace native vegetation, can reduce the carry capacity for livestock, reduce available habitat for wildlife, and hinder reclamation efforts.

###### 4.2.2.2.3.2. Cumulative Effects

Cumulative effects resulting from weed species are discussed in the PRB FEIS (page 4-171). Species of concern indentified in the PRB FEIS for the PRB are Canada thistle (*Cirsium arvense)*, Scotch thistle (*Onopordum acanthiuim)*, salt-cedar (*Tamarix ramosissima)*, leafy spurge (*Euphorbia esula)*, Russian knapweed (*Centaurea repens)*, and hoary cress (*Cardaria draba)*. All of these species have been identified in the project area.

###### 4.2.2.2.3.3. Mitigation Measures

The operator has committed to the control of noxious weeds and weed species of concern using measures identified in their Integrated Weed and Pest Management Plan. Additionally, successful reclamation through application of the operator's reclamation plans would discourage establishment of invasive species during operations. Likewise, measures incorporated into BLM COAs in Appendix B would further mitigate potential spread and establishment of weed species (e.g., Section B.3.2.2, Condition 1 and Section B.3.2.3, Condition 3).

###### 4.2.2.2.3.4. Residual Effects

Control efforts by the operator would be limited to the surface disturbance associated the implementation of the project. Cheatgrass and other weed species that are present within non-physically disturbed areas of the project area are anticipated to continue to spread unless control efforts are expanded. Cheatgrass and to a lesser extent, Japanese brome (*B. japonicus*) are found in such high densities and numerous locations throughout northeast Wyoming that a control program is not considered feasible at this time; these annual bromes would continue to be found within the project area.

#### 4.2.2.3. Ecological Sites

##### 4.2.2.3.1. Direct and Indirect Effects

Direct and indirect effects to ecological sites are discussed in the PRB FEIS (pages 4-153-4 to 4-164). As proposed, the project would potentially alter the disturbance regimes in the project area, especially the

frequency of fire due to increased activity in the project area. Additional effects include the increase in noxious weeds and alterations in vegetation community diversity and cover.

The discharged produced water from the Proposed Action would be transported via the Salt Creek Pipeline to Midwest, Wyoming, where it would be reinjected into the Madison aquifer. This would avoid the direct and indirect impacts to ecological sites from discharged produced water in the project area.

##### 4.2.2.3.2. Cumulative Effects

Cumulative effects to ecological sites are discussed in the PRB FEIS (pages 4-153 to 4-172). Cumulative effects to ecological sites include the further alteration of disturbance regimes from the increased activity, increase in noxious weeds, and alterations in vegetation community's diversity and cover.

##### 4.2.2.3.3. Mitigation Measures

Impacts to vegetation from surface disturbance would be reduced through the implementation of the mitigation measures in Appendix B; the Table Mountain Phase 4 CBNG POD and its associated plans including the Integrated Weed and Pest Management Plan, the site-specific reclamation plans for well pads and access roads for wells 4475 6-14, 4445 8-32, and 4477 10-21, the WMP, the sage-grouse BMPs, and the MSUP.

##### 4.2.2.3.4. Residual Effects

The alteration of biodiversity of ecological sites could result from changes in disturbance regimes, alterations in vegetation in reclaimed areas, and the spread and establishment of weed species.

### 4.2.3. Wildlife and Protected Species

In its *Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats* (WGFD 2009), WGFD developed impact thresholds to evaluate impacts to wildlife from oil and gas development. For species or habitats discussed in this EA where impact thresholds have been developed, those thresholds are disclosed and discussed both in relation to the current conditions (Affected Environment) and in relation to reasonable foreseeable development, including development associated with the proposed project (Impacts Analysis). Moderate impacts occur when impairment of habitat function becomes discernable. High impacts occur when impairment of habitat function increases. Extreme impacts occur where habitat function is substantially impaired. Mitigation for each level of impact is discussed in the guidelines. Thresholds for impacts generally are determined by well densities.

#### 4.2.3.1. Habitat Types

##### 4.2.3.1.1. Direct and Indirect Effects

Direct effects to wildlife habitats due to surface disturbances would cause direct loss of habitat and habitat fragmentation. These impacts would result from construction and operation of the proposed project. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and the displacement of more mobile species into adjacent habitats. Displacement also could result in some local reductions in wildlife populations, if adjacent habitats are at carrying capacity.

Project-related surface disturbance also would result in an incremental increase in habitat fragmentation, until reclamation has been completed and vegetation is re-established. Impacts to wildlife species from habitat fragmentation effects in the project area include, but are not limited to, increased noise levels, elevated human presence, dispersal of noxious weeds and invasive species, and dust deposition from project construction and unpaved road traffic, which would extend beyond the boundaries of the proposed project facilities. These effects would result in changes in habitat quality, habitat loss, increased animal displacement, reductions in local population and breeding success, and species composition. However, the severity of these effects on terrestrial wildlife would depend on factors such as sensitivity of the species,

seasonal use, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, and climate).

##### 4.2.3.1.2. Cumulative Effects

Approximately 20 percent of the surface within the POD has been exposed to existing development and is considered previously disturbed. Impacts to wildlife habitats are discussed in the section on Vegetation and the PRB FEIS (page 4-1 and page 4-151).

##### 4.2.3.1.3. Mitigation Measures

Impacts to wildlife habitats from surface disturbance would be reduced through the implementation of the mitigation measures in Appendix B; the Table Mountain Phase 4 CBNG POD and its associated plans including the Integrated Weed and Pest Management Plan, the site-specific reclamation plans for well pads and access roads for wells 4475 6-14, 4445 8-32, and 4477 10-21, the WMP, the sage-grouse BMPs, and the MSUP.

##### 4.2.3.1.4. Residual Effects

Residual effects identified in the PRB FEIS on page 4-408 include the loss of vegetative cover (i.e., wildlife habitats), despite expedient reclamation, for several years until reclamation is successfully established.

#### 4.2.3.2. Federally Threatened, Endangered, Proposed, and Candidate Species

##### 4.2.3.2.1. Blowout Penstemon and Ute Ladies'-Tresses Orchid

There are no known populations or the presence of suitable habitat for blowout penstemon within the project area. Implementation of the proposed project would have no effect on the blowout penstemon. Likewise, there are no known populations of Ute ladies'-tresses orchid or the presence of suitable habitat within the project area. Implementation of the proposed project would have no effect on the Ute ladies'-tresses orchid. As a result, cumulative effects and residual effects are not applicable. Mitigation measures beyond those proposed by the operator to encourage successful reclamation are not proposed.

##### 4.2.3.2.2. Proposed Species, including Mountain Plover

###### 4.2.3.2.2.1. Direct and Indirect Effects

Direct and indirect effects to mountain plover are discussed in the PRB FEIS (pages 4-254 to 4-255). Suitable mountain plover habitat is present, but limited within the project area. The presence of mountain plover has not been documented within the project area during surveys from 2006 through 2010.

Mountain plovers have been forced to seek habitat that may be poor quality habitat when loss or alteration of their natural breeding habitat (predominantly prairie dog colonies) occurs, such as heavily grazed land, burned fields, fallow agriculture lands, roads, oil and gas well pads, and pipelines. These areas could become reproductive sinks. Adult mountain plovers may breed there, lay eggs and hatch chicks; however, the young may not reach fledging age due to the poor quality of the habitat.

Recent analysis of the USWFS Breeding Bird Survey data suggests that mountain plover populations have declined at an annual rate of 3.7 percent a year over the last 30 years, which represents a cumulative decline of 63 percent during the last 25 years (Knopf and Rupert 1995).

Use of roads and disturbed construction areas by mountain plovers may increase their vulnerability to vehicle collision. Designing roads for a travel speed up to 25 miles per hour provides drivers an opportunity to notice and avoid mountain plovers and allows mountain plovers sufficient time to escape from approaching vehicles. Even if a nesting plover flushes in time, the nest likely would still be destroyed.

#### 4.2.3.2.2.2. Cumulative Effects

The cumulative impacts to mountain plovers are discussed in the PRB FEIS.

#### 4.2.3.2.2.3. Mitigation Measures

Mitigation measures for mountain plover are listed in Appendix B, Section B.2.9. In addition, mountain plovers undetected by surveys that may use the area would receive some protection from raptor and sage-grouse timing limitations.

#### 4.2.3.2.2.4. Residual Effects

There is potential for plovers to be impacted by project-related traffic outside the project boundary and a potential for impacts if individuals were undetected at the time of survey.

### 4.2.3.2.3. Candidate Species

#### 4.2.3.2.3.1. Greater Sage-grouse

##### 4.2.3.2.3.1.1. Direct and Indirect Effects

Impacts to sage-grouse associated with energy development are discussed in detail in the *12-Month Findings for Petitions to List the Greater Sage-Grouse (Centrocercus urophasianus) as Threatened or Endangered* (b). Impacts to sage-grouse are generally a result of loss and fragmentation of sagebrush habitats associated with roads and infrastructure. Research indicates that sage-grouse hens also avoid nesting in developed areas.

Noise can affect sage-grouse by preventing vocalizations that influence reproduction and other behaviors (WGFD 2003). In a study of greater sage-grouse population response to natural gas field development in western Wyoming, Holloran (2005) concluded that increased noise intensity, associated with active drilling rigs within 5 kilometers (3.1 miles) of leks, negatively influenced male lek attendance. In 2002, Braun et al. documented approximately 200 CBNG facilities within 1 mile of sage-grouse leks. Sage-grouse numbers were found to be consistently lower for these leks than for leks without this disturbance. Direct habitat losses from the facilities themselves, roads and traffic, and the associated noise were found to be the likely reason for this finding.

Infrastructure associated with noise concerns includes wellhead compressors. Currently, 27 of the 54 well sites would utilize wellhead compressors. Of the 27 well sites with wellhead compressors, 17 of the sites would require sage-grouse stipulations due to the proximity of suitable breeding habitat. Wells in close proximity to the Christensen Ranch 3 and Christensen Ranch 7 leks include: 4477 11-22, 4477 11-23, 4477 10-43, 4476 7-12, 4477 12-43, and 4476 6-14. However, well location approval was granted by the BLM on a well-specific basis as a result of the field onsite review (i.e., existing infrastructure within close proximity, location adjustment outside the 0.25-mile buffer, limited suitable sagebrush habitat) and with the application of timing stipulations addressed in Appendix B.

In its *Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats*, WGFD (2009) categorized impacts to sage-grouse by number of well pad locations per square mile within 2 miles of a lek and within identified nesting/brood-rearing habitats greater than 2 miles from a lek. Studies indicate that oil or gas development exceeding approximately one well pad per square mile resulted in calculable impacts on breeding sage-grouse populations (Holloran 2005; Walker et al. 2007). According to WGFD (2009) recommendations, the extreme threshold of impact occurs at a CBNG well density of three wells per square mile. Extreme impacts are those that occur within 2 miles of leks or within identified nesting/brood-rearing habitat, and cause loss or impairment of habitat function that cannot be mitigated onsite and would lead to eventual abandonment of most leks. Under Alternative B, there are 54 proposed wells within the project area in addition to the 143 already existing within the POD. Well density would be 11.1 wells per square mile, well above the one well per square mile

recommendation by the State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development (2008).

Excluding the Table Mountain Phase 4 CBNG POD, there are approximately 1,745 existing wells (http://wogcc.state.wy.us/2010) within the 4-mile cumulative effects analysis area (approximately 242.2 square miles). The existing well density is approximately 7.2 wells per section, already considered an extreme level of impact on sage-grouse. With approval of Alternative B (54 proposed well locations), well density would increases to 7.4 wells per square mile, remaining well above the one well per square mile recommendation by the State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development (2008).

**4.2.3.2.3.2. Cumulative Effects**

Recent research suggests that the cumulative and synergistic effects of current and foreseeable CBNG development within the vicinity of the project area would be likely to impact the local sage-grouse population, cause declines in lek attendance, and may result in local extirpation. The cumulative impact assessment area for this project encompasses the project area and the area that is encompassed by a 4-mile radius around the 14 sage-grouse leks that occur within 4 miles of the project boundary. Analysis of impacts up to 4 miles was recommended by the State Wildlife Agencies' Ad Hoc Committee for Consideration of Oil and Gas Development Effects to Nesting Habitat (2008). Furthermore, the multi-state recommendations presented to the WGFD for identification of core sage-grouse areas acknowledges there may be times when development in important sage-grouse breeding, summer, and winter habitats cannot be avoided. In those instances they recommend, "…infrastructure should be minimized and the area should be managed in a manner that effectively conserves sagebrush habitats" (State Wildlife Agencies' Ad Hoc Committee for Sage-grouse and Oil and Gas Development 2008). The sage-grouse population within northeast Wyoming has been exhibiting a steady long-term downward trend, as measured by lek attendance (WGFD 2008). Research suggests that these declines may be a result, in part, of CBNG development, as discussed in detail in USFWS (2010a).

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

The PRB FEIS acknowledged and disclosed anticipated effects on sage-grouse in the PRB by stating that "the synergistic effect of several impacts would likely result in a downward trend for the sage-grouse population, and may contribute to the array of cumulative effects that may lead to its Federal listing. Local populations may be extirpated in areas of concentrated development, but viability across the Project Area (Powder River Basin) or the entire range of the species is not likely to be compromised (page 4-270)." Based on the impacts described in the PRB Oil and Gas Project FEIS and the findings of more recent research, the Proposed Action may contribute to a decline in male attendance at the 4 leks that occur within 4 miles of the project area, and, potentially, extirpation of the local grouse population.

The Governor's Sage Grouse Implementation Team developed a "Core Population Area" strategy in an effort to conserve the greater sage-grouse population in Wyoming encouraging development outside of core areas (WGFD 2010). The Governor's Executive Order 2008-2, Greater Sage-Grouse Core Area Protection, provides direction for managing sage-grouse in core areas and non-core areas. This project proposal occurs in a non-core area for sage-grouse management and also is outside the possibility of a "connectivity" corridor (WGFD 2010).

Energy development began in the PRB in the late 1800s, but development accelerated after the 1960s and has included mainly coal mining, conventional oil, and development of CBNG (BLM 2005). Energy-related disturbance in the PRB is projected to increase from 220,257 acres in 2003 to 514,732 acres in 2020 (BLM 2005), but the area of sagebrush-specific disturbance is unknown. While reclamation measures have been, or would be applied to most of this area, habitat function for sage-grouse would not recover for many decades. Sage-grouse would re-occupy disturbed areas following ecological recovery (Braun 1998). However, energy-related disturbances are occurring at much greater rates than ecosystem recovery. Consequently, energy-related impacts to sage-grouse accrue as disturbance advances across the landscape.

##### 4.2.3.2.3.3. Mitigation Measures

The Buffalo FO RMP (BLM 2001) and the PRB FEIS (BLM 2003) included a 2-mile timing limitation on surface-disturbing activities around sage-grouse leks. The 2-mile measure originated with the Western Association of Fish and Wildlife Agencies (BLM 2004). Wyoming BLM adopted the 2-mile recommendation in 1990 (BLM 1990).

The 2-mile recommendation was based on early research indicating that most nests were located within 2 miles of a lek (BLM 2004). However, recent research conducted within the Great Plains portion of the sage-grouse range indicated that nest location is related more to habitat quality (e.g., concealment) than to lek proximity (Herman-Brunson et al. 2009). For example, Moynahan et al. (2007) found that 40 percent of sage-grouse hens nested further than 3 miles from leks in northcentral Montana. Recent research in the PRB suggests that impacts to leks from energy development are discernable out to a minimum of 4 miles, and that some leks within this radius have been extirpated as a direct result of energy development (Walker et al. 2007; Naugle et al. *In press*). Based on these studies, the BLM has determined that a 2-mile timing limitation is insufficient to prevent population decline. Consequently, timing stipulations to protect breeding, nesting, and brood-rearing sage-grouse were considered as potentially applicable to the entire POD area. However, application of timing restriction COAs were applied on a well-specific basis as a result of the field onsite review (i.e., consideration of the well in proximity to a lek and presence of suitable sagebrush habitat). These COAs are included in Appendix B, Section B.1., Site-specific Conditions of Approval.

##### 4.2.3.2.3.4. Residual Effects

While measures designed to reduce effects to sage-grouse were employed throughout the planning process, it is likely that the proposed activity would further degrade habitat effectiveness and depress sage-grouse recruitment and survival in the area. These effects were analyzed and disclosed in the PRB FEIS, page 4-270.

#### 4.2.3.3. BLM-Sensitive Species

The BLM would take necessary actions to meet the policies set forth in sensitive species policy (BLM Manual 6840). BLM Manual 6840.22A states, “The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other Proposed Actions and to develop sound conservation practices. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary.” The PRB FEIS discusses impacts to sensitive species on pages 4-257 to 4-265.

#### 4.2.3.3.1. Bald Eagle

Impacts to bald eagles are discussed in the PRB FEIS on pages 4-251 to 4-253. For this project, activities associated with the project may impact bald eagles by disturbing birds foraging in the area. A study completed in 2004 suggests that two-tracks and improved project roads pose minimal collision risk to bald eagles whose habits include feeding on road-side carcasses. In 1 year of monitoring road-side animal carcasses, the BLM Buffalo FO reported 439 carcasses, including 226 along Interstates (51 percent), 193 along paved highways (44 percent), 19 along gravel county roads (4 percent), and 1 along an improved CBNG road (<1 percent) (Bills 2004). No road-killed eagles were reported; bald and golden eagles were observed feeding on 16 of the reported road-side carcasses (<4 percent). The risk of big-game vehicle-related mortality along CBNG project roads is so insignificant or discountable that when combined with the lack of bald eagle mortalities associated with highway foraging leads to the conclusion that CBNG project roads do not affect bald eagles.

The cumulative effects for bald eagles associated with Alternative B are described in the PRB FEIS (pages 4-251 to 4-253). Mitigation measures and Conditions of Approval are listed in Appendix B, specifically Section B.2.9.1. No residual effects are anticipated.

#### 4.2.3.3.2. Brewer's Sparrow

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.3. Ferruginous Hawk

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Impacts expected from project actions are described in the Raptor section. Additionally, due to the territorial nature of ferruginous hawks, there is greater potential for disturbance to nesting ferruginous hawks. However, no active ferruginous hawk nests were identified during the 2010 surveys and therefore, adverse impacts to this species are not anticipated. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.4. Loggerhead Shrike

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.5. Sage Sparrow

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.6. Sage Thrasher

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.7. Western Burrowing Owl

The PRB FEIS discusses impacts, including direct and indirect effect, cumulative effects, and residual effects, to sensitive species on pages 4-257 to 4-273. Impacts expected from project actions are described in the Raptor section. Use of roads may increase owl vulnerability to vehicle collision.

The Thunder Basin National Grasslands in Campbell County, Wyoming, who cooperated with the BLM in the creation of the 2003 PRB FEIS, recommends a 0.25-mile timing restriction buffer zone for burrowing nest locations during their nesting season (April 15 to August 31). Instruction Memorandum No. 2006-197, directs the field offices to "use the least restrictive stipulations that effectively accomplish the resource objectives or uses." Alteration of the general raptor nest timing limitation (February 1 to July 31) to a more specific burrowing owl nesting season timing limitation would effectively reduce the vulnerability of owls to collision while shortening the timing restriction period to 4.5 months (see Chapter 3 for breeding, nesting, and migration chronology) from 6.5 months and from 0.5 mile to 0.25 mile.

Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4. Application of the BLM's MBTA MOU with the USFWS would serve to further mitigate potential effects to this migratory bird.

#### 4.2.3.3.8. Black-tailed Prairie Dog

Impacts to black-tailed prairie dogs are discussed in the PRB FEIS on pages 4-255 to 4-256. One proposed road passes through the prairie dog colony in Section 33, T45N, R76W. Therefore, there would be direct habitat loss associated with the road construction and vehicle traffic would increase prairie dog mortality along the road. The PRB FEIS discusses cumulative and residual impacts to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4.

#### 4.2.3.3.9. Swift Fox

The PRB FEIS discusses impacts to swift fox on page 4-265. The PRB FEIS discusses cumulative and residual impacts to sensitive species on pages 4-257 to 4-273. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4.

### 4.2.3.4. Big Game

The PRB FEIS discusses impacts, including direct and indirect effects, cumulative effects and residual effects, to big game on pages 4-181 to 4-215. The cumulative effects associated with Alternative B are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, pages 4-181 to 4-215. Mitigation measures and Conditions of Approval are listed in Appendix B, including operator committed measures in Section B.4.

### 4.2.3.5. Migratory Birds

#### 4.2.3.5.1. Direct and Indirect Effects

Direct and indirect effects to migratory birds are discussed in the PRB FEIS (pages 4-231 to 4-235). Disturbance of habitat within the project area is likely to impact migratory birds. Native habitats would be lost directly with the construction of wells, roads, and pipelines. Reclamation and other activities that occur in the spring may be detrimental to migratory bird survival. Prompt revegetation of short-term disturbance areas should reduce habitat loss impacts. Activities would likely displace migratory birds farther than the immediate area of physical disturbance. Drilling and construction noise can be troublesome for songbirds by interfering with the males' ability to attract mates and defend territory, and the ability to recognize calls from conspecifics (BLM 2003).

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

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

Migratory bird species within the PRB nest in the spring and early summer and are vulnerable to the same effects as sage-grouse and raptor species. Though no timing restrictions are typically applied specifically to protect migratory bird breeding or nesting, where sage-grouse or raptor nesting timing limitations are applied, nesting migratory birds also are protected. Where these timing limitations are not applied and migratory bird species are nesting, migratory birds remain vulnerable.

##### 4.2.3.5.2. Cumulative Effects

The cumulative effects associated with Alternative B are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, page 4-235.

##### 4.2.3.5.3. Mitigation Measures

Migratory bird species within the project area nest in the spring and early summer and are vulnerable to the same effects as sage-grouse and raptor species. Though no timing restrictions typically are applied specifically to protect migratory bird breeding or nesting, where sage-grouse or raptor nesting timing limitations are applied, nesting migratory birds also would receive protection. These mitigation measures are outlined in Appendix B, Section B.1.2. Migratory birds also would be afforded protection under the BLM's MBTA MOU with the USFWS.

##### 4.2.3.5.4. Residual Effects

Those species and individuals that are still nesting when the sage-grouse timing limitations are over (June 15) may have nests destroyed or disturbed by construction activities. Sage-grouse timing limitations would apply to the entire project. Protections around active raptor nests (February 1 to July 31) extend past most migratory bird nesting seasons. Only a percentage of known nest are active any given year, so the protections for migratory birds from June 15 to July 31 would depend on how many raptor nests are active.

#### 4.2.3.6. Raptors

##### 4.2.3.6.1. Direct and Indirect Effects

Human activities in close proximity to active raptor nests may interfere with nest productivity. Romin and Muck (1999) indicate that activities within 0.5 mile of a nest are prone to cause adverse impacts to nesting raptors. If mineral activities occur during nesting, they could be sufficient to cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to

overheating or chilling of eggs or chicks and can result in egg or chick mortality. Prolonged disturbance also can lead to the abandonment of the nest by the adults. Routine human activities near these nests also can draw increased predator activity to the area and resulting in increased nest predation.

To reduce the risk of decreased productivity or nest failure, the BLM Buffalo FO requires a 0.5 mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructures requiring human visitation be located in such a way as to provide adequate biologic buffer for nesting raptors. A biologic buffer is a combination of distance and visual screening that provides nesting raptors with security such that they would not be flushed by routine activities. Twenty-six of the 34 raptor nests documented within the POD are within 0.5 mile of project components (Table 4.2).

**Table 4.2 Proposed Project Infrastructure within 0.5 mile of Documented Raptor Nests**

| BLM Raptor Nest ID | Infrastructure Count | | | |
|---|---|---|---|---|
| | # of Wells | # of Culverts | # of Power Drops | Roads/Corridors (miles) |
| 10369 | 4 | 2 | 3 | 0.97 |
| 10370 | 2 | 5 | 3 | 0.98 |
| 10371 | 2 | 5 | 3 | 1.00 |
| 10372 | 4 | 2 | 3 | 1.11 |
| 10375 | 3 | 10 | 2 | 2.99 |
| 10379 | 4 | 2 | 1 | 1.57 |
| 10381 | 5 | 8 | 2 | 2.78 |
| 10665 | 4 | 3 | 1 | 1.57 |
| 4088 | 1 | 1 | 0 | 0.00 |
| 4208 | 0 | 0 | 1 | 0.86 |
| 5024 | 0 | 0 | 1 | 1.16 |
| 5319 | 1 | 1 | 0 | 0.46 |
| 5547 | 2 | 2 | 2 | 1.30 |
| 5548 | 2 | 3 | 1 | 0.87 |
| 6377 | 3 | 3 | 2 | 1.24 |
| 6381 | 3 | 11 | 2 | 2.98 |
| 6383 | 2 | 2 | 2 | 2.98 |
| 6385 | 0 | 5 | 1 | 0.00 |
| 6386 | 0 | 3 | 0 | 0.07 |
| 6387 | 3 | 3 | 2 | 1.24 |
| 6492 | 0 | 6 | 0 | 1.26 |
| 8373 | 1 | 4 | 0 | 0.76 |

Source: BLM 2010c.

An additional analysis on disturbance to raptor nest sites from proposed well and associated infrastructure locations also was conducted during site visits with the BLM wildlife biologist in the spring of 2010. A line-of-sight distance at the proposed locations also was evaluated from the highest point (approximately 6 feet) of infrastructure.

According to the onsite analysis, two proposed wells would create adverse impacts to two raptor nests, including repeated disturbance from human presence potentially resulting in nest failures. Wells 4476 8-43 and 4477 13-21 would be within 0.5 mile of multiple raptor nests and would be within 0.25 mile and line-of-sight of documented raptor nests, including one active red-tailed hawk nest. Several other nests were within 0.25 mile of proposed well sites, including 4477 11-34, 4476 8-23, 4477 13-21, and 4477 14-41, but were not within line-of-sight. Additionally, coordination with the BLM biologist during the onsite

field review decreased the potential for adverse impacts by modifying the locations or approving the proposed location based on existing infrastructure.

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

##### 4.2.3.6.2. Cumulative Effects

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

##### 4.2.3.6.3. Mitigation Measures

Measures intended to avoid, minimize, and mitigate impacts to raptors are outlined in Appendix B, including operator committed measures and site-specific Conditions of Approval in Section B.1.2.1. For example, to reduce the risk of adverse impacts to nesting raptors, no surface-disturbing activity would occur within 0.5 mile of all identified raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey. Surveys shall be conducted by a biologist following the most current BLM protocol. All survey results must be submitted in writing to the Buffalo FO and approved prior to initiation of surface-disturbing activities. A 0.5-mile timing restriction would be applied if a nest is identified as active. In addition, well metering, maintenance and other site visits within 0.5 mile of raptor nests should be minimized during the breeding season (February 1 to July 31).

##### 4.2.3.6.4. Residual Effects

There would be an increase in traffic, construction activity, and human presence in the area throughout the life of the project that would affect the quality of the area for nesting raptors. Timing limitations during the construction phase of the project would protect nests from disturbance, but there would be activities during well operation that may discourage raptors from using the nest locations. Specifically, development of wells 4476 8-43 and 4477 13-21 would likely cause abandonment of the raptor nests within line-of-sight for the duration of the well operations.

### 4.2.4. Water Resources

The operator has submitted a comprehensive WMP for this project (APC 2010). It is incorporated-by-reference into this EA pursuant to 40 CFR 1502.21. The WMP incorporates sound water management practices; monitoring of potential impacts Upper and Lower Willow Creek watersheds, as well as the other tributary watersheds within the POD (mainly Little Willow Creek); and the commitment to comply with Wyoming State water laws and regulations. The WMP also addresses potential landowner concerns and impacts to the water resources environment. Qualified hydrologists, in consultation with the BLM, developed the water management plan. Adherence with the plan, in addition to BLM applied mitigation (in the form of COAs), would reduce project-area and downstream impacts from proposed water management strategies.

It should be noted that the proposed management of produced water for the Table Mountain Phase 4 CBNG POD is to transport the water via the Salt Creek Pipeline to Midwest, Wyoming, where it would be reinjected into the Madison Aquifer. A number of alternatives for managing CBNG-produced water were evaluated for the project, and transport by pipeline to reinjection wells has been proposed by Anadarko as the selected water management strategy. Therefore, no surface discharge of CBNG-produced water would be associated with the Table Mountain Phase 4 CBNG POD (APC 2010).

Operator committed measures are listed in Appendix B of this EA. Potential impacts to water resources would be avoided or mitigated by implementation of the measures described for the construction phase and the operations/maintenance phase. In addition, resource-specific measures described for groundwater,

surface water, and wetland/riparian areas (Section B.2) would avoid or mitigate impacts to these resources when implemented by the operator.

The maximum water production is predicted to be 20 gallons per minute (gpm) per well or for the 54 wells proposed, the maximum water production is anticipated to be 1,080 gpm (approximately 2.41 cfs or 1,741 acre-feet per year) (APC 2010). This initial production rate is anticipated to decline approximately 30 percent during the first year, and an additional 10 percent per year thereafter (APC 2010). The PRB FEIS projected the total amount of water 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, page 2-26 in the PRB FEIS). For the Upper Powder River drainage, the projected volume produced within the watershed area was approximately 60,319 acre-feet in 2010 (the maximum production was estimated to be 171,423 acre-feet in 2006). As such, the volume of water resulting from the production of these wells would be 2.9 percent of the total volume projected for the Year 2010. This volume of produced water would be within the predicted parameters of the PRB FEIS.

#### 4.2.4.1. Groundwater

##### 4.2.4.1.1. Direct and Indirect Effects

No surface discharge is proposed for the Table Mountain Phase 4 CBNG POD. The proposed management of produced water for the project is to transport the water via the Salt Creek Pipeline to and reinject it into the Madison Aquifer near Midwest, Wyoming. Under those circumstances, no infiltration near surface discharge points or impoundments would occur. Saturation of near-surface alluvium would not occur, and groundwater quality issues related to produced-water recharge in underlying aquifers of the Wasatch and Fort Union formations would be avoided.

Based on representative data provided in the WMP, the water quality projected for this POD is approximately 1,940 mg/l TDS, with a pH of 7.4, and SAR of 14.8, and an EC of 3,300 µmhos/cm (APC 2010). CBNG produced water from the project would be reinjected under Anadarko's existing WDEQ Underground Injection Control (UIC) Permit, UIC 05-231, using an existing wellfield approximately 27 miles southwest of the project area. Negligible impacts to the Madison Aquifer in the Midwest area would result from the proposed water management.

In the PRB, the Madison Formation typically is isolated from the commonly used water-bearing zones of the Wasatch or Fort Union formations by two regional confining units (Whitehead 1996). These confining units typically consist of Upper Cretaceous-aged shales, chalk, and bentonite from the Lewis Shale downward to the Mowry Shale, and older rocks of Jurassic to Pennsylvanian age consisting of interbedded shales, limestones, and sandstones of the Morrison Formation and older rocks (Whitehead 1996). No impacts to Wasatch or Fort Union aquifers are anticipated from the proposed reinjection of CBNG produced water.

The PRB FEIS predicts that one of the environmental consequences of coal bed natural gas production is possible impacts to groundwater in nearby wells. "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 other wells in the area. The other (non-CBNG) permitted water wells produce from depths that range from -1 to 1,010 feet bgs, whereas the proposed CBNG wells would produce from the Big George Coal Zone at depths from approximately 1,400 to 2,000 feet bgs. The operator has committed to offer water well agreements to holders of properly permitted domestic and stock wells within the circle of influence (0.5 mile of a Federal CBNG producing well) of the proposed wells.

Additional wells in the project area have been used for ISL and ISR of uranium. These existing wells (or new installations) may be used for future uranium recovery (COGEMA 2008). The potential for impacts to uranium operations from pumping CBNG wells is limited by the stratigraphic and hydrogeologic setting of the project area. The ISL operations move uranium-bearing solutions by water injection and groundwater pumping. These activities are conducted in sandstone zones within the Wasatch Formation, at considerably shallower depths than CBNG recovery zones (COGEMA 2008).

Uranium deposits suitable for ISL recovery are typically associated with relatively shallow aquifers confined by relatively impermeable stratigraphic units (COGEMA 2008). In the project area, typically there are 800 to over 1,000 feet between the base of the Wasatch Formation and the Big George coal seam. The intervening lithology is primarily shale, and there is sufficient thickness to reasonably ensure that a restrictive shale layer occurs between the two recovery zones (COGEMA 2008). Drawdown from the CBNG coal would be greatly attenuated by the shales, and would be unlikely to reach the Wasatch ISL recovery zones.

However, artificial hydraulic connections from open boreholes or wells completed over multiple aquifers could create localized drawdown interactions between CBNG and ISL pumping activities (COGEMA 2008). These occurrences are likely to be infrequent, and could be avoided by proper well construction, plugging, and abandonment. As of 2008, monitoring of water level recovery in four ore sand wells in the Christensen Ranch ISR production area did not show additional effects from CBNG production, and CBNG production in the area had not discernibly affected uranium ore sands in the area (COGEMA 2008). Groundwater modeling using a MODFLOW simulation generally corroborated these findings on a wider basis, with results indicating that CBNG drawdown would generally propagate beyond one or two alternating sand/shale stratigraphic sequences in close vertical proximity above the target coal. The study concluded that CBNG-induced drawdown would not have a measurable impact on water levels in the shallower Wasatch ore sands unless there is an artificial connection between an improperly completed well or an improperly plugged and abandoned borehole (COGEMA 2008).

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 stored within the Wasatch - Tongue River sand and coals, and sands units above and below the coals is almost 750 million acre-feet of recoverable groundwater are (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).

#### 4.2.4.1.2. 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).

No measurable direct or indirect impacts to ISR of uranium are anticipated. Also, because of the stratigraphic and hydraulic considerations previously discussed, it is unlikely that in-situ uranium operations would directly or indirectly affect CBNG production. Therefore, no cumulative effects on the aquifers or their uses are anticipated from the proposed project or alternatives.

Development of CBNG through 2018 (and coal mining through 2033) would remove 4 million acre-feet of groundwater from the coal zone aquifer (PRB FEIS page 4-65). This volume of water "…cumulatively represents 0.5 percent of the recoverable groundwater stored in the Wasatch – Tongue River sands and coals (nearly 750 million acre-feet, from PRB FEIS Table 3-5). All of the groundwater projected to be removed during reasonably foreseeable CBNG development and coal mining would represent less than

0.3 percent of the total recoverable groundwater in the Wasatch and Fort Union Formations within the PRB (nearly 1.4 billion acre-feet, from Table 3-5)" (PRB FEIS page 4-65).

##### 4.2.4.1.3. Mitigation Measures

Adherence to the drilling COAs (Appendix B, Section B.3), the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and utilizing proper cementing procedures should protect any fresh water aquifers above the target coal zone. This would ensure that groundwater would not be adversely impacted by well drilling and completion operations. Implementation of operator committed measures and programmatic mitigation measures identified in the PRB FEIS (Appendix B) would help avoid negative impacts to groundwater or mitigate impacts if they occurred. No additional site-specific Conditions of Approval would be required.

##### 4.2.4.1.4. Residual Effects

As described in Chapter 3.4.1, the production of CBNG in this project area has already removed some of the water saturation in the coal zones for the production of gas. Because of this existing condition, the actual production of CBNG water from the project may be less than anticipated.

### 4.2.4.2. Surface Water

#### 4.2.4.2.1. Direct and Indirect Effects

##### 4.2.4.2.1.1. Produced Water Quality

Table 4.3 shows the average values of EC and SAR as measured at selected USGS gauging stations at high and low monthly flows as well as the Wyoming groundwater quality standards for TDS and SAR for Class I to Class III water (there is no current standard for EC). It also shows constituent limits for TDS, SAR, and EC detailed in the project area WYPDES permit, and the concentrations found in the POD's representative water sample.

**Table 4.3 Comparison of Regulated Water Quality Parameters to Predicted Water Quality**

| Sample location or Standard | TDS mg/l | SAR | EC µmhos/cm |
|---|---|---|---|
| Primary Watershed: Powder River at Arvada WY (USGS 06317000)[1] | | | |
| Historic Data Average at Maximum Flows | | 4.76 | 1,797 |
| Historic Data Average at Minimum Flows | | 7.83 | 3,400 |
| Secondary Watershed at Willow Creek Gauge (USGS 06313540) [2] | | | |
| Historic Data Average at Maximum Flows[3] | 2,506 | 13.36 | 3,456 |
| Historic Data Average at Minimum Flows[4] | 2,290 | 9.02 | 3,972 |
| WDEQ Quality Standards for Wyoming Groundwater for an Individual UIC Permit, Based on Water Use Classes in Receiving Formation [5] | | | |
| Drinking Water (Class I) | | | |
| Agricultural Use (Class II) | 500 | | |
| Livestock Use (Class III) | 2,000 | 8 | |
| Industrial Class IV (A) | 5,000 | | |
| Industrial Class IV (B) | 10,000 | | |
| | >10,000 | | |
| Predicted Produced Water Quality | | | |
| Coal Zone (Big George) | 1,940 | 14.8 | 3,300 |

[1] BLM 2003.
[2] USGS-NWIS 2010.
[3] Represents conditions for the upper 25 percent of recorded flows.
[4] Represents conditions for the lower 25 percent of recorded flows.
[5] WDEQ 2005.

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 page 4-69). The water quality projected for this POD is 1,940 mg/l TDS, which is within the WDEQ criteria for agricultural use (2,000 mg/l TDS). The SAR anticipated from the target coal exceeds the historic measured parameters at USGS Gaging Stations; 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 Big George 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 20 gpm per well (approximately 0.045 cfs or 72.5 acre-feet per year) is expected to be produced for this POD. For the 54 wells proposed, the maximum water production is anticipated to be 1,080 gpm (approximately 2.41 cfs or 1,741 acre-feet per year) (APC 2010). These initial production rates would be anticipated to decline approximately 30 percent during the first year, and an additional 10 percent per year thereafter (APC 2010).

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 would be sampled at the wellhead for analysis within 60 days of initial production. A copy of the water analysis would be submitted to the BLM authorized officer.

For more information, refer to the WMP included in the Table Mountain Phase 4 Administrative Record, available for review at the BLM Buffalo FO.

##### 4.2.4.2.1.2. Springs, Flowing Wells, and Impoundments

As listed in Attachment B of the operator's WMP, six flowing wells are known to occur within 1 mile of the project area. All of these occur along or near Lower Willow Creek with the exception of one in an upland setting northeast of Table Mountain in the southwest quarter of Section 26, T45N, R77W (Figure 3.4). These wells are permitted for stock watering or domestic uses, with permitted yields ranging from 3.0 to 13.5 gpm. The development of coal bed natural gas and the production of water in the area surrounding these existing features may affect their flow rate or water quality. The operator has committed to offer water well agreements to holders of permitted domestic and stock wells within the circle of influence (0.5 mile of a Federal CBNG producing well) of the proposed wells.

No springs are known to occur within one mile of the project boundary. Two impoundments occur within the project area. These are the Grover stock tank in the SE¼, NE¼, Section 9, T44N, R77W, and the Christensen impoundment in the NE¼, SE¼, Section 5, T44N, R76W. The latter has a capacity of approximately 13.1 acre-feet.

#### 4.2.4.2.2. Cumulative Effects

The analysis in this section includes cumulative data from Fee, State, and Federal CBNG development in the Upper Powder River watershed. The actual produced water data were obtained from the WOGCC (2010).

As of December 2009, all producing CBNG wells in the Upper Powder River watershed have discharged a cumulative volume of 255,531 acre-feet of water compared to the predicted 1,285,233 acre-feet disclosed in the PRB FEIS (Table 2-8, page 2-26). This volume is 22.5 percent of the total predicted produced water through 2009, as analyzed in the PRB FEIS for the Upper Powder River watershed. On an

annual basis, actual produced water volumes ranged from about 13 to 49 percent of the predicted annual volumes. These values are presented in Table 4.4 and graphically in Figure 4.1.

**Table 4.4 CBNG Produced Water Comparisons**

| Year | Upper Powder River Predicted (Annual acre-feet) | Upper Powder River Predicted (Cumulative acre-feet from 2002) | Upper Powder River Actual (Annual acre-feet)[1] | Percent of Predicted | Upper Powder River Actual (Cumulative acre-feet from 2002) | Percent of Predicted |
|---|---|---|---|---|---|---|
| 2002 | 100,512 | 100,512 | 15,846 | 15.8 | 15,846 | 15.8 |
| 2003 | 137,942 | 238,454 | 18,578 | 13.5 | 34,424 | 14.4 |
| 2004 | 159,034 | 397,488 | 20,991 | 13.2 | 55,414 | 13.9 |
| 2005 | 167,608 | 565,096 | 27,640 | 16.5 | 83,054 | 14.7 |
| 2006 | 171,423 | 736,519 | 40,930 | 23.9 | 123,984 | 16.8 |
| 2007 | 163,521 | 900,040 | 42,602 | 26.1 | 166,586 | 18.5 |
| 2008 | 147,481 | 1,047,521 | 45,936 | 31.1 | 212,522 | 20.3 |
| 2009 | 88,046 | 1,135,567 | 43,009 | 48.8 | 255,531 | 22.5 |
| 2010 | 60,319 | 1,195,886 | | | | |
| 2011 | 44,169 | 1,240,055 | | | | |
| 2012 | 23,697 | 1,263,752 | | | | |
| 2013 | 12,169 | 1,275,921 | | | | |
| 2014 | 5,672 | 1,281,593 | | | | |
| 2015 | 2,242 | 1,283,835 | | | | |
| 2016 | 1,032 | 1,284,867 | | | | |
| 2017 | 366 | 1,285,233 | | | | |
| **Total** | **1,285,233** | | **255,531** | | | |

[1] WOGCC 2010.

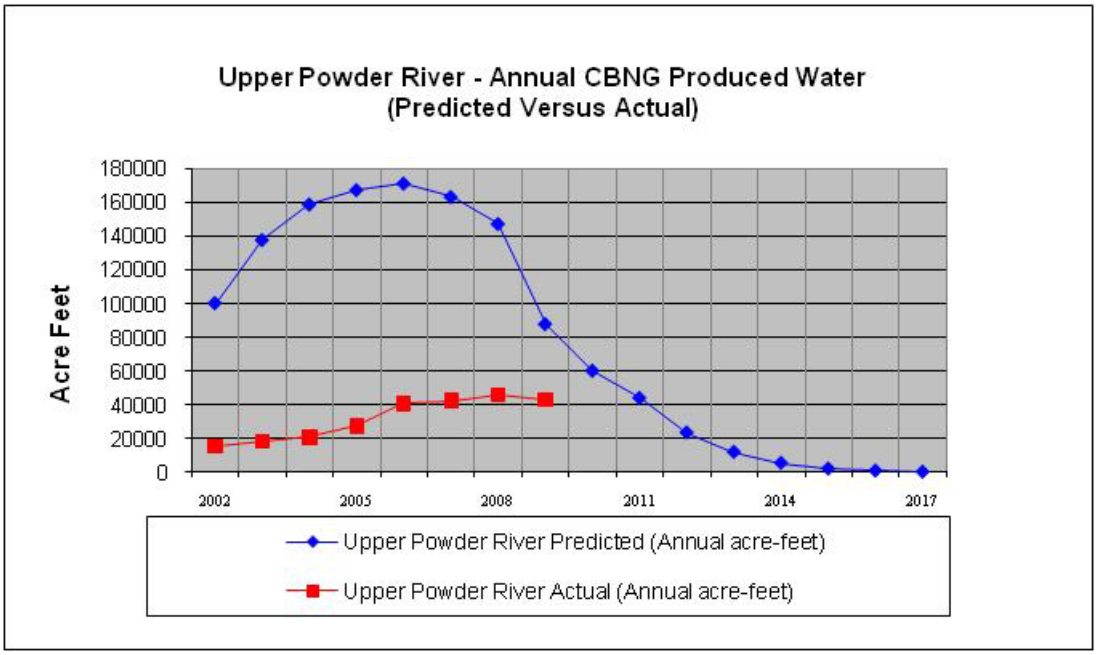


**Figure 4.1 Annual CBNG Water Production Comparisons**

The PRB FEIS identified downstream irrigation water quality as the primary issue for CBNG produced water. 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 10 primary watersheds in the PRB. These predictions of EC and SAR can only be reevaluated when additional water quality sampling is available.

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

1. They are proportional to the actual amount of cumulatively produced water in the Upper Powder River drainage, which is approximately 22.5 percent of the total predicted in the PRB FEIS.
2. This project would not discharge any CBNG produced water to the surface.

Refer to the PRB FEIS, pages 4-115 through 4-117 and Table 4-13 for cumulative effects relative to the watershed and page 4-117 for cumulative effects common to all sub-watersheds.

##### 4.2.4.2.3. Mitigation Measures

Operator committed measures and programmatic mitigation measures identified in the PRB FEIS apply and are included in Appendix B (Section B.2.2) in order to avoid, minimize, and mitigate negative effects. Because no produced water discharges would occur from the proposed project or alternatives, no site-specific Conditions of Approval would be required.

##### 4.2.4.2.4. Residual Effects

Because no produced water discharges would occur from the proposed project or alternatives, no residual effects would result.

### 4.2.5. Economics and Recovery of CBNG Resources

Direct and indirect effects to the socioeconomic structure of Johnson and Campbell counties as a result of project implementation would be as described in the PRB FEIS. Likewise, cumulative effects associated with Alternative B are within the analysis parameters and impacts described in the PRB FEIS starting on page 4-336. No mitigation is warranted and no residual effects are expected.

### 4.2.6. Cultural Resources

#### 4.2.6.1. Direct and Indirect Effects

The proposed Table Mountain Phase 4 POD will not physically impact the Pumpkin Buttes TCP (48CA268), but infrastructure is proposed within two miles of the TCP boundary within the setting of the site. The first draft of the project proposed installing pump jacks on wells within two miles of the Pumpkin Buttes TCP. Pump jacks would create a strong visual contrast that cannot be mitigated under the Programmatic Agreement (PA) between the Bureau of Land Management and the Wyoming State Historic Preservation Officer (SHPO) Regarding Mitigation of Adverse Effects to the Pumpkin Buttes TCP from Anticipated Federal Minerals Development in Campbell County, Wyoming (Pumpkin Buttes PA), and would require full consultation with both the Wyoming SHPO and interested tribes. As a result, Anadarko removed the pump jacks from the proposed plan. In the future, if Anadarko wishes to install pump jacks on wells within 2 miles of the Pumpkin Buttes TCP boundary, full consultation with SHPO and the tribes will be required. As designed, the project complies with the mitigation measures described in the Pumpkin Buttes PA. All mitigation measures described in appendices A-G of the Pumpkin Buttes PA will be applied as COAs to the Table Mountain Phase 4 POD. The mitigation measures are standard best management practices intended to reduce visual contrast and will be incorporated during all phases

(drilling, construction, operation, reclamation, etc.). Construction of 14 wells (all Federal wells in Section 34 T45N R76W, 4476 5-34, 4476 5-43, 4476 8-23, 4476 8-32, 4476 8-41, and 4476 8-43) and their associated infrastructure will result in a finding of "no adverse effect" on the setting of the Pumpkin Buttes TCP. The determination is dependent on Anadarko committing to the mitigation measures described in appendices A-G of the Pumpkin Buttes PA.

Proposed construction activities are planned through eligible prehistoric sites 48CA6365/48JO3763 and 48JO963. 48CA6365/48JO3763 currently has an existing crown and ditch road running through the site. The proposed utility corridor will be installed within the existing disturbance of the road. The site has been testing for contributing/non-contributing portions and the existing disturbance is considered a non-contributing portion of the site. 48JO963 also has been tested for contributing/non-contributing portions. The proposed utility corridor is considered to be in a non-contributing portion. Therefore, the BLM has determined a finding of "no adverse effect" to these eligible historic properties.

Following the Wyoming State Protocol Section VI(B)(1) the BLM determined that the project will result in a "No Adverse Effect." The BLM electronically notified the Wyoming SHPO on September 30, 2010.

#### 4.2.6.2. Cumulative Effects

Construction and development of oil and gas resources impacts cultural resources through ground disturbance, unauthorized collection, and visual intrusion of the setting of historic properties. This results in fewer archaeological resources available for study of past human life-ways, changes in human behavior through time, and interpreting the past to the public. Additionally, these impacts may compromise the aspects of integrity that make a historic property eligible for the National Register of Historic Places. Recording and archiving basic information about archaeological sites in the proposed project area serve to partially mitigate potential cumulative effects to cultural resources.

Fee actions constructed in support of Federal actions can result in impacts to historic properties. Construction of large plans of coalbed natural gas development on split estate often include associated infrastructure that is not permitted through BLM. Project applicants may connect wells draining fee minerals, or previously constructed pipelines on fee surface with a Federal plan of development. BLM has no authority over such development which can impact historic properties. BLM has the authority to modify or deny approval of Federal undertakings on private surface, but that authority is limited to the extent of the Federal approval. Historic properties on private surface belong to the surface owner and they are not obligated to preserve or protect them. The BLM may go to great lengths to protect a site on private surface from a Federal undertaking, but the same site can be legally impacted by the landowner at any time. The cumulative effect of numerous Federal approvals can result in impacts to historic properties. Archaeological inventories reveal the location of sites and although the BLM goes to great lengths to protect site location data, information can potentially get into the wrong hands. BLM authorizations that result in new access can inadvertently lead to impacts to sites from increased visitation by the public.

#### 4.2.6.3. Mitigation Measures

The incorporation of the mitigation measures to reduce visual contrast as outlined in the appendices of the Pumpkin Buttes PA will result in a finding of "no adverse effect" to the Pumpkin Buttes TCP. These mitigating measures include techniques such as narrow corridor widths and a reduction of vegetation and surface disturbance.

All surface disturbing activities within 200 feet of eligible historic properties 48CA6365/48JO3763 and 48JO963 will be monitored by a Cultural Resource Use Permitee (CRUP). The CRUP shall notify the Buffalo FO cultural staff no less than three days in advance of construction activities.

When a project is constructed in an area with a high potential for buried cultural material, archaeological monitoring is often included as a condition of approval. Construction monitoring is performed by a qualified archaeologist working in unison with construction crews. If buried cultural resources are located by the archaeologist, construction is halted and the BLM consults with the SHPO on mitigation or avoidance. Due to the presence of alluvial deposits the operator will be required to have an archaeologist monitor all earth moving activities associated with certain construction, as described in the site-specific COAs (Appendix B, Section B.1). All surface disturbing activity in the following areas will be monitored by a BLM CRUP holder or permitted crew chief: alluvial or eolian deposits along Willow Creek and North Prong Willow Creek. The BLM has identified these areas as having a high potential for buried cultural deposits (i.e., areas containing alluvial or eolian deposits near Willow Creek and North Prong Willow Creek). Some portions of the monitoring areas as described may lie outside alluvial or eolian deposits and exact monitoring areas are left to the discretion of the archaeological monitor. All monitored areas must be plotted on the map provided with the monitoring report. The submission of two copies of a monitoring report to Buffalo FO is required within 30 days of the completion of all monitoring work.

If any cultural values (e.g., sites, artifacts, human remains as described in the PRB FEIS, Appendix L) are observed during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo FO Field Manager will be notified. Further discovery procedures are explained in the standard COAs identified in the PRB FEIS ROD (Appendix B, Section B.3).

##### 4.2.6.4. Residual Effects

During the construction phase, there will be numerous crews working across the project area using heavy construction equipment without the presence of archaeological monitors. Due to the extent of work and the surface disturbance caused by large vehicles, it is possible that unidentified cultural resources can be damaged by construction activities. The increased human presence associated with the construction phase also can lead to unauthorized collection of artifacts or vandalism of historic properties.

## 4.3. Alternative C

### 4.3.1. Project Area Description

#### 4.3.1.1. Geologic Features, Mineral Resources, Land Ownership, and Land Use

The project area description associated with Alternative C is the same as those described for Alternative B, with the exception that two wells, 4476 8-43 and 4477 13-21, and associated facilities would not be constructed. Direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B above for geologic features, mineral resources, land ownership, and land use. Likewise, application of mitigation measures would not differ between Alternatives B and C.

### 4.3.2. Soils, Vegetation, and Ecological Sites

#### 4.3.2.1. Soils

Impacts associated with Alternative C do not differ appreciably from those described for Alternative B; impacts to soil resources would be slightly reduced for Alternative C. There would be slightly less impact (by one well) to severely erodible soils and poor reclamation potential soils. Direct and indirect effects, cumulative effect, residual effects, and application of mitigation measures associated with Alternative C do not differ appreciably from those described for Alternative B.

#### 4.3.2.2. Vegetation

##### 4.3.2.2.1. Wetlands/Riparian Areas and Weed Species

Implementation of Alternative C would reduce disturbance to vegetation by two wells and associated infrastructure. Overall, direct and indirect effects, cumulative effects, and residual effects would be largely similar to those indicated for Alternative B. Likewise, application of mitigation measures would not differ appreciably between the alternatives.

#### 4.3.2.3. Ecological Sites

Implementation of Alternative C would reduce disturbance to vegetation by two wells and associated infrastructure. Overall, direct and indirect effects, cumulative effects, and residual effects would be largely similar to those indicated for Alternative B. Likewise, application of mitigation measures would not differ appreciably between the alternatives.

### 4.3.3. Wildlife and Protected Species

#### 4.3.3.1. Habitat Types

Implementation of Alternative C would reduce disturbance to wildlife habitats by two wells and associated infrastructure. Overall, direct and indirect effects, cumulative effects, and residual effects would be largely similar to those indicated for Alternative B. Likewise, application of mitigation measures would not differ appreciably between the alternatives.

#### 4.3.3.2. Threatened, Endangered, Proposed, and Candidate Species

Direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

##### 4.3.3.2.1. Proposed Species

Direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

##### 4.3.3.2.2. Candidate Species,

###### 4.3.3.2.2.1. Greater Sage-grouse

Alternative C would reduce disturbance to sage-grouse habitat by two wells and associated infrastructure. The reduction of two wells within the project area would not reduce the average density of wells per square mile and, in association, the level of impact to sage-grouse leks. Therefore, direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

#### 4.3.3.3. BLM-Sensitive Species

Alternative C would reduce disturbance to BLM-sensitive species habitats by two wells and associated infrastructure. However, direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

#### 4.3.3.4. Big Game

Direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

#### 4.3.3.5. Migratory Birds

Alternative C would reduce disturbance to migratory bird habitats by two wells and associated infrastructure. However, direct and indirect effects, cumulative effects, and residual effects associated with Alternative C do not differ appreciably from those described for Alternative B. Likewise, application of mitigation measures would not differ appreciably between Alternatives B and C.

#### 4.3.3.6. Raptors

Direct and indirect impacts as a result of implementation of Alternative C would be similar to Alternative B with one notable exception. By eliminating two wells (4476 8-43 and 4477 13-21) and associated infrastructure (e.g., roads to the wells) from the project area, adverse impacts to raptors would be avoided or minimized at two active raptor nests. The removal of the two wells from the project would reduce disturbance to the nest site and reduce the chance for nest failure. Furthermore, Alternative C would reduce the risk for non-compliance with the MBTA and violation of the BLM's MBTA MOU with the USFWS.

The cumulative effects associated with Alternative C would be similar to those described above for Alternative B. Residual effects under Alternative C would be slightly reduced but would not differ appreciably when compared to Alternative B.

### 4.3.4. Water Resources

#### 4.3.4.1. Groundwater and Surface Water

Direct and indirect effects to groundwater and surface water for Alternative C would be similar to those described for Alternative B. Impacts to groundwater resources would be slightly reduced for this alternative as a result of a minor reduction in produced-water volumes. The cumulative effects and residual effects associated with Alternative C are similar to those described above for Alternative B. Furthermore, mitigation measures would be the same as those listed under Alternative B.

### 4.3.5. Economics and Recovery of CBNG Resources

Direct and indirect effects to the socioeconomic structure of Johnson and Campbell counties as a result of project implementation would be as described in the PRB FEIS and are similar to Alternative B with one exception. Implementation of Alternative C would result in slightly less natural gas recovery. The estimated lost natural gas under Alternative C (two less wells than Alternative B) is shown in Tables 4.5 and 4.6.

**Table 4.5 CBNG Gas Lost Without Any Surrounding Wells Drilled**

| Section | Township | Range | Well Name | Unrecovered CBNG (million cubic feet of gas) |
|---|---|---|---|---|
| 8 | 44N | 76W | TM-CBM Fed 4476 8-43 | 577.227 |
| 13 | 44N | 77W | TM-CBM Fed 4477 13-21 | 760.335 |

**Table 4.6 CBNG Gas Lost if Surrounding 80-acre Wells are Drilled**

| Section | Township | Range | Well Name | Unrecovered CBNG (million cubic feet of gas) |
|---|---|---|---|---|
| 8 | 44N | 76W | TM-CBM Fed 4476 8-43 | 63.495 |
| 13 | 44N | 77W | TM-CBM Fed 4477 13-21 | 83.637 |

Similar to Alternative B, the cumulative and residual effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. No additional mitigation measures would be required.

### 4.3.6. Cultural Resources

Direct and indirect effects to cultural resources for Alternative C would be similar to those described for Alternative B, with one exception. Impacts to the TCP would be slightly reduced for this alternative as a result of the removal of well 4476 8-43. The cumulative effects and residual effects associated with Alternative C are similar to those described above for Alternative B. Furthermore, mitigation measures

would be the same as those listed under Alternative B, negating the application of the Pumpkin Buttes PA for well 4476 8-43.

### 4.4. Summary of Effects

Table 4.7 provides a comparison of the cumulative effects associated with the alternatives.

**Table 4.7 Summary of Environmental Consequences for Table Mountain Phase 4 CBNG POD by Alternative**

| Resource/Species | Alternative A | Alternative B | Alternative C |
|---|---|---|---|
| Vegetation | No additional land disturbance. | Greatest vegetation cover loss. | Least vegetation cover loss. |
| Wetlands/Riparian Areas | No existing wetlands/ riparian areas would be disturbed. | One stream would be disturbed due to roads. | Same as Alternative B. |
| **Wildlife** | | | |
| Big Game | No habitat loss or fragmentation. Would likely see increased traffic passing through due to surrounding mineral development. | Greatest habitat loss. | Least habitat loss. |
| | | Greatest habitat fragmentation. | Least habitat fragmentation. |
| Raptors | No habitat loss. | Greatest foraging habitat fragmentation. | Least foraging habitat fragmentation. |
| | No wells authorized near nests. | 30 nests within 0.5 mile of wells and associated infrastructure (54 new wells). | Same as Alternative B (52 new wells). |
| | No new wells within 0.25 mile and line-of-site of raptor nests. | Two wells within 0.25 mile and line-of-site of two raptor nests. Adverse impacts to nesting individuals anticipated. | Same as Alternative A. |
| Migratory Birds | No habitat loss. | Greatest habitat loss. | Least habitat loss. |
| | No habitat fragmentation. | Greatest habitat fragmentation. | Least habitat fragmentation. |
| **Threatened and Endangered Species** | | | |
| Ute Ladies'-tresses Orchid | No loss to individuals. | No loss to individuals. | No loss to individuals. |
| Blowout Penstemmon | No loss to individuals. | No loss to individuals. | No loss to individuals. |
| Greater Sage-grouse | No habitat loss. | Greatest habitat loss. | Least habitat loss. |
| **Sensitive Species** | | | |
| Multiple Species | No habitat loss. | Greatest habitat loss. | Least habitat loss. |
| **Economics and Recovery of CBNG Resources** | | | |
| CBNG Development | Greatest loss of CBNG. | Least loss of CBNG. | Minimal loss of CBNG. |

## 5. CONSULTATION AND COORDINATION

Agencies and other parties summarized in Table 5.1 were consulted on the proposed project to confirm compliance with applicable laws and regulations.

**Table 5.1 Consultations**

| Contact | Title | Organization | Present at Field Review(s) |
|---|---|---|---|
| Dan Sellers | Natural Resource Specialist | BLM | Yes |
| Pat Cole | Wildlife Biologist | BLM | Yes |
| Casey Friese | Hydrologist | BLM | Yes |
| Stacey Gunderson | Civil Engineer | BLM | Yes |
| Seth Lambert | Archaeologist | BLM | Yes |
| Gabrielle Borin | Third-Party NEPA Contractor | AECOM | Yes |
| Doree DuFresne | Third-Party NEPA Contractor | AECOM | Yes |
| John Christenson | Landowner | Private | Yes |
| Tom Clayson | Regulatory Affairs Advisor | Anadarko | Yes |
| Mary Mondragon | Permitting Manager | Anadarko | Yes |
| Peter Angelos | S. I. Contractor | Anadarko | Yes |
| Clint Beaver | Land Agent | Anadarko | Yes |
| Chuck Cornelius | Inspection Boss | Anadarko | Yes |
| Curt Downing | Engineer | Anadarko | Yes |
| Jerry Greer | Lands | Anadarko | Yes |
| Craig Klaatsen | Roads | Anadarko | Yes |
| Colt Rodeman | Infrastructure (Field) | Anadarko | Yes |
| John Emmerich, comments on project received via letter dated April 27, 2010 (WER 12103.08) | Deputy Director | Wyoming Game and Fish | 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 ROD. Additionally, Anadarko currently is in possession of an individual Underground Injection Control permit from the WDEQ to inject coal bed methane water into the Madison Formation in Natrona County (Permit No. 05-231).

## 7. REFERENCES AND AUTHORITIES

Anadarko Petroleum Company (APC). 2010. Table Mountain Phase 4 CBNG POD, including the Master Multi-Point Surface Use and Operations Plan, Master Drilling Prognosis, Integrated Weed and Pest Management Plan, Water Management Plan, individual Applications for Permit to Drill, mapping, and other relevant information . Originally prepared in October 2008; subsequently revised July 2010. Anadarko Petroleum Company, Denver, Colorado.

Baker, W. L. 2006. Fire and Restoration of Sagebrush Ecosystems. Wildlife Society Bulletin 34(1):177-185.

Bartos. T. T. and K. Muller Ogle. 2002. Water Quality and Environmental Isotopic Analyses of Ground-water Samples Collected from the Wasatch and Fort Union Formations in Areas of Coalbed Methane Development – Implications to Recharge and Ground-Water Flow, Eastern Powder

River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 02-4045, 88 p.

Belnap J., J. H. Kaltenecker, R. Rosentreter, J. Williams, S. Leonard, and D. Eldridge. 2001. Biological soil crusts: Ecology and management. In: P. Peterson, editor. January 2001. U.S. Department of the Interior, Bureau of Land Management (BLM), U.S. Geological Survey (USGS), Forest and Rangeland Ecosystem Science Center, Denver, Colorado. BLM Technical Reference 1730-2, 110 pp.

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

Big Horn Environmental Consultants (BHEC). 2010. Table Mountain Phase 4 Wildlife Survey and Habitat Report. Prepared for Anadarko Petroleum Corporation. Sheridan, Wyoming. 10 pp.

Braun C. E. 1998. Sage-grouse declines in western North America: what are the problems? Proceedings of the Western Association of State Fish and Wildlife Agencies. 67:134–144.

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 67th North American Wildlife and Natural Resources Conference. Pp 337-349.

Chapman, S. S., S. A. Bryce, J. M. Omernik, D. G. Despain, J. ZumBerge, and M. Conrad. 2004. Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and photographs): USGS (map scale 1:1,400,000). USGS, Reston, Virginia.

Cogema Mining, Inc. (COGEMA). 2008. U.S. NRC License Renewal Application, Source Material License SUA-1341, Irigary and Christensen Ranch Projects. With Appendix B, "Coalbed Methane Water Production". Submitted to the U.S. Nuclear Regulatory Commission. Internet URL: http://adamswebsearch2.nrc.gov/idmws/ViewDocByAccession.asp?AccessionNumber=ML081850689. Accessed September 8, 2010

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines for management of sage-grouse populations and habitats. Wildlife Society Bulletin 28:967-985.

Cooper, S. V., P. Lesica, and G. M. Kudray. 2007. Post-fire Recovery of Wyoming Big Sagebrush Shrub-steppe in Central and Southeast Montana. Report to the United States Department of the Interior, Bureau of Land Management, State Office. Montana Natural Heritage Program, Helena, Montana. 16 pp. plus appendices.

Downey, J. S. 1984. Geohydrology of the Madison and Associated Aquifers in Parts of Montana, North Dakota, South Dakota, and Wyoming. USGS Professional Paper 1273-G. U.S. Government Printing Office, Washington, D.C.

Federal Emergency Management Agency. 2010. FEMA Map Service Center search for current and historic flood maps for Johnson and Campbell counties, Wyoming. Internet website: http://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?catalogId=10001&storeId=10001&categoryId=12001&langId=-1&userType=G&type=1&future=false. Accessed July 24, 2010.

Grenier, M., B. Oakleaf, K. Taylor, and M. Hymas. 2004. *Inventory and Mapping of Black tailed Prairie Dogs in Wyoming – An Estimate of Acreage Completion Report*.

Hayden-Wing Associates, LLC (HWA). 2008. Anadarko Petroleum Corporation Table Mountain Phase IV POD Wildlife Surveys – 2008. Prepared for Anadarko Petroleum Corporation. Laramie, Wyoming. October 2008.

Herman-Brunson, K. M., K. C. Jensen, N. W. Kaczor, C. C. Swanson, M. A. Rumble, and R. W. Klaver. 2009. Nesting ecology of greater sage-grouse *Centrocercus urophasianus* at the eastern edge of their historic range. Wildlife Biology 15:237-246.

Holloran, M. J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming. PhD Dissertation. University of Wyoming. Laramie, Wyoming. 211pp.

Ingelfinger, F. and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. Western North American Naturalist 64:385-395

Johnson, W. M. 1969. Life expectancy of a sagebrush control in central Wyoming. Journal of Range Management. 22: 177-182.

Knopf, F. L. and J. R Rupert. 1995. Habits and habitats of Mountain Plovers in California. Condor 97:743-751.

Love, J. D. and A. C. Christiansen, 1985. Geologic Map of Wyoming: USGS. Internet website: http://tin.er.usgs.gov/geology/state. Accessed July 27, 2010.

Lyon, A. G. and S. H. Anderson. 2003. Potential gas development impacts on sage-grouse nest initiation and movement. Wildlife Society Bulletin 31:486-491.

Naugle et al. In press.

Meffe, G. K. and C. R. Carroll. 1994. Principles of Conservation Biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Moynahan, B. J., M. S. Lindberg, J. J. Rotella, and J. W. Thomas. 2007. Factors affecting nest survival of greater sage-grouse in north-central Montana. Journal of Wildlife Management 71:1773-1783.

Noss, R. F. and A. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Defenders of Wildlife and Island Press, Washington, D.C.

Primack, R. B. 1993. Essentials of conservation biology. Sinauer Associates, Sunderland, Massachusetts,

Romin, L. A. and J. A. Muck. 1999. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances. U.S. Fish and Wildlife Service, Salt Lake City, Utah. May 1999.

State Wildlife Agencies' Ad Hoc Committee for Sage-grouse and Oil and Gas Development. 2008. Using the best available science to coordinate conservation actions that benefit greater sage-grouse across states affected by oil and gas development in Management Zones I-II (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming). Unpublished report. Colorado Division of Wildlife, Denver; Montana Fish, Wildlife and Parks, Helena; North Dakota Game and Fish Department, Bismarck; Utah Division of Wildlife Resources, Salt Lake City; Wyoming Game and Fish Department, Cheyenne.

Temple S. A. 1986. Predicting impacts of habitat fragmentation on forest birds: A comparison of two models. Pages 301-304 in Wildlife 2000 (J. Verner, C. J. Ralph, and M. L. Morrison, Eds.). Univ. Wisconsin Press, Madison.

Temple S. A. and J. R. Cary. 1988. Modeling dynamics of habitat-interior bird populations in fragmented landscapes Conservation Biol.2 :340-347.

Temple, S. A. and B. A. Wilcox. 1986. Introduction: Predicting effects of habitat patchiness and fragmentation. In Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates, ed. J. Verner, M. L. Morrison, and C. J. Ralph, 261-62. Madison: University of Wisconsin Press.

Tirmenstein, D. 1999. *Artemisia tridentata* spp. *tridentata*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Internet website: http://www.fs.fed.us/database/feis/. Accessed August 11, 2010.

Uranium Producers of America. 2010. Internet website: http://www.uraniumproducersamerica.com/situ.html. Accessed July 28, 2010.

United States Department of Agriculture, Natural Resources Conservation Service (NRCS). 2010. Soil Survey Geographic (SSURGO) Database for South Johnson County Area and South Campbell County Area, Wyoming. Internet website: http://soildatamart.nrcs.usda.gov. Accessed June 28, 2010.

_____. 1998. Soil Quality-Agronomy Technical Note #7.

U.S. Department of Agriculture, Soil Conservation Service (SCS). 1993. Soil Survey Manual. Soil Survey Division Staff. U.S. Department of Agriculture Handbook 18.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2010a. Buffalo Resource Management Plan Revision. Internet website: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/planning/rmps/buffalo/docs/scoping.Par.46657.File.dat/EnergyMineralResources.pdf. Buffalo, Wyoming, Field Office. Accessed July 27, 2010.

_____. 2010b. Personal communication with Bonnie Heidel, Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming Referenced In BLM EA Number WY-070-10-121.

_____. 2010c. Greater sage-grouse lek locations and raptor nest database. Buffalo, Wyoming, Field Office. Accessed July 2010.

_____. 2009. Final Mineral Occurrences and Development Potential Report. Buffalo, Wyoming, Field Office. June 19, 2009.

_____. 2006. Federal Mining Claims. Internet website: http://www.geocommunicator.gov/NILS-PARCEL2/map.jsp?MAP=MC>. Published in Denver, Colorado, on October 3, 2006. Accessed August 2010.

_____. 2005. Task 2 report for the Powder River Basin Coal review past and present and reasonably foreseeable development activities. Prepared by ENSR Corporation, Fort Collins, Colorado for the BLM Casper Field Office. Internet website: http://www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal/prbdocs/coalreview/Task2.html.

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

_____. 2003. Powder River Basin Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS). EIS # WY-070-02-065. Wyoming State Office, Cheyenne, Wyoming. April 30, 2003.

_____. 2001. Approved Resource Management Plan for Public Lands Administered by the BLM Buffalo Field Office. Buffalo, Wyoming, Field Office. April 2001.

_____. 1990. Instruction Memorandum No. WY-90-564: Resource Management Plan Action and Wyoming BLM Standard Mitigation Guidelines for Surface Disturbing Activities. Wyoming State Office. Cheyenne, Wyoming.

_____. 1985. Buffalo Resource Management Plan for Buffalo Resource Area. Buffalo, Wyoming, Field Office. October 1985.

U.S. Department of the Interior, U.S. Fish and Wildlife Service (USFWS). 2010a. Greater Sage-Grouse. Internet website: http://www.fws.gov/mountain-prairie/species/birds/sagegrouse/. Accessed September 7, 2010. Last Updated March 5, 2010.

_____. 2010b. 12-Month findings for Petitions to List the Greater Sage-grouse (*Centrocercus urophasianus*) as Threatened or Endangered. FWS-R6-ES-2010-0018, MO 92210-0-0008-B2. March 23, 2010 (Volume 75, Number 55).

_____. 2009. National Wetlands Inventory. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation. Internet website: http://www.fws.gov/wetlands. Accessed August 2010.

_____. 2007. Reinitiation of Formal Consultation for Powder River Oil and Gas Project. March 23, 2007.

_____. 2002. Mountain Plover Survey Guidelines. U.S. Fish and Wildlife Service. March 2002. 6 pp.

_____. 2000. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition To List the Black-Tailed Prairie Dog as Threatened. Federal Register 64(24):5476-5488. February 4, 2000.

U.S. Environmental Protection Agency (USEPA). 2010. Impaired Water 303(d) Listed Water Information for Cycle 2008, Powder River, Wyoming (WYPR100902020102). Internet website: http://iaspub.epa.gov/tmdl_waters10/enviro.control?p_list_id=WYPR100902020102_00&p_cycle=2008. Accessed July 24, 2010.

U.S. Geological Survey – National Water Information Service (USGS-NWIS). 2010. Flow and water quality data for USGS surface water gages in Johnson County, Wyoming, for the Powder River and tributaries. Internet website: http://waterdata.usgs.gov/wy/nwis/dvstat/?referred_module=sw and http://nwis.waterdata.usgs.gov/wy/nwis/qwdata?search_criteria=county_cd&submitted_form=introduction. Accessed July 24, 2010.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

Whitehead, R. L. 1996. Groundwater Atlas of the United States, Montana, North Dakota, South Dakota, Wyoming. USGS Hydrologic Atlas (HA) 730-I. Internet website: http://pubs.usgs.gov/ha/ha730/ch_i/index.html. Accessed July 25, 2010.

Wyoming Department of Agriculture. 2010. Weed and Pest Declared List (by County) Amended February 2010. Internet website: http://www.wyoweed.org/Documents/DocumentPage/2010%20Declared%20List.pdf Accessed August 2010.

Wyoming Department of Environmental Quality (WDEQ). 2005. Water Quality Rules and Regulations. Chapter 8, Quality Standards for Wyoming Groundwaters. Ground Water Section, Wyoming Department of Environmental Quality, Cheyenne, WY.

Wyoming Game and Fish Department (WGFD). 2010. Correspondence between J. Emmerich (WGFD Deputy Director) and D. Spencer (BLM). Letter dated April 27, 2010.

_____. 2009. Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats. Version 4.0. Revised November 2009.

_____. 2008. Hunting and Sage-Grouse: A Technical Review of Harvest Management on a Species of Concern in Wyoming. Wyoming Game and Fish Department. Green River, Wyoming. 21pp.

_____. 2006. Pronghorn and Mule Deer Seasonal Range Boundaries for Wyoming. 2006.

Wyoming Oil and Gas Conservation Commission. 2010. Actual CBNG Produced Water for the Powder River Basin. Internet website: http://Wogcc.state.wy.us. Accessed August 2010.

Wyoming State Geological Survey (WSGS). 2010a. Uranium. Internet website: http://www.wsgs.uwyo.edu/WSGSgroups. Accessed July 27, 2010.

_____. 2010b. Coalbed Natural Gas Monitoring Wells Spreadsheet. Internet website: http://wygl.wygisc.org/wygeolib/catalog/search/search.page. Accessed August 2010.

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**Figures**

**Figure 3.1 Potential Erosion Hazard**
**Figure 3.2 Areas of Greater than 25% Slope**
**Figure 3.3 Hydrology**
**Figure 3.4 Water Well Locations**

## Appendix A: Affected Resources and Species Worksheets

### Table A.1 Affected General Resources Worksheet

| Resource | Resource Present | Resource Affected | PRB FEIS Sufficient | Notes |
|---|---|---|---|---|
| **Air Quality** | Yes | Yes | Yes | See PRB FEIS 3-291, 3-298, 4-404 through 4-406, 4-377, and 4-386 |
| **Cultural** | | | | See PRB FEIS 3-206, 3-228, 4-273, 4-287, and 4-394 |
| Native American religious concerns | Yes | Yes | No | PBTCP & PRB FEIS 3-228, 4-227; address in EA |
| Traditional Cultural Properties | Yes | Yes | No | PBTCP; address in EA |
| **Mineral Potential** | | | | See PRB FEIS 3-66, 3-70, 3-230, 4-127 through 4-129 |
| Coal | No | No | Yes | See PRB FEIS 3-66 |
| Fluid Minerals | Yes | Yes | Yes | See PRB FEIS 3-68 and 3-69 |
| Locatable Minerals | Yes | Yes | No | Address in EA |
| Other leasables | Yes | No | Not applicable | |
| Salable minerals | Yes | No | Not applicable | |
| **Paleontology** | | | | |
| PFYC 3 | Yes | Yes | Yes | See PRB FEIS 3-65-66, 4-125 through 4-127 |
| PFYC 5 | No | No | Not applicable | |
| **Rangeland Management** | Yes | No | Not applicable | |
| Existing range improvements | No | No | Not applicable | |
| Proposed range improvements | No | No | Not applicable | |
| **Recreation** | | | | See PRB FEIS 3-263, 3-273, 4-319 through 4-328 |
| Developed site | No | No | Not applicable | See PRB FEIS 3-266 and 4-326 |
| Walk-in-Area (2009 data) | No | No | Not applicable | |
| **Social & Economic** | Yes | Yes | No | See PRB FEIS 3-275-3-289, 4-336 through 4-370; address in EA |
| **Soils & Vegetation** | Yes | Yes | No | See PRB FEIS 3-80-3-107, 4-134-4-152, 4-153-4-164, 4-343-4-391, and 4-406; address in EA |
| Erosion Hazard | Yes | Yes | No | See PRB FEIS 3-82 and 4-35; address in EA |
| Poor Reclamation Potential | Yes | Yes | No | Address in EA |
| Slope hazard | Yes | Yes | No | See PRB FEIS 3-81, and 4-135; address in EA |
| Forest products | No | No | Not applicable | |
| Invasive Species | Yes | Yes | No | See PRB FEIS 3-103-3-108, and 4-153; address in EA |
| Wetlands/Riparian | Yes | Yes | No | See PRB FEIS 3-108-3-111, 4-172-4-178, 4-406, and 4-395 through 4-396; address in EA |
| **Special Designations** | | | | |
| Proposed ACEC | No | No | Not applicable | |
| Wild & Scenic River | No | No | Not applicable | See PRB FEIS 3-273 |
| Wilderness Characteristics/Citizen | No | No | Not applicable | |

**Table A.1 Affected General Resources Worksheet**

| Resource | Resource Present | Resource Affected | PRB FEIS Sufficient | Notes |
|---|---|---|---|---|
| Proposed | | | | |
| WSA | No | No | Not applicable | |
| **Visual Resources** | | | | |
| Class II | No | No | Not applicable | |
| Class III | Yes | Yes | Yes | See PRB FEIS 3-252-3-263, 4-302-4-314, and 4-403 |
| **Water** | | | | See PRB FEIS 3-1-3-56, 4-1-4-122, 4-135, 4-393, and 4-405 |
| Floodplains | Yes | No | Not applicable | |
| Groundwater | Yes | Yes | No | See PRB FEIS 3-1-3-30, 4-1-4-69, 4-392, and 4-405; address in EA |
| Surface water | Yes | Yes | No | See PRB FEIS 3-36-3-56, 4-69-4-122, 4-393, and 4-405; address in EA |
| Drinking water | Yes | No | Yes | See above PRB FEIS "Water" references |
| **Wildland Urban Interface** | No | No | Not applicable | |
| **Wildlife** | | | | |
| ESA listed, proposed, or candidate species | Yes | Yes | No | Sage-grouse would be affected by this proposal and would require thorough analysis of effects including cumulative effects |
| BLM sensitive species | Yes | Yes | Yes | See attached sensitive species wildlife checklist |
| General wildlife | Yes | Yes | No | Nesting raptor site-specific effects |
| Aquatic species | No | No | Not applicable | |
| Upland game birds | Yes | No | Not applicable | |
| West Nile virus potential | Yes | No | Not applicable | |

**Table A.2 Threatened, Endangered, Proposed, and Candidate Species Worksheet**

| Common Name | Habitat | Presence? [1] | Direct Impacts Anticipated? | Intend to apply COA? | Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS? |
|---|---|---|---|---|---|
| ***Endangered*** | | | | | |
| Black-footed ferret | Black-tailed prairie dog colonies or complexes >1,000 acres | NP | No | No | No, 4-251, BA & BO |
| Blowout penstemon | Sparsely vegetated, shifting sand dunes | NP | No | No | No, but not addressed in PRB FEIS; address in EA |
| ***Threatened*** | | | | | |
| Ute ladies'-tresses orchid | Areas with appropriate hydrology | NP | No | No | No, PRB FEIS 4-253 & BA; address in EA |
| ***Proposed*** | | | | | |
| Mountain plover | Short-grass prairie with slopes <5% | NS | No | No | No, PRB FEIS 4-254, 4-255 & BA; address in EA |
| ***Candidate*** | | | | | |
| Greater sage-grouse | Basin-prairie shrub, mountain-foothill shrub | K | Yes | Yes | Yes, PRB FEIS 4-257 through 4-273; address in EA relative to 12-month finding (USFWS) and recent PRB research |

[1] Key: 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.

**Table A.3 Sensitive Species Worksheet**

| Common Name | Habitat | Presence? [1] | Direct Impacts Anticipated? | Intend to apply COA? | Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS? |
|---|---|---|---|---|---|
| ***Amphibians*** | | | | | **4-258** |
| Northern leopard frog | Beaver ponds and cattail marshes from plains to montane zones | NP | No | No | No |
| Columbia spotted frog | Ponds, sloughs, small streams, and cattails in foothills and montane zones. Confined to headwaters of the S Tongue R drainage and tributaries | NP | No | No | No |
| ***Fish*** | | | | | 4-259 & 4-260 |
| Yellowstone cutthroat trout | Cold-water rivers, creeks, beaver ponds, and large lakes in the Upper Tongue sub-watershed | NP | No | No | No |
| ***Birds*** | | | | | 4-260 to 4-264 |
| Baird's sparrow | Shortgrass prairie and basin-prairie shrubland habitats; plowed and stubble fields; grazed pastures; dry lakebeds; and other sparse, bare, dry ground | NP | No | No | No |
| Bald eagle | Mature forest cover often within 1 mile of large water body with reliable prey source nearby | NS | No | No | No, PRB FEIS 4-251 to 4-253 & BA; address in EA |
| Brewer's sparrow | Sagebrush shrubland | K | No | No | No, but new MBTA MOU applies |
| Ferruginous hawk | Basin-prairie shrub, grasslands, rock outcrops | NS | No | Yes – Raptor COA | No, but new MBTA MOU applies |
| Loggerhead shrike | Basin-prairie shrub, mountain-foothill shrub | NS | No | No | No, but new MBTA MOU applies |
| Long-billed curlew | Grasslands, plains, foothills, wet meadows | NP | No | No | No |
| Northern goshawk | Conifer and deciduous forests | NP | No | Yes – Raptor COA | No |
| Peregrine falcon | Cliffs | NP | No | Yes – Raptor COA | No |

**Table A.3 Sensitive Species Worksheet**

| Common Name | Habitat | Presence? [1] | Direct Impacts Anticipated? | Intend to apply COA? | Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS? |
|---|---|---|---|---|---|
| Sage sparrow | Basin-prairie shrub, mountain-foothill shrub | NS | No | No | No, but new MBTA MOU applies |
| Sage thrasher | Basin-prairie shrub, mountain-foothill shrub | NS | No | No | No, but new MBTA MOU applies |
| Trumpeter swan | Lakes, ponds, rivers | NP | No | No | No |
| Western Burrowing owl | Grasslands, basin-prairie shrub | NS | No | Yes – Raptor COA | No |
| White-faced ibis | Marshes, wet meadows | NP | No | No | No |
| Yellow-billed cuckoo | Open woodlands, streamside willow and alder groves | NS | No | No | No |
| ***Mammals*** | | | | | 4-264 &4-265 |
| Black-tailed prairie dog | Prairie habitats with deep, firm soils and slopes less than 10 degrees | K | Yes | No | No, PRB FEIS 4-255, 4-256; address in EA |
| Fringed myotis | Conifer forests, woodland chaparral, caves and mines | NS | No | No | No |
| Long-eared myotis | Conifer and deciduous forest, caves and mines | NS | No | No | No |
| Spotted bat | Cliffs over perennial water | NP | No | No | No |
| Swift fox | Grasslands | K | No | No | No, Address in EA; den site within 10 miles |
| Townsend's big-eared bat | Caves and mines | NP | No | No | No |
| ***Plants*** | | | | | 4-258 |
| Limber pine | Mountains, associated with high elevation conifer species | NP | No | No | No |
| Porter's sagebrush | Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5,300-6,500 feet | NP | No | No | No |
| William's wafer parsnip | Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6,000-8,300 feet | NP | No | No | No |

[1] **Key: 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.

**Table A.4 Non-designated Wildlife Worksheet**

| Common Name / Group | Presence?[1] | Direct Impacts Anticipated? | Intend to apply COA? | Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS? |
|---|---|---|---|---|
| Big Game | K | No | No | No, PRB FEIS 4-181 to 4-215 |
| Aquatics | NP | No | No | No, PRB FEIS 4-235 to 4-249 |
| Migratory Birds | K | No | No | No, PRB FEIS 4-231 to 4-235; MBTA MOU applies |
| Raptors | K | Yes | Yes | No, PRB FEIS 4-216 to 4-221; MBTA MOU applies |
| Plains Sharp-tailed Grouse | NS | No | No | No, PRB FEIS 4-221 to 4-226 |

[1] **Key: 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.

## Appendix B: Site-specific Conditions of Approval, Programmatic Mitigation Measures, Standard Conditions of Approval, and Operator Committed Measures

### Site-specific Conditions of Approval

In addition to the operator committed measures, and those incorporated from the Powder River Basin (PRB) Final Environmental Impact Statement (FEIS), the Bureau of Land Management (BLM) is including the following site-specific Conditions of Approval (COAs) to alleviate environmental impacts.

**Surface Use**

1. A 20-foot undisturbed vegetative buffer must be maintained between all surface disturbance from well drilling activities or well operation due to slope and the proximity to adjacent drainages for the following wells: 4476 5-14, 4476 5-34, 4476 6-14, 4476 6-43, 4476 7-23, 4476 7-34, 4476 8-12, 4476 8-32, 4476 8-41, 4476 18-32, 4477 1-14, 4477 2-21, 4477 2-41, 4477 3-41, 4477 10-22, 4477 10-43, 4477 11-14, 4477 11-32, 4477 12-23, 4477 12-34, 4477 12-43, 4477 13-12, 4477 14-41, 4477 15-32, and 4576 34-12.

2. All permanent aboveground structures (e.g., production equipment, tanks, etc.) not subject to safety requirements will be painted to blend with the natural color of the landscape. The paint used will be a color which simulates "Standard Environmental Colors." The color selected for this Table Mountain Phase 4 Coalbed Natural Gas (CBNG) Plan of Development (POD) is Covert Green.

3. Prior to constructing and drilling the well location, the operator shall build all engineered roads (including topsoiling, crowning, ditching, drainage culverts, et cetera) to ensure safe, environmentally sound, year-round access.

4. Due to poor reclamation potential, potential erosion, disturbance, and topography, a 30-Day Stabilization COA will apply to the following wells and infrastructure: 4476 5-14, 4476 5-23, 4476 5-34, 4476 5-43, 4476 6-14, 4476 6-43, 4476 7-12, 4476 8-12, 4476 8-21, 4476 8-32, 4476 8-41, 4476 8-43, 4476 8-32, 4477 1-21, 4477 1-23, 4477 2-21, 4477 2-41, 4477 3-41, 4477 10-12, 4477 10-21, 4477 10-23, 4477 10-34, 4477 10-43, 4477 11-14, 4477 11-32, 4477 11-34, 4477 12-14, 4477 12-23, 4477 12-34, 4477 12-43, 4477 13-12, 4477 13-21, 4477 14-41, 4477 15-32, 4576 34-12, 4576 34-21, and 4576 34-43.

5. Line the pit for the following wells: 4476 5-14, 4476 5-23, 4476 5-34, 4476 6-14, 4476 6-43, 4476 7-23, 4476 7-34, 4476 8-12, 4476 8-32, 4476 8-41, 4476 18-32, 4477 1-14, 4477 2-21, 4477 2-41, 4477 3-41, 4477 10-22, 4477 10-43, 4477 11-14, 4477 11-32, 4477 12-23, 4477 12-34, 4477 12-43, 4477 13-12, 4477 14-41, 4477 15-32, and 4576 34-12.

6. The operator will follow the guidance provided in the Wyoming Policy on Reclamation (Instruction Memorandum WY-90-231). The Wyoming Reclamation Policy applies to all surface-disturbing activities. Authorizations for surface-disturbing actions are based upon the assumptions that an area can and ultimately would be successfully reclaimed. BLM reclamation goals emphasize eventual ecosystem reconstruction, which means returning the land to a condition approximate to an approved "Reference Site" or Natural Resources Conservation Service Ecological Site Transition State. Final reclamation measures are used to achieve this goal. BLM reclamation goals also include the short-term goal of quickly stabilizing disturbed areas to protect both disturbed and adjacent undisturbed areas from unnecessary degradation. Interim reclamation measures are used to achieve this short-term goal.
7. Before replacing topsoil on disturbed surfaces, and on all other compacted surfaces, compaction will be remediated by ripping to the depth of compaction. Scarification will only be used on shallow soils.

8. The operator will seed on the contour to a depth of no more than 0.5 inch. To maintain quality and purity, certified seed with a minimum germination rate of 80 percent and a minimum purity of 90 percent will be used. On BLM surface or in lieu or a different specific mix desired by the surface owner, use the following:

10- to 14-inch Precipitation Zone
Clayey Ecological Site Seed Mix. Use this seed mix for well 4476 8-23.

| Species | % in Mix | Lbs PLS* |
|---|---|---|
| **Western Wheatgrass** (*Pascopyrum smithii*) | 35 | 4.2 |
| **Green needlegrass** (*Nassella viridula*) | 30 | 4.8 |
| **Slender Wheatgrass** (*Elymus trachycaulus* ssp. *trachycaulus*) | 20 | 1.2 |
| **Prairie coneflower** (*Ratibida columnifera*) | 5 | 0.6 |
| **White or purple prairie clover** (*Dalea candidum, purpureum*) | 5 | 0.6 |
| **Rocky Mountain beeplant** (*Cleome serrulata*) | 5 | 0.6 |
| **Totals** | **100** | **12 lbs/acre** |

10- to 14-inch Precipitation Zone
Sandy Ecological Site Seed Mix. Use this seed mix for the following wells: 4476 8-32, 4576 34-12, 4576 34-14, and 4576 34-21.

| Species | % in Mix | Lbs PLS* |
|---|---|---|
| **Thickspike Wheatgrass** (*Elymus lanceolatus* ssp. *lanceolatus*) | 25 | 3.0 |
| **Prairie sandreed** (*Calamovilfa longifolia*) | 35 | 4.2 |
| **Indian ricegrass** (*Achnatherum hymenoides*) | 25 | 3.0 |
| **Prairie coneflower** (*Ratibida columnifera*) | 5 | 0.6 |
| **White or purple prairie clover** (*Dalea candidum, purpureum*) | 5 | 0.6 |
| **Blue flax** (*Linum lewisii*) | 5 | 0.6 |
| **Totals** | **100** | **12 lbs/acre** |

10- to 14-inch Precipitation Zone
Shallow Loamy Ecological Site Seed Mix. Use this seed mix for the following wells: 4476 18-32, 4476 5-14, 4476 5-43, 4476 6-14, 4476 6-32, 4476 7-23, 4477 10-14, 4477 10-21, 4477 10-23, 4477 10-32, 4477 10-34, 4477 10-43, 4477 11-22, 4477 11-23, 4477 11-32, 4477 12-34, 4477 15-32, 4477 2-21, 4477 2-41, and 4477 3-41.

| Species | % in Mix | Lbs PLS* |
|---|---|---|
| **Thickspike Wheatgrass** (*Elymus lanceolatus* ssp. *lanceolatus*) | 50 | 6.0 |

| | | |
|---|---|---|
| **Bluebunch wheatgrass** (*Pseudoroegneria spicata* ssp. *Spicata*) | 35 | 4.2 |
| **Prairie coneflower** (*Ratibida columnifera*) | 5 | 0.6 |
| **White or purple prairie clover** (*Dalea candidum, purpureum*) | 5 | 0.6 |
| **Rocky Mountain beeplant** (*Cleome serrulata*) | 5 | 0.6 |
| **Totals** | **100** | **12 lbs/acre** |

10- to 14-inch Precipitation Zone

Loamy Ecological Site Seed Mix. Use this seed mix for the following wells: 4476 5-23, 4476 6-43, 4476 7-12, 4476 7-34, 4476 8-12, 4476 8-21, 4476 8-41, 4476 8-43, 4477 10-12, 4477 10-41, 4477 11-14, 4477 11-34, 4477 1-14, 4477 11-41, 4477 1-21, 4477 12-14, 4477 12-23, 4477 1-23, 4477 12-43, 4477 13-12, 4477 13-21, 4477 1-41, 4477 14-41, 4576 34-23, 4576 34-32, 4576 34-34, 4576 34-41, and 4576 34-43.

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

## Wildlife

### Raptors:

The following conditions will reduce impacts to raptors:

1. No surface-disturbing activity shall occur within 0.5 mile of all identified raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey (refer to **Table B.1**). Surveys shall be conducted by a biologist following the most current BLM protocol. All survey results must be submitted in writing to the Buffalo Field Office (FO) and approved prior to initiation of surface-disturbing activities. A 0.5 mile timing restriction will be applied if a nest is identified as active. This timing limitation will affect the following:

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |
| 10369 | Wells: 4 | 4477 1-14 4477 1-21 4477 1-23 4477 2-41 | --- | --- | --- | --- | --- |
| | Culverts: 2 | | NE¼/NW¼ | NW¼ | 1 | 44N | 77W |
| | Power Drops: 3 | | SE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | NW¼ | 1 | 44N | 77W |
| | | | NE¼ | SW¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 0.97 mile | | NE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | SE¼ | 1 | 44N | 77W |
| 10370 | Wells: 2 | 4477 1-14 4477 2-41 | --- | --- | --- | --- | --- |
| | Culverts: 5 | | NW¼/SW¼ | SE¼ | 2 | 44N | 77W |
| | | | NE¼ | SW¼ | 2 | 44N | 77W |
| | | | NE¼/NW¼ | NW¼ | 1 | 44N | 77W |
| | Power Drops: 3 | | NE¼ | SW¼ | 2 | 44N | 77W |
| | | | NW¼ | SE¼ | 2 | 44N | 77W |
| | | | SE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | NW¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 0.98 mile | | NE¼ | NE¼ | 2 | 44N | 77W |
| 10371 | Wells: 2 | 4477 1-14 4477 2-41 | --- | --- | --- | --- | --- |
| | Culverts: 5 | | NW¼/SW¼ | SE¼ | 2 | 44N | 77W |
| | | | NE¼ | SW¼ | 2 | 44N | 77W |
| | | | NE¼/NW¼ | NW¼ | 1 | 44N | 77W |
| | Power Drops: 3 | | NE¼ | SW¼ | 2 | 44N | 77W |
| | | | NW¼ | SE¼ | 2 | 44N | 77W |
| | | | SE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | NW¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 1.00 mile | | NE¼ | NE¼ | 2 | 44N | 77W |
| 10372 | Wells: 4 | 4477 1-14 4477 1-21 4477 1-23 4477 2-41 | --- | --- | --- | --- | --- |
| | Culverts: 2 | | NE¼/NW¼ | NW¼ | 1 | 44N | 77W |
| | Power Drops: 3 | | SE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | NW¼ | 1 | 44N | 77W |
| | | | NE¼ | SW¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 1.11 miles | | NE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | SE¼ | 1 | 44N | 77W |

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |
| 10375 | Wells: 3 | 4476 8-12<br>4476 8-23<br>4476 8-21 | --- | --- | --- | --- | --- |
| | Culverts: 10 | | NE¼/SE¼ | NE¼ | 7 | 44N | 76W |
| | | | SW¼ | NW¼ | 8 | 44N | 76W |
| | | | SE¼/NE¼/NW¼ | SW¼ | 8 | 44N | 76W |
| | | | NW¼ | SE¼ | 8 | 44N | 76W |
| | Power Drops: 2 | | SW¼ | NW¼ | 8 | 44N | 76W |
| | | | SW¼ | NE¼ | 8 | 44N | 76W |
| | Proposed Roads/Corridors: 2.99 miles | | NE¼/NW¼/SE¼/SW¼ | NE¼ | 7 | 44N | 76W |
| | | | NE¼/SE¼ | SE¼ | 7 | 44N | 76W |
| | | | NE¼/NW¼/SE¼/SW¼ | NW¼ | 8 | 44N | 76W |
| | | | NW¼/SW¼ | SW¼ | 8 | 44N | 76W |
| 10379 | Wells: 4 | 4477 11-34<br>4477 12-14<br>4477 13-12<br>4477 14-41 | --- | --- | --- | --- | --- |
| | Culverts: 2 | | NE¼ | NW¼ | 14 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| | Power Drops: 1 | | SW¼ | NW¼ | 13 | 44N | 77W |
| | Proposed Roads/Corridors: 1.57 miles | | NW¼/SW¼/SE¼ | SW¼ | 12 | 44N | 77W |
| | | | SE¼ | SW¼ | 11 | 44N | 77W |
| | | | SW¼ | SE¼ | 11 | 44N | 77W |
| | | | NE¼ | NW¼ | 14 | 44N | 77W |
| | | | NW¼/SW¼ | NW¼ | 13 | 44N | 77W |
| 10381 | Wells: 5 | 4477 12-14<br>4477 12-34<br>4477 13-12<br>4477 13-21<br>4477 14-41 | --- | --- | --- | --- | --- |
| | Culverts: 8 | | NE¼/SE¼ | SW¼ | 12 | 44N | 77W |
| | | | SW¼ | SE¼ | 12 | 44N | 77W |
| | | | SW¼ | NE¼ | 13 | 44N | 44N |
| | | | NW¼ | SW¼ | 13 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| | Power Drops: 2 | | SW¼ | NE¼ | 13 | 44N | 77W |
| | | | NW¼ | SW¼ | 12 | 44N | 77W |
| | Proposed Roads/Corridors: 2.78 miles | | NW¼/NE¼/SW¼/SE¼ | SW¼ | 12 | 44N | 77W |
| | | | SW¼ | SE¼ | 12 | 44N | 77W |
| | | | NW¼/SW¼ | NE¼ | 13 | 44N | 77W |
| | | | NW¼/NE¼/SW¼/SE¼ | NW¼ | 13 | 44N | 77W |
| | | | NW¼/SW¼ | SW¼ | 13 | 44N | 77W |
| | | | NW¼ | SE¼ | 13 | 44N | 77W |

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |
| **10665** | Wells: 4 | 4477 11-34<br>4477 12-14<br>4477 13-12<br>4477 14-41 | --- | --- | --- | --- | --- |
| | Culverts: 3 | | NE¼ | NW¼ | 14 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| | | | NW¼ | SW¼ | 13 | 44N | 77W |
| | Power Drops: 1 | | SW¼ | NW¼ | 13 | 44N | 77W |
| | Proposed Roads/Corridors: 1.57 miles | | NW¼/SW¼/SE¼ | SW¼ | 12 | 44N | 77W |
| | | | SE¼ | SW¼ | 11 | 44N | 77W |
| | | | SW¼ | SE¼ | 11 | 44N | 77W |
| | | | NE¼ | NW¼ | 14 | 44N | 77W |
| | | | NW¼/SW¼ | NW¼ | 13 | 44N | 77W |
| **4088** | Wells: 1 | 4477 1-21 | --- | --- | --- | --- | --- |
| | Culverts: 1 | | NE¼ | NW¼ | 1 | 44N | 77W |
| **4208** | Power Drops: 1 | | NW¼ | SE¼ | 34 | 45N | 77W |
| | Proposed Roads/Corridors: 0.86 mile | | NE¼/SE¼ | SW¼ | 34 | 45N | 77W |
| | | | SW¼/SE¼ | SE¼ | 34 | 45N | 77W |
| | | | NE¼ | NW¼ | 3 | 44N | 77W |
| **5024** | Power Drops: 1 | | NW¼ | SE¼ | 34 | 45N | 77W |
| | Proposed Roads/Corridors: 1.16 miles | | NE¼/SE¼ | SW¼ | 34 | 45N | 77W |
| | | | SW¼/SE¼ | SE¼ | 34 | 45N | 77W |
| | | | NE¼ | NW¼ | 3 | 44N | 77W |
| **5319** | Wells: 1 | 4476 8-41 | --- | --- | --- | --- | --- |
| | Culverts: 1 | | SE¼ | NE¼ | 8 | 44N | 76W |
| | Proposed Roads/Corridors: 0.46 mile | | SE¼ | NE¼ | 8 | 44N | 76W |
| **5547** | Wells: 2 | 4477 1-21<br>4477 1-23 | --- | --- | --- | --- | --- |
| | Culverts: 2 | | NE¼/NW¼ | NW¼ | 1 | 44N | 77W |
| | Power Drops: 2 | | NW¼ | NW¼ | 1 | 44N | 77W |
| | | | NE¼ | SW¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 1.30 miles | | NE¼ | NE¼ | 2 | 44N | 77W |
| | | | NW¼ | SE¼ | 1 | 44N | 77W |
| | | | SW¼ | NE¼ | 1 | 44N | 77W |

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |
| 5548 | Wells: 2 | 4477 1-21, 4477 1-41 | --- | --- | --- | --- | --- |
| | Culverts: 3 | | NE¼ | NW¼ | 1 | 44N | 77W |
| | | | SE¼ | NE¼ | 1 | 44N | 77W |
| | Power Drops: 1 | | SE¼ | NE¼ | 1 | 44N | 77W |
| | Proposed Roads/Corridors: 0.87 mile | | SW¼/NE¼/SE¼ | NW¼ | 6 | 44N | 76W |
| | | | NE¼/SW¼ | NE¼ | 1 | 44N | 77W |
| 6377 | Wells: 3 | 4476 8-32<br>4476 8-41<br>4476 8-43 | --- | --- | --- | --- | --- |
| | Culverts: 3 | | SE¼ | NE¼ | 8 | 44N | 76W |
| | | | NW¼ | SE¼ | 8 | 44N | 76W |
| | | | NE¼ | SW¼ | 8 | 44N | 76W |
| | Power Drops: 2 | | SE¼,SW¼ | NE¼ | 8 | 44N | 76W |
| | Proposed Roads/Corridors: 1.24 miles | | SW¼/NW¼/NE¼ | NE¼ | 8 | 44N | 76W |
| | | | SW¼ | SE¼ | 8 | 44N | 76W |
| 6381 | Wells: 3 | 4476 8-12<br>4476 8-23<br>4476 8-21 | --- | --- | --- | --- | --- |
| | Culverts: 11 | | NE¼/SE¼ | NE¼ | 7 | 44N | 76W |
| | | | SW¼ | NW¼ | 8 | 44N | 76W |
| | | | SE¼/NE¼/NW¼ | SW¼ | 8 | 44N | 76W |
| | | | NW¼ | SE¼ | 8 | 44N | 76W |
| | Power Drops: 2 | | SW¼ | NW¼ | 8 | 44N | 76W |
| | | | SW¼ | NE¼ | 8 | 44N | 76W |
| | Proposed Roads/Corridors: 2.98 miles | | NE¼/NW¼/SE¼/SW¼ | NE¼ | 7 | 44N | 76W |
| | | | NE¼/SE¼ | SE¼ | 7 | 44N | 76W |
| | | | NE¼/NW¼/SE¼/SW¼ | NW¼ | 8 | 44N | 76W |
| | | | NW¼/SW¼ | SW¼ | 8 | 44N | 76W |
| 6383 | Wells: 2 | 4476 6-14<br>4477 1-41 | --- | --- | --- | --- | --- |
| | Culverts: 2 | | SE¼ | NE¼ | 1 | 44N | 77W |
| | | | NE¼ | NE¼ | 12 | 44N | 77W |
| | Power Drops: 2 | | NE¼ | NE¼ | 1 | 44N | 77W |
| | | | SW¼ | NE¼ | 6 | 44N | 76W |
| | Proposed Roads/Corridors: 2.98 miles | | NE¼/NW¼/SE¼/SW¼ | NW¼ | 6 | 44N | 76W |
| | | | SW¼ | NE¼ | 6 | 44N | 76W |
| | | | SW¼ | SW¼ | 6 | 44N | 76W |
| | | | SW¼ | SE¼ | 6 | 44N | 76W |
| | | | SE¼ | NE¼ | 1 | 44N | 77W |
| | | | NE¼/SE¼ | SE¼ | 1 | 44N | 77W |
| 6385 | Culverts: 5 | | NE¼/SW¼ | SE¼ | 13 | 44N | 77W |
| | | | SE¼ | SW¼ | 18 | 44N | 76W |

**Table B.1 No Surface-disturbing Activity from February 1 through July 31 at the Following Project Infrastructure**

| BLM Raptor Nest ID | Project Infrastructure | Well ID | Location Information for Culverts, Power Drops, and Roads/Utility Corridors | | | | |
|---|---|---|---|---|---|---|---|
| | | | Qtr/Qtr | Qtr | Section | Township | Range |
| | Power Drops: 1 | | NE¼ | SE¼ | 13 | 44N | 77W |
| 6386 | Culverts: 3 | | SE¼ | SW¼ | 18 | 44N | 76W |
| | Proposed Roads/Corridors: 0.07 mile | | NE¼/SE¼/SW¼ | SW¼ | 18 | 44N | 76W |
| 6387 | Wells: 3 | 4476 8-32<br>4476 8-41<br>4476 8-43 | --- | --- | --- | --- | --- |
| | Culverts: 3 | | SE¼ | NE¼ | 8 | 44N | 76W |
| | | | NW¼ | SE¼ | 8 | 44N | 76W |
| | | | NE¼ | SW¼ | 8 | 44N | 76W |
| | Power Drops: 2 | | SE¼/SW¼ | NE¼ | 8 | 44N | 76W |
| | Proposed Roads/Corridors: 1.24 miles | | SW¼/NW¼/NE¼ | NE¼ | 8 | 44N | 76W |
| | | | SW¼ | SE¼ | 8 | 44N | 76W |
| 6492 | Culverts: 6 | | NW¼ | SW¼ | 13 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| | | | SW¼ | NE¼ | 13 | 44N | 77W |
| | | | SW¼ | SE¼ | 13 | 44N | 77W |
| | Proposed Roads/Corridors: 1.26 miles | | NW¼/SW¼ | SW¼ | 13 | 44N | 77W |
| | | | NW¼/NE¼/SE¼ | NW¼ | 24 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| 8373 | Wells: 1 | 4477 13-12 | --- | --- | --- | --- | --- |
| | Culverts: 4 | | NW¼ | SW¼ | 13 | 44N | 77W |
| | | | SW¼ | NW¼ | 13 | 44N | 77W |
| | Proposed Roads/Corridors: 0.76 mile | | NW¼/SW¼ | SW¼ | 13 | 44N | 77W |
| | | | NW¼ | NW¼ | 24 | 44N | 77W |
| | | | NW¼/SW¼ | NW¼ | 13 | 44N | 77W |

2. If an undocumented raptor nest is located during project construction or operation, the Buffalo FO (307-684-1100) shall be notified within 24 hours.

**Sage-grouse**

The following conditions will reduce impacts to sage-grouse:

1. No surface-disturbing activities are permitted within the Table Mountain Phase 4 CBNG POD boundary between March 15 and June 30 to protect nesting and brood-rearing sage-grouse. This condition will be implemented on an annual basis for the life of the project. This timing limitation applies to 41 of the 54 wells. The well locations without sage-grouse timing limitations include: 4476 5-14, 4476 5-23, 4476 6-32, 4476 6-43, 4476 7-34, 4476 8-12, 4476 8-41, 4476 8-43, 4576 34-14, 4576 34-32, 4576 34-34, 4576 34-41, and 4576 34-43.

2. Disruptive activity is restricted on or within a 0.25-mile radius of the perimeter of occupied or undetermined sage-grouse leks from 6:00 pm to 8:00 am from March 15 to May15. Disruptive activities are those that "…require people and/or activity to be in nesting habitats for a duration of

1 hour or more during a 24-hour period…" (BLM 2009). This condition applies to the following wells in close proximity to the Christensen Ranch 3 and Christensen Ranch 7 leks: 4477 11-22, 4477 11-23, 4477 10-43, 4476 7-12, 4477 12-43, and 4476 6-14.

3. Noise from infrastructure within the POD is not to exceed 49 decibels (10 dBA above background noise) at any nearby sage-grouse or sharp-tailed grouse display grounds.

**Cultural**

1. Per the Programmatic Agreement (PA) Between the BLM and the Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects to The Pumpkin Buttes Traditional Cultural Property (TCP) from Anticipated Federal Minerals Development Campbell County, Wyoming; Stipulations II; Anadarko will instruct all employees, contractors, subcontractors and any additional parties involved with on the ground operations of their project to avoid the Pumpkin Buttes TCP.

2. Per the PA Between the BLM and the Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects to The Pumpkin Buttes TCP from Anticipated Federal Minerals Development Campbell County, Wyoming; Appendices A-G; Anadarko will operate under mitigation measures found in Appendices A-G of the PA during all phases (drilling, construction, operation, reclamation, etc.) of wells within 2 miles of the TCP boundary (see following list) and their associated infrastructure (new surface disturbance to junction with existing disturbance). Table Mountain Phase 4 wells within 2 miles of the TCP boundary include: All Federal wells in Section 34 T45N R76W, 4476 5-34, 4476 5-43, 4476 8-23, 4476 8-32, 4476 8-41, and 4476 8-43.

3. All surface disturbing activities within 200 feet of eligible historic properties 48CA6365/48JO3763 and 48JO963 will be monitored by a cultural resource use permitee (CRUP). The CRUP shall notify the Buffalo FO cultural staff no less than 3 days in advance of construction activities.

4. All surface disturbing activity in the following areas will be monitored by a BLM CRUP holder or permitted crew chief: areas containing alluvial or eolian deposits near Willow Creek and North Prong Willow Creek. The BLM has identified these areas as having a high potential for buried cultural deposits. Some portions of the monitoring areas as described may lie outside alluvial or eolian deposits and exact monitoring areas are left to the discretion of the archaeological monitor. All monitored areas must be plotted on the map provided with the monitoring report. The submission of two copies of a monitoring report to Buffalo FO is required within 30 days of the completion of all monitoring work.

    a. All surface disturbing activity proposed for Table Mountain Phase 4 that occurs within alluvial or eolian deposits along Willow Creek and North Prong Willow Creek will be monitored by a CRUP.

**Programmatic Mitigation Measures Identified in the PRB FEIS ROD**

The following programmatic mitigation measures are listed in Appendix A-5 of the PRB FEIS Record of Decision (ROD).

Programmatic mitigation measures are those, determined through analysis, which may be appropriate to apply at the time of Application for a Permit to Drill (APD) approval if site-specific conditions warrant. These mitigation measures can be applied by BLM, as determined necessary at the site-specific National Environmental Policy Act APD stage, as COAs and will be in addition to stipulations applied at the time of lease issuance and any standard COA.

**Surface Water**

1. Channel Crossings:
   - 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.
   - Channel crossings by pipelines will be constructed so that the pipe is buried at least 4 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.

**Wetland/Riparian**

1. To protect the biological and hydrologic features of riparian areas, woody draws, wetlands, and floodplains, all well pads, compressors, and other non-linear facilities will be located outside of these areas.
2. To reduce adverse effects on existing wetlands and riparian areas, water discharge should not be allowed if increased discharge volumes or subsequent recharge of shallow aquifers will inundate and kill woody species, such as willows or cottonwoods.
3. For any jurisdictional wetlands identified that may be impacted, a detailed mitigation plan will be developed during the APD/POD or sundry notice approval process. Federal requirements to replace all impacted wetlands will mitigate this loss, so environmental impacts will occur only during the life of the project (including reclamation).
4. Any fences used in wetland areas should be placed well back from the wetlands to prevent waterfowl mortalities and should be constructed to standards that allow big game movements.
5. Crossings of wetland/riparian areas by linear features, such as pipelines, roads, and power lines will be avoided to the extent practicable. Where crossings cannot be avoided, impacts will be minimized through use of the following measures:
   - Site-specific mitigation plans will be developed during the APD, POD, or Sundry Notice approval process for all proposed disturbance to wetland/riparian areas.
   - Crossings will be constructed perpendicular to wetland/riparian areas where practical.

**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. The Companies will locate compressor stations so that noise from the stations at any nearby sage-grouse or sharp-tailed grouse display grounds does not exceed 49 decibels (dB) (10 decibels on the A-weighted scale [dBA] above background noise) at the display ground.
2. 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.

**Threatened, Endangered, or Sensitive Species**

1. The Companies will conduct clearance surveys for threatened, endangered, or other special-concern species at the optimum time. Inventory for special concern species, other than federally listed species below, is contingent upon landowner concurrence. This will require coordination with the BLM before November 1 annually to review the potential for disturbance and to agree on inventory parameters.

**Bald Eagle**

1. In the event that a bald eagle (dead or injured) is located during construction or operation, the U.S. Fish and Wildlife Services' (USFWS') Wyoming Field Office (307-772-2374) and the USFWS' Law Enforcement Office (307-261-6365) will be notified within 24 hours.
2. A minimum disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round for all bald eagle nest sites. A seasonal minimum disturbance-free buffer zone of 1 mile will be established for all bald eagle nest sites (February 15 through August 15).
3. Additional mitigation measures may be necessary if the site-specific project is determined by a BLM biologist to have adverse effects to bald eagles or their habitat.

**Mountain Plover**

1. In the event that a mountain plover is located during construction or operation, the USFWS' Wyoming Field Office (307-772-2374) and the USFWS' Law Enforcement Office (307-261-6365) will be notified within 24 hours.
2. A disturbance-free buffer zone of 0.25 mile will be established around all mountain plover nesting locations between March 15 and July 31.
3. Work schedules and shift changes will be set to avoid the periods from 30 minutes before to 30 minutes after sunrise and sunset during June and July, when mountain plovers and other wildlife are most active.

**Transportation**

1. The Companies will provide georeferenced spatial data depicting as-built locations of all facilities, wells, roads, pipelines, power lines, reservoirs, discharge points, and other related facilities to the BLM upon completion of POD construction and development. Until POD construction and development is complete, the company will provide the most current as-builts yearly on or before November 1.
2. Companies will contact the counties to pursue development of maintenance agreements to ensure county roads are adequately maintained for the projected increase in use.

**Visual Resources**

1. The Companies will complete the following measures, where practical: use existing well pads where feasible, use vegetative and topographic screening when siting well locations, avoid highwall cuts.
2. Use buried power lines to each well, where feasible, to reduce the linear element in the landscape.

**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 dB measured at a distance of 0.25 mile from the appropriate booster (field) compressor. When background noise exceeds 55 dBA, noise levels will be no greater than 5 dBA

above background. This may require the installation of electrical compressor motors at these locations.

Two measurements commonly used to relate the time-varying quality of environmental noise to its known effects on people are the equivalent sound level ($L_{eq}$) and the average day/night noise level ($L_{dn}$). The $L_{eq}$ is an A-weighted sound level containing the same sound energy as the instantaneous sound levels measured over a specific time period. Noise levels are perceived differently, depending on the length of exposure and the time of day. The $L_{dn}$ takes into account the duration and time the noise is encountered. An additional 10 dBA are added to late night and early morning (10:00 p.m. to 7:00 a.m.) noise exposure levels to account for people's greater sensitivity to sound during the nighttime hours. After adjustment, the 24 hourly values are averaged to determine the $L_{dn}$.

Existing literature concludes an Ldn of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise (Federal Energy Regulatory Commission 2003).

Noise can be reduced by construction of obstacles in the direct path from the noise source to a receiver or by increasing the distance between a Coalbed Methane (CBM) facility and an existing noise-sensitive receptor.

**Air Quality**

A number of mitigation options for CBM are part of Wyoming Department of Environmental Quality's (WDEQ's) normal regulatory procedure. For instance, in the permitting of compressors, the agency always requires the application of best available control technology (BACT). The theory here is simply that given the air resource available, within technological and financial feasibility, the number of operations that can be allowed is maximized.

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 (AO).

   - A variety of potential emission reduction measures (BLM 1999d) are available to further limit nitrogen oxide ($NO_X$) and other air pollutant emissions. The evaluation was not intended to rank or identify a required emission reduction measure; the appropriate level of control will be determined and required by the applicable air quality regulatory agencies during the pre-construction permit process.

     BLM also will continue to cooperate with existing visibility and atmospheric deposition impact monitoring programs. The need for, and the design of, additional monitoring could include the involvement of the U.S. Environmental Protection Agency (EPA) Region 8 Federal Leadership Forum and applicable air quality regulatory agencies. Based upon future recommendations, operators could be required to cooperate in the implementation of a coordinated air quality monitoring program. Oil and gas lease terms (Section 6) require the lessee, within the lease rights granted, to take measures deemed necessary by the lessor for the conduct of operations in a manner that minimizes adverse impacts to air quality, as well as other resources.

**Geology**

Inadvertent release to the atmosphere of the methane resource will be controlled through Wyoming Oil and Gas Conservation Commission (WOGCC) requirements and APD conditions of approval that address

well control, casing, ventilations, and plugging procedures appropriate to site-specific CBM development plans.

**Standard Conditions of Approval Identified in the PRB FEIS ROD**

Standard Conditions of Approval are those measures that apply to all oil and gas development. These conditions are applied to both APD and Sundry Notices when they are not specifically addressed in those plans by the Companies. There are standard conditions of approval that apply only to CBM activities and others that apply to both conventional oil and gas and CBM activities. Section B.3.1 identifies standard conditions of approval applicable to development involving only coal bed methane. Section B.3.2 identifies standard conditions of approval that are pertinent to all Federal oil and gas lease development. Not all of the conditions in this second section are applicable to development of CBM.

It is important to note that site-specific mitigation measures also are developed by the BLM AO, as needed, on a case-by-case basis at the onsite inspection to address special, unanticipated issues not addressed by a programmatic mitigation measure or standard conditions of approval (e.g., erosive soils, steep slopes, proximity to existing improvements, et cetera).

The following standard conditions of approval are listed in Appendix A-4 of the PRB FEIS ROD.

**Applicable to Coal Bed Methane Well Development Only**

1. A pre-construction field meeting shall be conducted prior to beginning any dirt work approved under this POD. The operator shall contact the BLM AO (Dan Sellers at 307-684-1100) at least 4 days prior to beginning operations so that the meeting can be scheduled. The operator is responsible for having all contractors present (dirt contractors, drilling contractor, pipeline contractor, project oversight personnel, etc.) including the overall field operations superintendent, and for providing all contractors copies of the approved POD, project map, and BLM *Conditions of Approval* pertinent to the work that each will be doing.
2. Reserve pits will be adequately fenced during and after drilling operations until pit is reclaimed so as to effectively keep out wildlife and livestock. Adequate fencing, in lieu of more stringent requirements by the surface owner, is defined as follows:
    - Construction materials will consist of steel or wood posts. Three or four strand wire (smooth or barbed) fence or hog panel (16-foot length by 50-inch height) or plastic snow fence must be used with connectors such as fence staples, quick-connect clips, hog rings, hose clamps, twisted wire, etc. Electric fences will not be allowed.
    - Construction standards: Posts shall be firmly set in ground. If wire is used it must be taut and evenly spaced, from ground level to top wire, to effectively keep out animals. Hog panels must be tied securely into posts and one another using fence staples, clamps, etc. Plastic snow fencing must be taut and sturdy. Fence must be at least 2 feet from edge of pit. three sides fenced before beginning drilling, the fourth side fenced immediately upon completion of drilling and prior to rig release. Fence must be left up and maintained in adequate condition until pit is closed.
3. Reserve pits will be closed as soon as possible, but no later than 90 days from time of drilling/well completion, unless the BLM AO gives an extension. Squeezing of pit fluids and cuttings is prohibited. Pits must be dry of fluids or they must be removed via vac truck or other environmentally acceptable method prior to backfilling, recontouring and replacement of topsoil. Mud and cuttings left in pit must be buried at least 3 feet below recontoured grade. The operator will be responsible for recontouring any subsidence areas that develop from closing a pit before it is sufficiently dry.

4. The operator shall complete wells (case, cement and under ream) as soon as possible, but no later than 30 days after drilling operations, unless an extension is given by the BLM AO.
5. If in the process of air drilling the wells there is a need to utilize mud, all circulating fluids will be contained either in an approved pit or in an aboveground containment tank. The pit or containment tank will be large enough to safely contain the capacity of all expected fluids without danger of overflow. Fluid and cuttings will not be squeezed out of the pit, and the pit will be reclaimed in an expedient manner.
6. The operator shall restrict travel on unimproved two-track roads during periods of inclement weather or spring thaw when the possibility exists for excessive surface resource damage (e.g., rutting in excess of 4 inches, travel outside two-track roadway, etc.).
7. Phased reclamation plans will be submitted to BLM for approval prior to individual POD facility abandonment via a Notice of Intent (NOI) Sundry Notice. Individual facilities, such as well locations, pipelines, discharge points, impoundments, etc. need to be addressed in these plans as they are no longer needed. Individual items that will need to be addressed in reclamation plans include:
   - Pit closure (Close as soon as possible after suitably dry, but no later than 90 days from time of drilling unless an extension is given by BLM AO). BLM may require closure prior to 90 days in some cases due to land use or environmental concerns.
   - Configuration of reshaped topography, drainage systems, and other surface manipulations.
   - Waste disposal.
   - Revegetation methods, including specific seed mix (pounds pure live seed/acre) and soil treatments (seedbed preparation, fertilization, mulching, etc.). On private surface, the landowner should be consulted for the specific seed mix.
   - Other practices that will be used to reclaim and stabilize all disturbed areas, such as water bars, erosion fabric, hydro-mulching, etc.
   - An estimate of the timetables for beginning and completing various reclamation operations relative to weather and local land uses.
   - Methods and measures that will be used to control noxious weeds, addressing both ingress and egress to the individual well or POD.
   - Decommissioning/removal of all surface facilities.
   - Closure and reclamation of areas utilized or impacted by produced CBM water, including discharge points, reservoirs, off-channel pits, land application areas, livestock/wildlife watering facilities, surface discharge stream channels, etc.
8. The first well drilled to each targeted coal zone will be designated as the POD reference well. Designated reference wells must have the ability to be sampled at the wellhead. Water quality samples will be collected by the operator and submitted for analysis using WDEQ National Pollution Discharge Elimination System (NPDES) criteria within 30 to 60 days of initial water production. Results of the analysis will be submitted to the Buffalo FO-BLM AO as soon as they become available.

**Pertinent to All Oil and Gas Well Developmen**

**General**

1. If any cultural values (sites, artifacts, human remains [Appendix L, FEIS]) are observed during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. The AO will conduct an evaluation of the cultural values to establish appropriate mitigation, salvage or treatment. The operator is responsible for informing all persons in the area who are

associated with this project that they will be subject to prosecution for knowingly disturbing historic or archaeological sites, or for collecting artifacts. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized BLM AO. Within 5 working days the AO will inform the operator as to:

- Whether the materials appear eligible for the National Register of Historic Places;
- The mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and
- A time-frame for the AO to complete an expedited review under 36 Code of Federal Regulations 800.11 to confirm, through the State Historic Preservation Officer, that the findings of the AO are correct and that mitigation is appropriate. The AO will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the AO that the required mitigation has been completed, the operator will then be allowed to resume construction measures.

2. If paleontological resources, either large or conspicuous, and/or a significant scientific value are discovered during construction, the find will be reported to the AO immediately. Construction will be suspended within 250 feet of said find. An evaluation of the paleontological discovery will be made by a BLM-approved professional paleontologist within 5 working days, weather permitting, to determine the appropriate action(s) to prevent the potential loss of any significant paleontological values. Operations within 250 feet of such a discovery will not be resumed until written authorization to proceed is issued by the AO. The operator will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operation.
3. Please contact Dan Sellers, BLM Buffalo FO Natural Resource Specialist (307-684-1100), if there are any questions concerning the following surface use COAs.

**Construction**

1. The operator will limit vegetation removal and the degree of surface disturbance wherever possible. Where surface disturbance cannot be avoided, all practicable measures will be utilized to minimize erosion and stabilize disturbed soils.
2. Construction and drilling activity will not be conducted using frozen or saturated soil material during periods when watershed damage or excessive rutting is likely to occur.
3. Remove all available topsoil (depths vary from 4 inches on ridges to 12+ inches in bottoms) from constructed well locations including areas of cut and fill, and stockpile at the site. Topsoil also will be salvaged for use in reclamation on all other areas of surface disturbance (roads, pipelines, etc.). Clearly segregate topsoil from excess spoil material. Any topsoil stockpiled for 1 year or longer will be signed and stabilized with annual ryegrass or other suitable cover crop.
4. The operator will not push soil material and overburden over side slopes or into drainages. All soil material disturbed will be placed in an area where it can be retrieved without creating additional undue surface disturbance and where it does not impede watershed and drainage flows.
5. Construct the backslope no steeper than ½:1, and construct the foreslope no steeper than 2:1, unless otherwise directed by the BLM AO.
6. Maintain a minimum 20-foot undisturbed vegetative border between toe-of-fill of pad and/or pit areas and the edge of adjacent drainages, unless otherwise directed by the BLM AO.

7. With the overall objective of minimizing surface disturbance and retaining land stability and productivity, the operator shall utilize equipment that is appropriate to the scope and scale of work being done for roads and well pads (utilize equipment no larger than needed for the job).

8. The operator shall utilize wheel trenchers or ditch witches to construct all pipeline trenches, except where extreme topography or other environmental factors preclude their use.

9. Reserve pit will be adequately fenced during and after drilling operations until reclaimed so as to effectively keep out wildlife and livestock. This requires that it be fenced on the three nonworking sides prior to drilling and on the remaining side immediately following rig release. Fencing will be constructed in accordance with BLM specifications. Plastic snow fence is not acceptable fencing material for conventional wells.

10. The reserve pit will be oriented to prevent collection of surface runoff. After the drilling rig is removed, the operator may need to construct a trench on the uphill side of the reserve pit to divert surface drainage around it. If constructed, the trench will be left intact until the pit is closed.

11. The reserve pit will be lined with an impermeable liner if permeable subsurface material is encountered. An impermeable liner is any liner having a permeability less than $10^{-7}$ centimeters per second. The liner will be installed so that it will not leak and will be chemically compatible with all substances that may be put in the pit. Liners made of any man-made synthetic material will be of sufficient strength and thickness to withstand normal installation and pit use. In gravelly or rocky soils, a suitable bedding material such as sand will be used prior to installing the liner.

12. The reserve pit will be constructed so that at least half of its total volume is in solid cut material (below natural ground level).

13. Culverts will be placed on channel bottoms on firm, uniform beds, which have been shaped to accept them, and aligned parallel to the channel to minimize erosion. Backfill will be thoroughly compacted.

14. The minimum diameter for culverts will be 18 inches. However, all culverts will be appropriately sized in accordance with standards in BLM Manual 9113.

15. Construction and other project-related traffic will be restricted to approved routes. Cross-country vehicle travel will not be allowed.

16. Maximum design speed on all operator constructed and maintained roads will not exceed 25 miles per hour.

17. Pipeline construction shall not block nor change the natural course of any drainage. Pipelines shall cross perpendicular to drainages. Pipelines shall not be run parallel in drainage bottoms. Suspended pipelines shall provide adequate clearance for maximum runoff.

18. Pipeline trenches shall be compacted during backfilling. Pipeline trenches shall be routinely inspected and maintained to ensure proper settling, stabilization and reclamation.

19. During construction, emissions of particulate matter from well pad and road construction will be minimized by application of water or other non-saline dust suppressants with at least 50 percent control efficiency. Dust inhibitors (surfacing materials, non-saline dust suppressants, and water) will be used as necessary on unpaved roads that present a fugitive dust problem. The use of chemical dust suppressants on public surface will require prior approval from the BLM AO.

20. Operators are required to obtain a NPDES Storm Water Permit from the WDEQ for any projects that disturb 5 or more acres (changing to 1 acre in March 2005). This general construction storm water permit must be obtained from WDEQ **prior** to any surface-disturbing activities and can be obtained by following directions on the WDEQ website at http://deq.state.wy.us. Further information can be obtained by contacting Barb Sahl (307-777-7570).

21. The operator shall submit a Sundry Notice (Form 3160-5) to BLM for approval prior to construction of any new surface-disturbing activities that are not specifically addressed in the approved APD or POD Surface Use Plan.

**Operations/Maintenance**

1. Confine all equipment and vehicles to the access road(s), pad(s), and area(s) specified in the approved APD or POD.
2. All waste, other than human waste and drilling fluids, will be contained in a portable trash cage. This waste will be transported to a State-approved waste disposal site immediately upon completion of drilling operations. No trash or empty barrels will be placed in the reserve pit or buried on location. All State and local laws and regulations pertaining to disposal of human and solid waste will be complied with.
3. The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with this project (well locations, roads, water management facilities, etc.). Use of pesticides shall comply with the applicable Federal and State laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of Interior. Prior to the use of pesticides on public land, the holder shall obtain from the BLM AO written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the AO to such use.
4. All permanent aboveground structures (e.g., production equipment, tanks, et cetera) not subject to safety requirements will be painted to blend with the natural color of the landscape. The paint used will be a color which simulates "Standard Environmental Colors." The color selected for this Table Mountain Phase 4 CBNG POD is Covert Green.
5. Sewage shall be placed in a self-contained, chemically treated porta-potty on location.
6. The operator and their contractors shall ensure that all use, production, storage, transport, and disposal of hazardous and extremely hazardous materials associated with the drilling, completion, and production of this well will be in accordance with all applicable existing or hereafter promulgated Federal, State, and Local government rules, regulations and guidelines. All project-related activities involving hazardous materials will be conducted in a manner to minimize potential environmental impacts. In accordance with Occupational Safety and Health Administration requirements, a file will be maintained onsite containing current Material Safety Data Sheets for all chemicals, compounds and/or substances which are used in the course of construction, drilling, completion and production operations.
7. Produced fluids shall be put in test tanks on location during completion work. Produced water will be put in the reserve pit during completion work per Onshore Order #7.
8. The only fluids/waste materials, which are authorized to go into the reserve pit are Resource Conservation and Recovery Act exempt exploration and production wastes. These include:

   - Drilling muds and cuttings;
   - Rigwash; and
   - Excess cement and certain completion and stimulation fluids defined by the EPA as exempt.

   It does not include drilling rig waste, such as:

   - Spent hydraulic fluids;
   - Used engine oil;

- Used oil filter;
- Empty cement, drilling mud, or other product sacks;
- Empty paint, pipe dope, chemical or other product containers; and
- Excess chemicals or chemical rinsate.

Any evidence of non-exempt wastes being put into the reserve pit may result in the BLM AO requiring specific testing and closure requirements.

9. Operators are advised that prior to installation of any oil and gas well production equipment, which has the potential to emit air contaminants, the owner or operator of the equipment must notify the WDEQ, Air Quality Division (307-777-7391) to determine permit requirements. Examples of pertinent well production equipment include fuel-fired equipment (e.g., diesel generators); separators; storage tanks; engines; and dehydrators.
10. If this well is drilled during the fire season (June through October), the operator shall institute all necessary precautions to ensure that fire hazard is minimized, including but not limited to mowing vegetation on the access route(s) and well location(s), keeping firefighting equipment readily available when drilling, etc.

**Dry Hole/Reclamation**

1. All disturbed lands associated with this project, including the pipelines, access roads, water management facilities, etc. will be expediently reclaimed and reseeded in accordance with the surface use plan and any pertinent site-specific COAs.
2. Disturbed lands will be recontoured back to conform with existing undisturbed topography. No depressions will be left that trap water or form ponds.
3. The fluids and mud must be dry in the reserve pit before recontouring pit area. The operator will be responsible for recontouring of any subsidence areas that develop from closing a pit before it is completely dry. The plastic pit liner (if any) will be cut off below grade and properly disposed of at a state authorized landfill before beginning to recontour the site.
4. Before the location has been reshaped and prior to redistributing the topsoil, the operator will rip or scarify the drilling platform and access road on the contour, to a depth of at least 12 inches. The rippers are to be no farther than 24 inches apart.
5. Distribute the topsoil evenly over the entire location and other disturbed areas. Prepare the seedbed by disking to a depth of 4 to 6 inches following the contour.
6. Waterbars are to be constructed at least 1 foot deep, on the contour with approximately 2 feet of drop per 100 feet of waterbar to ensure drainage, and extended into established vegetation. All waterbars are to be constructed with the berm on the downhill side to prevent the soft material from silting in the trench. The initial waterbar should be constructed at the top of the backslope. Subsequent waterbars should follow the following general spacing guidelines:

| Slope (percent) | Spacing Interval (feet) |
|---|---|
| ≤2 | 200 |
| 2 – 4 | 100 |
| 4 – 5 | 75 |
| ≥5 | 50 |

7. BLM will not release the performance bond until the area has been successfully revegetated (evaluation will be made after the second complete growing season) and has met all other reclamation goals of the surface owner and surface management agency.
8. A Notice of Intent to Abandon and a Subsequent Report of Abandonment must be submitted for abandonment approval.
9. For performance bond release approval, a Final Abandonment Notice (with a surface owner release letter on split-estate) must be submitted prior to a final abandonment evaluation by BLM.
10. Soil fertility testing and the addition of soil amendments may be required to stabilize some disturbed lands.
11. Any mulch utilized for reclamation needs to be certified weed free.

**Producing Well**

1. Landscape those areas not required for production to the surrounding topography as soon as possible. The fluids and mud must be dry in the reserve pit before recontouring pit area. The operator will be responsible for recontouring and reseeding of any subsidence areas that develop from closing a pit before it is completely dry.
2. Reduce the backslope to 2:1 and the foreslope to 3:1, unless otherwise directed by the BLM AO. Reduce slopes by pulling fill material up from foreslope into the toe of cut slopes.
3. Production facilities (including dikes) must be placed on the cut portion of the location and a minimum of 15 feet from the toe of the back cut unless otherwise approved by the BLM AO.
4. A dike will be constructed completely around the production facilities (i.e., production tanks, water tanks, and heater-treater). The dikes for the production facilities must be constructed of impermeable soil, hold 110 percent of the capacity of the largest tank plus 1 foot of freeboard, and be independent of the back cut.
5. Any chemicals used in treating the wells (e.g., corrosion inhibitor, emulsion breaker, etc.) will be in a secure, fenced-in area with appropriate secondary containment structure (dikes, catchment pan, etc.).
6. The load out line coming from the oil/condensate tank(s) will have a suitable containment structure to capture and recycle any oil spillage that might occur.
7. Any spilled or leaked oil, produced water, or treatment chemicals must be reported in accordance with NTL-2A and immediately cleaned up in accordance with BLM requirements. This includes clean-up and proper disposition of soils contaminated as a result of such spills/leaks.
8. Distribute stockpiled topsoil evenly over those areas not required for production and reseed as recommended.
9. Upgrade and maintain access roads and drainage control (e.g., culverts, drainage dips, ditching, crowning, surfacing, etc.) as necessary and as directed by the BLM AO to prevent soil erosion and accommodate safe, environmentally sound access.
10. Prior to construction of production facilities not specifically addressed in the APD/POD, the operator shall submit a Sundry Notice to the BLM AO for approval.
11. If not already required prior to constructing and drilling the well location, the operator shall immediately upgrade the entire access road to BLM standards (including topsoiling, crowning, ditching, drainage culverts, surfacing, etc.) to ensure safe, environmentally sound, year-round access.
12. Waterbars shall be installed on all reclaimed pipeline corridors per the guidelines in B.3.2.4.

**Operator Committed Measures**

The operator has incorporated several measures to alleviate resource impacts. For a detailed description of the design features, construction practices, and water management strategies associated with the Proposed Action, refer to the final Master Multi-Point Surface Use Plan, submitted on July 19, 2010, with clarifying information filed August 4 and 5, 2010, and resubmitted on August 18, 2010. Additional operator committed measures are incorporated in the following documents: Master Drilling Prognosis, Integrated Weed and Pest Management Plan, Water Management Plan, individual Federal APDs, POD maps, Wildlife Mitigation Plan (focus on sage-grouse conservation). And site-specific reclamation plans. These documents are available for review as part of the Table Mountain Phase 4 Administrative Record maintained at the BLM Buffalo FO.

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 0.5 mile of a Federal CBNG producing well in the POD.
4. Provide water analysis from a designated reference well in each coal zone.
5. The Operator has certified that a Surface Use Agreement has been reached with the landowners.