

Summary

A group of oil and gas companies (Lance Oil and Gas [Western Gas Company], Barrett Resources Corporation [Williams], Devon Energy Corporation, Yates Petroleum Corporation, Pennaco Energy [Marathon Oil Corporation], and CMS Oil and Gas [Perenco S.A]), collectively identified as the Powder River Basin Companies (Companies), has notified the U.S. Department of Interior, Bureau of Land Management (BLM) and U.S. Department of Agriculture, Forest Service (FS) of their intent to develop additional coal bed methane (CBM) resources in Wyoming's Powder River Basin (PRB). Implementation of this project would continue and expand development of CBM that has been occurring in the PRB over the last few years. In general, the Companies propose to:

- Drill, complete, operate, and reclaim almost 39,400 new natural gas wells and
- Construct, operate, and reclaim various ancillary facilities needed to support the new wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors.

The proposed project would occur in a Project Area of almost 8 million acres. This Project Area encompasses all or parts of Campbell, Converse, Johnson, and Sheridan counties and all or parts of 18 fourth-order watersheds (sub-watersheds). The proposed project would involve both public and privately owned lands. The public lands include areas administered by the BLM, the Medicine Bow National Forest, and the state. Additional information on land ownership and jurisdiction is presented in Chapter 3 of the Environmental Impact Statement.

Purpose of and Need for the Proposed Action

The Companies hold valid federal, state, and private leases for oil and natural gas in the Project Area. The leases have created contractual and property rights for the Companies from the United States, the State of Wyoming, and private mineral owners to develop oil and natural gas resources. The purpose of the Companies' proposal is to extract, transport, and sell oil and natural gas at a profit from the portions of the Project Area leased by them.

BLM and FS recognize the extraction of oil and natural gas is essential to meeting the nation's future needs for energy. As a result, private exploration and development of federal oil and gas reserves are integral to the agencies' oil and gas leasing programs under the authority of the Mineral Leasing Act of 1920, as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976. The oil and gas leasing program managed by BLM and FS encourages the development of domestic oil and gas reserves and reduction of the U.S. dependence on foreign sources of energy.

As a result of the contractual and property rights created by the valid leases, the direction set forth in BLM's oil and gas leasing program, the status of BLM's two RMPs, and the FS' LRMP, Revised LRMP, and FEIS for Oil and Gas Leasing, BLM and FS need to evaluate the level of development of oil and natural gas in the Project Area over the next 10 years. Specifically, BLM and FS need to evaluate the direct, indirect, and cumulative effects of the Proposed Action and reasonable alternatives and the conformance of this action with the associated RMPs.

When the five sets of primary guidance documents identified above were prepared, the levels of development for oil and natural gas anticipated at the time were less than are currently proposed by the Companies and the agencies' current Reasonably Foreseeable Development (RFD) Scenario (Appendix A). In particular, the current and proposed levels of development of CBM were not specifically defined. Consequently, BLM and FS need to evaluate conformance of the Proposed Action and alternatives to that action with the RMPs for Buffalo and Casper, the LRMP for Medicine Bow National Forest, and the FEIS for Oil and Gas Leasing on TBNG.

Therefore, this FEIS serves five purposes. First, it provides the basis to analyze and disclose the impacts of the level of development proposed in the Project Area (both under the Proposed Action and RFD scenarios). It addresses the effects of implementing a level of development of oil and natural gas within the Project Area that is conceptual in nature. The wells, roads, pipelines, and ancillary facilities depicted in this FEIS represent a proposed level of development and tentative locations for these facilities. The final location for each component would be established through future site-specific analyses that BLM and FS would require for each facility. These analyses would occur when the Companies file applications for each component, such as an Application for Permit to Drill (APD), a FS Special Use Permit (SUP), or a BLM Right-of-Way (ROW) Grant.

Second, this FEIS provides the means for the BLM and FS to provide federal minerals to meet the nation's energy needs. It also facilitates protection of the financial interest of the United States by preventing drainage of federal minerals.

Third, the FEIS identifies mitigation measures to address issues and conditions of approval for the subsequent site-specific applications for individual locations. These measures and conditions would be incorporated into the permitting process for the individual facilities (again through the APD, SUP, or ROW Grant processes).

Fourth, for the US Forest Service, the NEPA analysis documented in this FEIS will be used to assess the lease stipulations in the revised (2002) LRMP to determine whether the lease stipulations need to be modified or if new stipulations need to be developed for the 58,460 acres of the TBNG west of the coal outcrop line that have potential for development of CBM. In the July 2002 ROD for the FEIS and LRMP revision for the TBNG, these decisions were deferred pending completion of this FEIS.

Finally, BLM also is using the outcome of the impact analysis to review the existing RMP decisions. This includes decisions concerning the level of resource

use and conditions of use. If the decision makers determine that one or both of the agencies will amend one or both land use plans, the analyses contained in this FEIS will provide the basis for the amendments.

NEPA Process, Including Tiering and Decision Making

NEPA and directives by the Council on Environmental Quality (CEQ) require BLM and FS to analyze proposed actions that would involve federal lands and leases in terms of their potential effects on the human environment. Furthermore, regulations that implement the Mineral Leasing Act, as amended require BLM and FS to review and act on APDs and the attached Surface Use Plans of Operations (SUPO) and to decide on the requirements for surface occupancy specified in the SUPO. BLM and FS also issue ROW Grants and SUPs to construct and operate linear transportation facilities, such as roads and pipelines, across federal lands under Title V of FLPMA and under the Mineral Leasing Act.

The analysis of effects to the human environment discloses the potential environmental consequences of proposed actions and alternatives. BLM and FS also are responsible for establishing provisions to ensure that facilities and disturbed lands are reclaimed if an oil and gas operator would fail to complete adequate reclamation efforts. Bonds are required for oil and gas operations on federal leases to indemnify the government for safe rehabilitation, royalty payments, and civil penalties. Bonds also are required for ROWs on federal lands.

The BLM, Buffalo Field Office in Buffalo, Wyoming, is the lead federal agency responsible for conducting the NEPA analysis and preparing this FEIS. The FS (Medicine Bow National Forest) is a cooperating agency and is responsible for protecting non-mineral resources on National Forest System (NFS) land in TBNG. The Proposed Action and the alternatives were developed by an oversight team consisting of BLM, FS, State of Wyoming agencies, five conservation districts, and the four counties. Wyoming agencies specifically designated to represent the state as a cooperating agency on this team included the Office of Federal Land Policy, Wyoming Department of Environmental Quality (WDEQ), the Wyoming Oil and Gas Conservation Commission (WOGCC), and the Wyoming State Engineer (WSEO). The state also designated eight additional agencies to assist these four agencies.

This document provides the responsible agencies with information that can be used as the basis for a final decision that considers factors relevant to the proposal. Scoping issues and concerns raised by the public and agencies drove the development of alternatives and focused the environmental impact analysis. This FEIS documents (1) the analysis of effects that could result from implementation of the Proposed Action or alternatives, (2) the development of protection measures necessary to avoid, minimize, reduce, eliminate, or rectify environmental consequences, and (3) the review of BLM's existing RMP decisions.

The regulations that implement NEPA encourage tiering in an EIS. Tiering is the process of referencing information presented in other NEPA documents that were

prepared previously, such as EISs, to minimize repetition. This FEIS is specifically tiered to the five sets of guidance documents identified previously.

Finally, this FEIS is not a decision document; it documents the potential environmental consequences of implementing the proposed oil and gas development project and alternatives. The decisions about the FEIS and proposed plan amendment will be documented in separate Records of Decision (ROD) (one for the BLM and one for the FS) signed by the agency's responsible official. Decisions by BLM and FS will apply to federal lands and leases administered by BLM and the FS. Decisions by other jurisdictions to issue or deny approvals related to this proposal may be aided by the disclosure of effects available in this analysis.

Decisions to be Made Based on this NEPA Analysis

The decision makers for the BLM (Wyoming State Director) and FS (Medicine Bow-Routt National Forests Supervisor) will decide based on the analysis documented in this FEIS whether new mitigation measures need to be adopted and if any of the management plans will be amended. They also will decide whether current RMP or LRMP lease stipulations are adequate or if new stipulations need to be developed.

The FS has released a ROD, Revised LRMP, and FEIS for the TBNG (July 2002). East of the coal outcrop line new leasing decisions are included in the July 2002 ROD. That decision deferred new oil and gas leasing decision on the area west of the coal outcrop line until the cumulative effects of the development of CBM could be disclosed in this FEIS. Currently, the area west of the coal outcrop is available for leasing under the 1994 ROD for Oil and Gas Leasing on the TBNG. After the analysis of cumulative effects contained in this FEIS is available, the FS will make decisions for the portion of the TBNG west of the coal outcrop line on whether or not to implement the stipulations identified in the leasing analysis conducted for the 2002 Revised LRMP in the ROD accompanying this FEIS. In addition, the ROD will include a decision on stipulations and forest plan standards and guidelines needed to implement mitigation measures identified in this FEIS.

Decisions to be Made Following Additional NEPA Analysis

The RODs associated with this FEIS will not be the final review or the final approvals for the actions associated with the PRB oil and gas project. BLM and FS must analyze and approve each component of the project that involves disturbance of federal lands on a site-specific basis. A separate authorization(s) from BLM (and other permitting agencies) is required approving any APD, ROW Grant, or SUP before any construction can occur.

The APD includes a surface use program and a drilling plan. The detailed information to be submitted under each program is identified in Onshore Oil and Gas

Order No. 1 and 43 CFR Part 3162.3. An on-site inspection of the locations proposed for the well, access road, pipelines, and other areas of proposed surface use would be conducted before approval. The inspection team would include BLM, FS (if construction would occur on NFS lands), the lessee or its designated representative, and the primary drilling and construction contractors. Where applicable, federal grazing lessees would be invited to participate. For inspections that involve split estate lands (lands with both private surface and federal minerals ownership), BLM also would invite the surface owner to attend the on-site.

The on-site inspection would identify potentially sensitive areas and the environmental consequences associated with the proposal at each location and apply the methods needed to mitigate the effects on a site-specific basis. The on-site inspection could include site-specific surveys for cultural resources or threatened or endangered species, if the potential for these resources to occur exists on or near the proposed disturbance. After the site inspection, the APD may be revised or site-specific mitigation measures may be added as Conditions of Approval to the APD, consistent with applicable lease terms, to protect surface or subsurface resource values near the proposed activity. These conditions may include adjusting the proposed locations of well sites, roads, and pipelines; identifying the construction methods to be employed; and establishing reclamation standards for the lands.

Since the ROD for the Wyodak FEIS was issued, BLM has required that CBM projects be submitted as Plans of Development (POD). A POD is a group of wells and their supporting infrastructure (such as roads, pipelines, power lines, water discharge points, booster stations, and compressor stations) for a geographic area or sub-watershed. The POD helps the operators develop a logical, economical, environmentally sound CBM project that the BLM can efficiently review and approve.

BLM is responsible for conducting an environmental review on BLM lands (BLM surface ownership or all federal ownership of the mineral estate), preparing the documentation, and specifying mitigation measures to protect surface resources prior to APD approval. The FS would have similar responsibilities on NFS lands. BLM is responsible for approval of the drilling program, protection of ground water and other subsurface resources, and final approval of the APD on both BLM and NFS lands.

Access roads and pipelines on land managed by BLM outside the applicant's lease would require a ROW Grant. Likewise, facilities on NFS lands would require an SUP. The APD could be acceptable as an application for a ROW Grant or SUP for off-lease facilities if it provides sufficient detail of the entire proposal.

After drilling, routine well operations would not require approval. However, BLM would have authority for approving a variety of related activities. Any changes to an approved APD, certain subsequent well operations, and all subsequent new surface disturbances, such as workover pits, would require prior approval. Requirements pertaining to subsequent well operations are set forth in 43 CFR 3162.3–2. Disposal of produced water from federal leases would require prior approval, as outlined in Onshore Oil and Gas Order No. 7. BLM also would approve plugging and abandonment of wells, protection measures for hydrogen

sulfide (if necessary), gas venting, gas flaring, and certain measures for handling production.

Public Participation

Scoping

BLM and FS consider public participation a crucial component in defining the scope of the environmental analysis presented in this EIS. Consequently, the agencies worked to ensure the public was informed about the Companies' proposal and the opportunities available for participating in the environmental process.

BLM and FS first informed the public of their intent to conduct an environmental impact analysis of oil and gas development in the PRB during May and June 2000. In May, the agencies prepared and mailed 900 copies of a Scoping Letter that solicited comments to assist the BLM and FS in identifying the specific issues and concerns the agencies should address in the analysis and should document in the EIS.

On 21 June 2000, formal scoping for the analysis began with publication in the *Federal Register* of a Notice of Intent (NOI) to prepare an EIS. BLM published additional notices in the *Federal Register* to correct mistakes in the first NOI and to invite the public's participation in the analysis and potential amendments to the RMPs for Buffalo and Platte River.

BLM also sent a news release to more than 60 media outlets (newspapers, radio stations, and television stations) in Wyoming and Montana. This news release announced the intent of the agencies to prepare an EIS and identified times and locations for the public meetings. Additionally, several newspapers prepared stories on the project.

In addition to the publications and mailings, the agencies held four public meetings to discuss the proposal and receive comments from the public. The first meeting was held in Sheridan, Wyoming, on 6 June 2000. The second and third meetings were held on 7 June 2000 in Buffalo, Wyoming, and on 8 June 2000 in Gillette, Wyoming. The final meeting was held in Douglas, Wyoming, on 12 June 2000. The proposal was described and participants were provided the opportunity to ask questions and submit comments at all meetings.

Finally, BLM and FS have been keeping the public informed of the status of the analysis through a periodic newsletter and a project-specific web site (www.prb-eis.org). BLM also included project information on its Wyoming web site.

Review of the DEIS

In mid-January 2002, the DEIS was distributed to the public. The distribution list included the agencies, companies, organizations, and individuals that had expressed an interest in the project during scoping. It also included several agencies and elected officials to whom BLM and the FS commonly send EISs.

The DEIS was available for public review and comment from January 18, 2002, through May 15, 2002. The BLM and FS encouraged reviewers to submit written comments on the document during this period. In addition, the BLM held public meetings on the draft EIS on March 18 through 21, 2002, to provide the public with the opportunity to submit verbal and written comments in person.

Reviewers of the DEIS submitted a variety of comments. Most of the comments were contained in 17,940 letters. However, 28 individuals provided verbal comments at the public meetings. Overall, the comments focused on the issues identified in the DEIS and the NEPA process. Appendix L contains a summary of the comments received on the DEIS and the BLM and FS' responses to those comments.

In response to the comments, BLM and FS made a variety of changes throughout the document. The discussion of the alternatives in Chapter 2 was revised to address errors in some calculations, update information in response to WDEQ's changes in its procedures for permitting disposal of water produced from CBM wells, and to expand and clarify information on the alternatives and their impacts. For example, a graph showing the cumulative number of CBM wells producing by year was added and WDEQ revised the distributions of methods for handling water produced from CBM wells. Certain assumptions changed to reflect conditions more accurately. The cumulative analysis for air and surface water was coordinated with BLM Montana and its cooperators and was combined for this EIS and the Statewide Montana EIS. Discussion of the affected environment in Chapter 3 was expanded to provide at least some of the additional information requested in the comments, particularly the description of biological resources. Throughout Chapter 4, the discussion of environmental consequences was revised and expanded to provide a clearer perception of the likely effects of the alternatives. Because of the variety of changes made throughout the document in response to comments, BLM and FS printed this EIS in its entirety rather than printing it as an abbreviated FEIS.

Issue Identification and Issue Statements

BLM and FS reviewed and analyzed the comments they received during the scoping process. Public response to the notices and meetings included 74 letters, comment forms, and e-mails. In addition, 106 people attended one or more of the four public meetings.

The agencies' process for identifying issues involved three overall steps. First, specific comments were arranged into groups of common concerns. Next, a primary issue statement was prepared for each group of comments. Finally, the issue statements were evaluated for applicability to this NEPA analysis.

The analysis of comments initially identified 27 issues. Eighteen of these 27 issues were identified as key or significant (see November 2000 Scoping Summary to review non-significant issues). These issues were used to define the scope of this NEPA analysis. Key issues were used to analyze environmental effects, prescribe mitigation measures, or both. Issues are "significant or key" based on the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. The decision on an issue's significance is dif-

ferent than and separate from any determination of the significance of an environmental consequence. The other nine issues were not identified as key because they involved standard parts of a NEPA analysis (for example, the analysis must consider an adequate range of alternatives) or the agencies concluded that they were beyond the scope of this NEPA analysis. The 18 key issues that constituted the overall scope of the NEPA analysis are:

Issue 1: The effects of the additional development of oil and gas resources on aquifers present in and downgradient of the project area.

Issue 2: The effects of the additional development of oil and gas resources on the quantity and distribution of surface water in and downstream of the project area.

Issue 3: The effects of the additional development of oil and gas resources on the quality of surface water in and downstream of the project area and the potential to adversely affect current uses of surface waters.

Issue 4: The effects of the additional development of oil and gas resources on the project area's geology, geologic hazards, and the extraction of other mineral resources present in the project area.

Issue 5: The effects of the additional development of oil and gas resources on soils in and downstream of the project area.

Issue 6: The effects of the additional development of oil and gas resources on air quality and visibility.

Issue 7: The effects of the additional development of oil and gas resources on vegetation in and downstream of the project area, including wetlands and riparian areas.

Issue 8: The effects of the additional development of oil and gas resources on species of wildlife and their habitats (particularly key species and habitats).

Issue 9: The effects of the additional development of oil and gas resources on fisheries and aquatic habitats.

Issue 10: The effects of the additional development of oil and gas resources on the project area's ecological integrity and biological diversity.

Issue 11: The effects of the additional development of oil and gas resources on special-concern species, and in particular on threatened, endangered, candidate, or sensitive species of plants and animals.

Issue 12: The effects of the additional development of oil and gas resources on rangeland resources and grazing operations.

Issue 13: The effects of the additional development of oil and gas resources on cultural resources, paleontological resources, and Native Americans.

Issue 14: The effects of the additional development of oil and gas resources on recreational opportunities and the recreational experience.

Issue 15: The effects of the additional development of oil and gas resources on the project area's aesthetics.

Issue 16: The effects of the additional development of oil and gas resources on the local economy.

Issue 17: The effects of the additional development of oil and gas resources on human health and safety.

Issue 18: The analysis needs to include an analysis of environmental justice.

Alternatives Analyzed in Detail

Three alternatives were analyzed in detail: (1) Proposed Action, (2) Proposed Action with Reduced Emission Levels and Expanded Produced Water Handling Scenarios, and (3) No Action.

Alternative 1 – The Companies’ proposed action was combined with BLM’s RFD Scenario. The RFD Scenario is based primarily on geology (potential for oil and gas resources to occur) and past and present oil and gas development, with consideration of other significant factors such as economics, technology, and physical limitations on access, existing or anticipated infrastructure, and transportation.

Along with industry’s proposed action, which relates only to CBM, BLM’s RFD Scenario forecasts the continued drilling of an estimated 3,200 oil wells. The RFD Scenario also forecasts an estimated 51,000 CBM wells in the EIS area over the next 10 years. About 25 trillion cubic feet (tcf) of CBM may be recoverable from coal beds in the PRB within Wyoming.

The Companies’ projections of CBM well drilling and production include various ancillary facilities in the Project Area. The ancillary facilities include access roads, pipelines to gather gas and produced water, electrical utilities, facilities to treat and compress gas and dispose of produced water, and pipelines to deliver gas under high pressure to transmission pipelines. Although the Companies would develop new wells throughout the 10-year period beginning in 2002, most drilling would occur during the first 8 years. Not all 51,000 wells would be drilled into a single coal seam. Wells drilled into different coal seams can be collocated on common well pads. The projected number of well pads is 35,589. The total numbers of wells and well pads is based on an 80-acre spacing pattern (eight pads per square mile). The 51,000 proposed CBM wells include an estimated 12,000 existing wells.

Under the Proposed Action, the Companies would construct, operate, and maintain wells and ancillary facilities in 10 of the 18 sub-watersheds that make up the Project Area. However, most of the new wells (63 percent) and facilities would be constructed in two sub-watersheds: the Upper Powder River and Upper Belle Fourche River. Sub-watersheds that would contain relatively high numbers of wells and facilities include Clear Creek, Crazy Woman Creek, Tongue River, and Little Powder River.

Overall, implementation of the Proposed Action could disturb as many as 212,000 acres, though requirements for reclamation will be imposed. This short-term disturbance would encompass about 3 percent of the Project Area, and most would be associated with construction of pipelines and roads. Long-term disturbance is projected to involve approximately 109,000 acres. Compressor stations would account for the smallest amount of the overall disturbance.

Construction of wells in the Powder River Basin would begin during 2003. Generally, construction of most CBM wells would be completed over the first 8 years

(by the end of 2011). The production lifetime of the wells is expected to be about 7 years, and final reclamation is expected to be completed during the 2 to 3 years after production ends.

Emphasis for water handling for Alternative 1 is untreated surface discharge. All compression would be powered by CBM.

Alternative 2 proposes the same number of CBM and conventional wells as the proposed action. However, two additional water-handling methods are analyzed: A – emphasis on infiltration, and B – emphasis on treatment for beneficial use.

There are also two air quality options: A – 50 percent of booster compression would be electrically powered, and B – 100 percent of booster compression would be electrically powered.

Alternative 3 – No Action. This alternative would consist of no new federal wells. Wells would be developed only on state and private mineral ownership.

Affected Environment

The PRB is part of the Missouri Plateau of the Great Plains. This region is characterized by rolling uplands that have been greatly dissected by tributaries of the Missouri River system. The Bighorn Mountains, which are part of the Rocky Mountains, lie just west of the PRB, in part within the westernmost portion of the Project Area. On the east, the PRB is bounded by the Black Hills. On the south, the PRB is bounded by the Casper arch, the Laramie Mountains, and the Hartville Uplift.

The PRB consists of a dissected, rolling upland plain, with low to moderate relief, broken by buttes, mesas, hills, and ridges. Extensive areas of open high hills in the northern portion of the Project Area indicate rough, broken terrain where moderate to deep erosion has occurred. Erosion-resistant clinker, produced by the natural burning of coal beds in the PRB, caps many hills and ridges in the Project Area with a characteristic broken, red brick or scoria-like rock. Elevations in the Project Area range from 3,350 to 9,250 feet above mean sea level (msl).

The PRB is drained toward the north and east by the Tongue, Powder, Little Powder, Belle Fourche, and Cheyenne Rivers, which all flow into the Missouri River system. The Project Area forms a low divide among these smaller drainage systems. The major river valleys have wide flat floors and broad floodplains. Tributaries in the Project Area are incised and drain areas of isolated, flat-topped, clinker-covered buttes and mesas, 100 to 500 feet above the valley floor. Flow in the Project Area is generally toward the northeast. Perennial streams generally originate in the mountainous areas because of significant annual precipitation and geologic conditions that foster discharge of groundwater.

Surface water quality in the Project Area is generally adequate to support designated uses. Surface waters in the Project Area are typically alkaline, with moderate to high levels of hardness. These waters vary from a calcium bicarbonate type in the mountain streams, to a sodium sulfate type in the lowlands. Surface water quality in the Project Area is affected by depletions and return flows from irriga-

tion. Surface water in the Project Area is withdrawn to support agricultural, domestic, and stock water uses. Irrigation accounts for about 98 percent of surface water withdrawals in the Project Area.

The groundwater resources of the PRB that are at or near the land surface are contained in unconsolidated Quaternary alluvial or basin fill deposits or in semi-consolidated to consolidated lower Tertiary sandstones and coal beds that are the uppermost aquifers in the Northern Great Plains aquifer system. Clinker, which also can make up an aquifer, has formed from some of the lower Tertiary sediments. The Lower Tertiary Aquifer System consists of the Wasatch aquifers, the Fort Union aquifers contained in the Tongue River member of the Fort Union Formation, the Lebo confining layer, and the Tullock aquifer.

The PRB contains some of the largest accumulations of low-sulfur sub-bituminous coal in the world. Thick coal deposits occur at or near the surface along the eastern boundary of the Project Area, along a north-south trend situated west of both Gillette and Wright, and in the northwestern portion of the Project Area. Important coal seams within the Wasatch Formation, from oldest to youngest, include the School, Badger, Felix, and Lake De Smet. Important coal seams within the Fort Union Formation, from oldest to youngest, include the Canyon, Anderson, Wyodak, and Big George.

Although specific air quality monitoring is not conducted throughout most of the Project Area, air quality in rural areas is currently considered to be very good, as characterized by limited sources of emissions (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion, resulting in relatively low air pollutant concentrations. Occasional high concentrations of carbon monoxide (CO) and particulate matter may occur in more urbanized areas (such as Buffalo, Gillette, and Sheridan) and around industrial facilities, especially under stable atmospheric conditions common during the winter.

The Project Area is characterized as a mosaic of vegetation types that includes prairie grasslands, shrublands, riparian areas, and forested areas. Fourteen vegetation types were identified within the Project Area. They are short-grass prairie, mixed-grass prairie, wet meadow, herbaceous riparian, sagebrush shrubland, other shrubland, shrubby riparian, coniferous forest, aspen, forested riparian, agriculture, urban/disturbed, barren, and water. These broad categories often represent several vegetation types that were similar in terms of dominant species and ecological importance.

All of the vegetation types present in the Project Area provide habitats for some species of wildlife. When they are undisturbed, the major vegetation types in the Project Area provide high-quality habitats for many species of wildlife. Because these habitats tend to occur in a mosaic across the landscape, many species of wildlife can be expected to use more than one habitat. Primary species of wildlife of concern in the Project Area include the pronghorn antelope, mule deer, white-tailed deer, elk, moose, sage grouse, sharp-tailed grouse, and various raptors. Perennial streams in the Project Area support a diverse fish fauna of mostly native, game and nongame species.

Not surprisingly, the Project Area supports a variety of special-status species that are of concern to the management agencies. These species of plants and animals include several listed by the U.S. Department of Interior, Fish and Wildlife Service (USFWS), as threatened or endangered or being considered for listing as threatened or endangered. They also include species that the BLM or FS consider rare or sensitive.

A variety of prehistoric and historic cultural resource sites have been documented in each of the sub-watersheds in the Project Area by site type or historic theme and during evaluation for the National Register. The files search for this area reveals a high proportion of sites that are unevaluated or for which information on evaluation is lacking – 35.6 percent for prehistoric and 35 percent for historic. The tables for the files search show 13 percent of the prehistoric sites and 9.6 percent of the historic sites as listed or eligible. Typically, about 10 to 15 percent of the documented sites in an area are evaluated as eligible for listing in the National Register of Historic Places when adequate information is available.

Land ownership in the Project Area consists primarily of private lands intermingled with federal and state lands. Mineral ownership in the Project Area consists primarily of federal mineral estates. Rangeland/livestock grazing is the dominant land use for both public and private lands in the Project Area.

Gillette and Sheridan are the hubs for the transportation network in the Project Area. Interstate highways in the Project Area include Interstate (I)-25 and I-90. The major north-south transportation corridors include State Route 59 in Campbell and Gillette Counties, and I-25 in Johnson and Sheridan Counties. The principal east-west highway for Campbell and Johnson Counties is I-90. I-90 runs north from the Town of Buffalo to the City of Sheridan, and continues north to the Montana state line. U.S. highways in the Project Area include U.S. Routes 14, 16 east of Buffalo, and 87. The primary state highways in the Project Area are Routes 59, and 387. Secondary state highways that traverse the area include Routes 50, 51, 192, 196, 338, and 450. Numerous county roads also provide local access to public and private lands in the Project Area.

Oil and gas pumping units and associated well pads and access roads are evident throughout the Project Area. However, most of the existing well development is in the eastern half of the Project Area. Well development is most evident in Campbell County between the cities of Gillette and Wright, and north, west, and northwest of Gillette. Development is also evident along I-90 and State Highways 14 and 93 in Campbell and Sheridan Counties. The landscape that has resulted from ongoing oil and gas development in this area is rural/industrial.

Most of the areas with significant scenic values occur in the western part of the Project Area. The South Big Horns Area is located in the southwest quarter of Johnson County, primarily within the Middle Fork Powder River sub-watershed. The area provides sensitive and unique resource values, including scenery. Special management areas (SMA) within the South Big Horns Area include the Middle Fork Recreation Area, the Red Wall/Hole-in-the-Wall area, Outlaw Cave, the Dull Knife Battlefield site, and the Gardner Mountain and North Fork Wilderness Study Areas. The Powder River Breaks in eastern Johnson County, the Fortification Creek SMA and wild and scenic area (WSA), and the Weston Hills Recrea-

tion Area in the eastern part of the Project Area also provide scenic settings for a variety of dispersed recreational activities.

Two scenic byways exist in the western part of the Project Area. They provide access to the Bighorn Mountains. The Bighorn Scenic Byway is on U.S. Route 14 west of Ranchester. The Cloud Peak Skyway is on U.S. Route 16 west of Buffalo.

Recreational use of the Project Area is limited because more than 75 percent of the land is privately owned. Opportunities for dispersed recreation can be found on federal and state lands throughout the Project Area, however. A few developed recreational sites or facilities exist within special management areas on federal lands in the Project Area. Developed recreational facilities, such as campgrounds, are generally limited to private lands in or near larger communities in the Project Area, and to state historical sites located in the western part of the Project Area. Communities in the Project Area, including Sheridan, Gillette, Wright, Buffalo, and Kaycee, provide a variety of municipal and private recreational facilities, including golf courses, rodeo grounds, ball parks, and swimming pools.

Major sources of noise are towns; industrial facilities; major roadways, such as I-90; railroad corridors; and frequent high winds. Noise in rural areas away from industrial facilities and transportation corridors is generally 30 to 40 decibels on the A-weighted scale (dBA) when the wind speeds are low. Levels of noise close to industrial facilities and transportation corridors are likely to be in the range of 50 to 70, dBA depending on the proximity to the source. The most significant noise from CBM operations results from operation of compressor stations that use multiple engines to move natural gas from central gathering facilities and along high-pressure transmission pipelines. Noise from these compressor stations has been estimated to be 55 dBA at 600 feet from the compressor station.

The Project Area encompasses all or portions of Converse, Campbell, Johnson, and Sheridan counties in Wyoming. It also includes four incorporated municipalities: Gillette, Wright, Sheridan, and Buffalo. Gillette is the county seat and the largest incorporated city in Campbell County. Wright is in southern Campbell County. Sheridan is the county seat of Sheridan County, and Buffalo is the county seat of Johnson County.

Summary Comparison of Alternatives and Environmental Consequences

The following tables summarize the alternatives considered in detail and the likely environmental consequences of each. Table S-1 contains the summary of alternatives. This table contrasts the four alternatives in terms of their physical characteristics. The matrix presented in Table S-2 provides a comparison summary of the effects to the various environmental resources that would be realized by implementing each of the four alternatives for the Powder River Basin Oil and Gas Project.

Agency-Preferred Alternative

BLM's preferred alternative is a combination of Alternative 2A and Alternative 1. BLM prefers Alternative 2A for all parts of the project except the use of electric booster compressors. Thus, the portion of Alternative 1 preferred by BLM is the natural gas-fired compressors. The following discussion presents BLM's rationale for these preferences.

Although implementation of Alternative 2A for water may disturb more land and cost more than Alternative 1, BLM prefers Alternative 2A, emphasis on infiltration to reduce or mitigate impacts to water because:

1. Alternative 2A involves separate water management strategies for each sub-watershed that align with WDEQ's current approach to permitting.
2. The water management plans required under Alternative 2A would minimize the volume of water that reaches the main-stems in the sub-watersheds of the Little Powder River, Powder River, and Tongue River. This would reduce the potential for adverse effects on the water quality in the sub-basins most sensitive to potential changes in water quality, and most heavily used by irrigators.
3. Alternative 2A would maximize local beneficial use of the produced water rather than discharging the water downstream where the state and surface owners get no benefit from this resource.
4. Alternative 2A maximizes infiltration and storage of the produced water into the shallow aquifers of Wyoming, rather than having this resource pumped into surface waters that leave the state. This infiltration also would help with deeper aquifer recharge in the PRB.
5. Encourages treatment of produced water, where feasible and practicable.

BLM's preferred alternative retains the action as proposed with respect to the use of natural gas-fired compressors.

For Alternative 1, (natural gas fired compression engines) the analysis documents that the benefits to air quality and visibility from electrifying half or all of the booster compressors is negligible and would be insufficient to justify the additional costs of requiring the Companies to use electric booster compressors. An additional factor that led to this decision is the need for new power generation to provide electricity to these compressors. Also, the Companies would build relatively few booster compressors on surface owned by the Federal government and BLM does not have the ability to require electrification of compressors constructed off Federal surface. The State of Wyoming is responsible for permitting the compressors. The need for electrical compression as a condition of approval is best developed based on a case by case review of the emissions permit applications to be issued by the WDEQ. Choosing this option as the preferred alternative for air does not preclude the WDEQ from requiring the use of electric compression if determined to be necessary during its permitting process. This gives the WDEQ maximum flexibility to permit facilities in the most economical way that complies with applicable national and state air quality standards.

BLM and the State of Wyoming are committed to preventing any exceedence of air quality standards. In response to comments on the DEIS, BLM has used the same model for air quality impacts as the Montana BLM, and has gathered new data since the draft. Although the new model shows that there is a potential for greater air impacts than in the DEIS, the majority of these additional impacts result from other activities that are ongoing within the Project Area and not the project itself. BLM and the state will continue to monitor and implement adaptive management strategies at the permitting stage to assure that air quality in the region continues to meet federal and state goals for PM₁₀, HAPS, visibility impairment, and atmospheric deposition.

Proposed Amendments to RMP/LRMP

The BLM RMPs would be amended to: (1) allow oil and gas exploration and development at the level analyzed in the FEIS; (2) adopt the operational requirements included as a new Appendix I in the FEIS and standard conditions of approval (Appendix C in the DEIS and FEIS) that have been established over time; (3) adopt the mitigation measures developed in previous NEPA documents (referenced in Appendix C in the DEIS and included as a new Appendix L in the FEIS); and (4) adopt the new mitigation described in the FEIS (Chapter 4 in the DEIS and FEIS). In addition, the FEIS updates the NEPA analysis for the RMPs for management of oil and gas exploration and development on federal leases.

For the U.S. Forest Service, the FEIS will be used to allow oil and gas exploration and development at the level analyzed in the FEIS, update the NEPA analysis for the LRMP and adopt the 2002 LRMP stipulations for the area west of the coal outcrop line.

Table S-1 Summary Comparison of Alternatives Considered in Detail

Parameter	Alternative			
	1	2A	2B	3
New CBM Facilities				
<i>Number of Wells</i>				
Federal ownership	23,863	23,863	23,863	0
Non-federal ownership	15,504	15,504	15,504	15,504
Total	39,367	39,367	39,367	15,504
<i>Number of Well Pads</i>				
Federal ownership	15,425	15,425	15,425	0
Non-federal ownership	10,572	10,572	10,572	10,572
Total	25,997	25,997	25,997	10,572
<i>Roads (miles)</i>				
Improved	7,135	7,135	7,135	2,864
Two-track	10,619	10,619	10,619	4,387
<i>Pipeline (miles)</i>				
2-3-inch poly	14,127	14,127	14,127	5,836
12-inch poly	5,311	5,311	5,311	2,194
12-inch steel	1,408	1,408	1,408	516
<i>Overhead Electric Line (miles)</i>	5,311	5,311	5,311	2,194
<i>Compressors</i>				
Number of booster units	1,060	1,060	1,060	350
Number of booster stations	184	184	184	62
Total horsepower of booster units	371,000	371,000	371,000	122,500
Number of reciprocating units	298	298	298	97
Number of reciprocating stations	61	61	61	19
Total horsepower of reciprocating units	491,700	491,700	491,700	160,050
<i>Water Handling Facilities</i>				
Analyzed number of surface discharge facilities	1,217	606	878	419
Analyzed number of infiltration facilities	1,301	3,091	2,169	638
Analyzed number of containment impoundments	57	12	37	24
Analyzed number of injection wells	323	305	292	147
Analyzed number of LAD facilities	28	68	72	13
<i>Projected Short-term Disturbance (acres)</i>	193,589	202,843	199,233	79,052
<i>Projected Long-term Disturbance (acres)</i>	85,884	95,138	91,528	35,458
<i>Workforce Requirements</i>				
Construction and installation (peak no. of employees)	505	595	552	187
Operation and maintenance (peak no. of employees)	1,918	2,191	2,157	1,921
Reclamation and abandonment (peak no. of employees)	189	214	196	126
New non-CBM Facilities				
<i>Number of new wells</i>				
Federal ownership	1,791	1,791	1,791	0
Non-federal ownership	1,409	1,409	1,409	1,409
Total	3,200	3,200	3,200	1,409
<i>Projected short-term disturbance (acres)</i>	8,800	8,800	8,800	3,581
<i>Projected long-term disturbance (acres)</i>	7,520	7,520	7,520	3,060
<i>Workforce Requirements</i>				
Construction and installation (peak no. of employees)	42	42	42	42
Operation and maintenance (peak no. of employees)	25	25	25	25
Reclamation and abandonment (peak no. of employees)	23	23	23	23
Total Projected Disturbance (CBM and non-CBM)				
Projected short-term disturbance (acres)	202,389	211,643	208,033	82,633
Projected long-term disturbance (acres)	93,404	102,658	99,048	38,518

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
<i>Groundwater</i>				
Removal	Remove 3,069,665 acre-feet during the life of the project, about 0.2 percent of the recoverable groundwater stored within the Wasatch and Fort Union Formations	Same as Alternative 1	Same as Alternative 1	Remove 1,627,742 acre-feet during the life of the project, about 0.1 percent of the recoverable groundwater stored within the Wasatch and Fort Union Formations.
Maximum Drawdown				
Fort Union Formation	Up to 800 feet	Same as Alternative 1	Same as Alternative 1	Similar to Alternative 1. However, the areal extent of the 25-foot drawdown contour would tend to decrease in areas where large concentrations of federal wells were projected to be drilled under Alternative 1, due to non-development under Alternative 3.
Deep Wasatch Sands	Deep Wasatch Sands within 100 feet of the coal zone could experience drawdowns that are 5 to 10 percent of the projected drawdown in the coal.	Same as Alternative 1	Same as Alternative 1	Similar to Alternative 1. However, in areas that would have had very high concentrations of federal wells under Alternative 1, the extent of drawdown within the Wasatch Sands would be less, because of non-development under Alternative 3.
Period of Maximum Drawdown				
Fort Union Formation	2006–2009	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Deep Wasatch Sands	Drawdown in the deep Wasatch Sands would occur several years after drawdown in the coal occurs.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Buildup				
Shallow Wasatch Sands	Up to 50 feet near impoundments. Up to 10 feet farther from impoundments.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Alluvium	Up to 10 feet has been documented; anticipated rise in water level could be more or less.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Infiltration and Recharge	Recharge of shallow Wasatch aquifer increased during CBM development as a result of infiltration below creeks and impoundments that receive CBM discharge water. An estimated 15 to 33 percent of CBM produced water infiltrates the surface.	Similar to Alternative 1. An estimated 28 to 43 percent of CBM produced water infiltrates the surface	Similar to Alternative 1. An estimated 21 to 30 percent of CBM produced water infiltrates the surface.	Similar to Alternative 1, however, the volume of water produced under Alternative 3 would be a little more than half the volume of water produced under Alternative 1. Although the same percentage of CBM-produced water would infiltrate the surface, the volume of water infiltrating the surface likely would be reduced by half.
Quality	Groundwater quality within the regional aquifer systems and alluvial aquifers would not be noticeably affected.	Same as Alternative 1	Same as Alternative 1.	Same as Alternative 1
Recovery	Rapid initial recovery of water levels in developed coals following cessation of CBM pumping. Recovery to within 50 to 100 feet of pre-development water levels occurs by 2030. By 2060, water levels in the coal would recover to within 10 to 50 feet of pre-operational levels, exception in very localized areas of the basin. Water levels eventually would recover to within 20 feet or less of pre-operational levels over the next hundred years or so. Recovery of more than 50 percent in the deep Wasatch Sands would occur by 2030. Water levels eventually would recover to within less than 20 feet of pre-operational levels over the next hundred years or so.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Springs/Wells	Wells completed in developed coals that are located within the areal extent of the 100-foot drawdown contour could experience drops in water level and possibly methane occurrence. Flowing artesian wells and springs that emanate from coals in this area are likely to experience a decrease in flow rate. Recovery of artesian conditions likely would not occur unless recovery of the last five percent or so of hydraulic head occurs. Wells and springs in the Wasatch aquifer are not expected to be substantially affected unless they are within 100 feet (vertically) of developed coal.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
<i>Surface Water</i>				
Quantity	An estimated 33 to 62 percent of CBM produced water would contribute to surface flows. Perennial flows likely to develop in formerly ephemeral channels	Similar to Alternative 1; an estimated 9 to 52 percent of CBM produced water would contribute to surface flows.	Similar to Alternative 1; an estimated 6 to 52 percent of CBM produced water would contribute to surface flows.	Similar to Alternative 1; however, the volume of water produced under this alternative would be a little more than half the volume produced under Alternative 1. Although the same percentage of CBM produced water would contribute to surface flows, the volume of water would be reduced by half.
CBM produced water discharged to main stems during peak year of water production	200,336acre-feet	131,937 acre-feet	125,109 acre-feet	102,917 acre-feet
Quality	Noticeable changes in water quality of main stems during periods of low flow. NPDES permit conditions would provide enforceable assurance that water quality standards and designated uses would not be degraded from discharges of CBM produced water.	Similar to Alternative 1; however, changes would be less noticeable because of the decrease in direct surface discharge.	Similar to Alternative 1; however, changes would be less noticeable because of the decrease in direct surface discharge and increase in the proportion of CBM produced water to undergo active treatment.	Similar to Alternative 1

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
	Concentrations of suspended sediment in surface waters likely to rise above present levels as a result of increased flows and runoff from disturbed areas.	Similar to Alternative 1	Similar to Alternative 1	Similar to Alternative 1
	SAR values and concentrations of sodium may inhibit the use of irrigation on some tributaries.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Use	Increased availability of surface water for irrigation and other downstream beneficial uses.	Similar to Alternative 1	Similar to Alternative 1; however, the volume of CBM produced water available to support beneficial use would be as much as 20 percent greater than under Alternative 1 because of the proportion of produced water to undergo active treatment.	Similar to Alternative 1; however, the volume of CBM produced water available to support beneficial use would decrease from Alternative 1 by about half.
	Numerous impoundments would be constructed to temporarily store CBM produced water for beneficial use. An estimated 6 to 23 percent of CBM produced water would be held in storage.	Similar to Alternative 1. An estimated 8 to 25 percent of CBM produced water would be held in storage.	Similar to Alternative 1. An estimated 7 to 24 percent of CBM produced water would be held in storage.	Similar to Alternative 1. Although the same percentage of CBM produced water would be held in storage, the volume of water stored would be reduced by about half.
<i>Physiography, Geology, Paleontology, and Minerals</i>				
Paleontology	If Class 3, 4, or 5 formations are present in areas of disturbance, ground-disturbing activities could damage or destroy surface and sub-surface fossils.	Similar to Alternative 1, but with a higher potential caused by the larger amount of disturbance.	Similar to Alternative 1, but with a higher potential caused by the larger amount of disturbance.	Similar to Alternative 1, but with a reduced potential caused by the smaller amount of disturbance.
Minerals	Would produce about 16 trillion cubic feet of CBM. Would produce about 220 million barrels of oil equivalent from the non-CBM wells.	Same as Alternative 1	Same as Alternative 1	Would produce about 8 trillion cubic feet of CBM. Considerable drainage of CBM resources from federal mineral ownership lands would occur. Would produce about 100 million barrels of oil equivalent from the non-CBM wells.

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Geological Hazards	Implementation is unlikely to cause noticeable ground subsidence or increase the potential for underground coal fires. Migration of some CBM could occur within the PRB as development of CMB occurs.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1, but to a smaller extent because of the smaller number of wells.
<i>Soils</i>				
Erosional effects from facilities located on soils with high wind erosion potential	Increased wind erosion caused by removal of vegetation, excavation, and stockpiling of soil, especially in sandy soils. Approximately 25,474 acres in the short term and 13,403 acres in the long term would be disturbed on soils with high wind erosion potential.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Because of the decrease in surface discharge and the increase in impoundments, the potential for wind erosion would increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Because of the decrease in surface discharge and the increase in impoundments, the potential for wind erosion would increase slightly, but less than in Alternative 2A.	All disturbances would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a smaller scale.
Erosional effects from facilities located on soils with high water erosion potential	Increased water erosion and sedimentation caused by removal of vegetation, excavation, slope steepening, and compaction, especially in clayey soils. Approximately 76,691 acres in the short term and 38,452 acres in the long term would be disturbed on soils with high water erosion potential. Estimates of soil loss on these soils range from 3.4 to 18.7 tons/acre/year on bare soil and 0.5 to 2.6 tons/acre/year 1 year after reclamation.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Because of the decrease in surface discharge and the increase in impoundments, the potential for water erosion would increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Because of the decrease in surface discharge and the increase in impoundments, the potential for water erosion would increase slightly, but the increase would be less than in Alternative 2A.	All disturbances would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a smaller scale.
Facility location on slopes greater than 25 percent	No facilities would be located on slopes greater than 25 percent. Roads would be located to avoid steep slopes.	No facilities would be located on slopes greater than 25 percent. Roads would be located to avoid steep slopes.	No facilities would be located on slopes greater than 25 percent. Roads would be located to avoid steep slopes.	No facilities would be located on slopes greater than 25 percent. Roads would be located to avoid steep slopes.

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Effects on soil productivity	Reduction in soil productivity caused by removal of vegetation, compaction, changes in salinity, excavation, and stockpiling of soil. Implementation would disturb soils with high compaction potential (99,504 acres), low potential for revegetation (82,639 acres), high salinity (538 acres), or on Prime Agricultural (89,238 acres) soils.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options (additional 9,254 acres). Because of the decrease in surface discharge and the increase in impoundments, the potential for infiltration would be reduced, but soil mixing and compaction could increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options (additional 5,644 acres). Because of the decrease in surface discharge and the increase in impoundments, the potential for infiltration would be reduced, but soil mixing and compaction could increase slightly. These changes in effects from Alternative 1 would be less than would be experienced under Alternative 2A.	All disturbances would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a much smaller scale (15,326 fewer acres of disturbance).
<i>Air Quality</i>				
Total near-field concentrations of criteria pollutants	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)
Cumulative near-field concentrations of criteria pollutants	Above PSD Class II increment for PM ₁₀ 24 hour; concentrations of other pollutants below increments	Below PSD Class II increments	Below PSD Class II increments	Below PSD Class II increments
Total far-field concentrations of criteria pollutants	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)	Compliance with Wyoming and national ambient air quality standards (WAAQS, NAAQS)
Cumulative far-field concentrations of NO ₂ annual	Above PSD Class I increment in Northern Cheyenne Reservation. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation. Concentrations in other areas are below increments
Cumulative far-field concentrations of PM ₁₀ 24 hour	Above PSD Class I increment in Northern Cheyenne Reservation and Washakie Wilderness. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation and Washakie Wilderness. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation and Washakie Wilderness. Concentrations in other areas are below increments	Above PSD Class I increment in Northern Cheyenne Reservation. Concentrations in other areas are below increments
Maximum 8-hour concentrations of hazardous air pollutants (HAP)	Formaldehyde concentrations above strictest threshold, but well within range. Concentrations for other HAP within range of states' thresholds	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Cancer risk	Below threshold	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Cumulative visibility impacts in mandatory federal Class I areas	Potential impacts range from 3 days above 1 dV at Red Rock Lakes Wilderness to 32 days above 1 dV at Wind Cave National Park. Potential maximum deciview change is 29 dV at UL Bend Wilderness.	Potential impacts range from 3 days above 1 dV at Red Rock Lakes Wilderness to 30 days above 1 dV at Wind Cave National Park. Potential maximum deciview change is 29 dV at UL Bend Wilderness.	Potential impacts range from 2 days above 1 dV at Red Rock Lakes Wilderness to 28 days above 1 dV at Wind Cave National Park. Potential maximum deciview change is 27 dV at UL Bend Wilderness.	Potential impacts range from 2 days above 1 dV at Red Rock Lakes Wilderness to 25 days above 1 dV at Wind Cave National Park. Potential maximum deciview change is 24 dV at UL Bend Wilderness.
Acidification of sensitive lakes	Potential impacts are 180% of the level of acceptable change (LAC) in Upper Frozen Lake and 104% of the LAC in Florence Lake. Impacts at other lakes are below the LAC.	Potential impacts are 175% of the level of acceptable change (LAC) in Upper Frozen Lake and 100% of the LAC in Florence Lake. Impacts at other lakes are below the LAC.	Potential impacts are 175% of the level of acceptable change (LAC) in Upper Frozen Lake. Impacts at other lakes are below the LAC.	Potential impacts are 175% of the level of acceptable change (LAC) in Upper Frozen Lake. Impacts at other lakes are below the LAC.
<i>Vegetation</i>				
Overall short-term vegetation loss	202,389 acres	211,643 acres	208,033 acres	82,633 acres
Overall long-term vegetation loss	93,404 acres	102,658 acres	99,048 acres	38,518 acres
Sagebrush shrublands (short-term without water handling facilities)	53,626 acres	53,626 acres	53,626 acres	21,106 acres
Riparian, wetlands (short-term without water handling facilities)	3,214 acres	3,214 acres	3,214 acres	3,229 acres
<i>Wildlife</i>				
Road density increase	1.40 mi/mi ²	1.40 mi/mi ²	1.40 mi/mi ²	0.59 mi/mi ²
Important habitats to species of big game				
Pronghorn winter-yearlong range	Approximately 1 percent of this range would be disturbed in the Project Area over the long term.	Same as Alternative 1	Same as Alternative 1	Less than 1 percent of this range would be disturbed in the Project Area over the long term.
White-tailed deer winter-yearlong and yearlong ranges	Less than 1 percent of both ranges would be disturbed in the Project Area over the long term; one hundred percent of the winter-yearlong disturbance would occur in the Middle Powder River sub-watershed.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Mule deer winter-yearlong range	Less than 1 percent of winter-yearlong range would be disturbed in the Project Area over the long term — about 50 percent of which would occur in the Upper Powder River sub-watershed.	Same as Alternative 1	Same as Alternative 1	Less than 1 percent of winter-yearlong range would be disturbed in the Project Area over the long term.
Elk crucial winter range (Fortification Creek)	Less than 1 percent of crucial winter range would be disturbed in the Fortification Creek Management Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Big game	Habitat fragmentation may alter big game habitat use. Human disturbance may displace big game from otherwise suitable habitats to lower-quality habitats. Nutritional status and reproductive success may be reduced. Increased human activities may result in increased vehicle collisions, poaching, and legal hunting success.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Raptors	Ground nesting and prey habitats would be disturbed. Increased human presence may alter raptor activity patterns. New utility poles may provide new perch sites for raptors. New aboveground lines and the potential for increased collisions between vehicles and wildlife may increase raptor mortality. Habitat disturbance may alter prey availability. Raptor population declines may occur.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Sage and plains sharp-tailed grouse	Disturbance of suitable nesting, feeding, and brood rearing habitats may occur. Increased human activity may affect nesting, breeding, and brood rearing activities. Increased above-ground utility lines may result in increased grouse collisions and raptor population. Populations, especially of sage grouse, may decline.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Waterfowl	Habitat disturbance may be beneficial or detrimental, depending on local hydrological conditions. Benefits include creation of new habitats and improvements of existing habitats. Produced waters may also eliminate or degrade existing habitats. Indirect effects to waterfowl may occur from exposure to elevated levels of salts and metals in production waters.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Migratory birds	Mortality from vehicle and power line collision would increase. Habitats would be lost, degraded, and fragmented. Populations of some species would decline. Populations may increase for species adapted to disturbed habitats.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
<i>Aquatic Life</i>	Surface discharge of produced CBM water in 10 sub-watersheds could increase stream flows, sedimentation, and concentrations of salt and heavy metals in streams and ponds. Discharge of produced water to the surface under this alternative would result in the greatest potential effects to aquatic species of all the alternatives.	The same types of effects would occur to aquatic life under this alternative as under Alternative 1. The magnitude of the effects would be less under Alternative 2 because of an increased emphasis on containment and treatment.	Same as Alternative 2A	The same types of effects would occur under this alternative as under Alternative 1. However, the magnitude of these effects would be reduced by about 50 percent. The effects of Alternative 3 also would be smaller in magnitude than Alternative 2A or Alternative 2B.
<i>Threatened, Endangered, or Proposed Species</i>				
Black-tailed prairie dog	Project would directly affect individuals and suitable habitats.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Preble's meadow jumping mouse	No effect to this species based on the assumed lack of occurrence within the Project Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Black-footed ferret	Same as Alternative 2A	This alternative is not likely to adversely affect the ferret.	Same as Alternative 2A	Same as Alternative 2A

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Bald eagle	Same as Alternative 2A	This alternative is likely to adversely affect the bald eagle, but not likely to jeopardize the continued existence of the bald eagle.	Same as Alternative 2A	Same as Alternative 2A
Ute-ladies' tresses orchid	Same as Alternative 2A	This alternative is likely to adversely affect the orchid, but not likely to jeopardize the continued existence of the orchid.	Same as Alternative 2A	Same as Alternative 2A
Mountain plover	Same as Alternative 2A	This alternative is likely to adversely affect the mountain plover, but not likely to jeopardize the continued existence of the plover.	Same as Alternative 2A	Same as Alternative 2A
Western boreal toad	No effect to this species based on the lack of occurrence within the Project Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
<i>Cultural Resources</i>				
Total number of cultural resource sites that may be affected (based on known site densities).	2,896	3,073	2,992	1,470
General Distribution of Effects	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek, and Antelope Creek sub-watersheds. It is expected that 257 sites may be historic properties that require some form of protection or mitigation.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek, and Antelope Creek sub-watersheds. It is expected that 283 sites may be historic properties that require some form of protection or mitigation. Because of additional water handling facilities along the drainages, this alternative is likely to require more protective or mitigative measures than the other alternatives.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek, and Antelope Creek sub-watersheds. It is expected that 271 sites may be historic properties that require some form of protection or mitigation.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek, and Antelope Creek sub-watersheds. It is expected that 178 sites may be historic properties that require some form of protection or mitigation. Some infrastructure or support facilities may occur on federal surface for private development, but federal control over the identification and protection of historic properties would be minimal.
<i>Land Use and Transportation</i>				
Disturbance of Mixed Rangeland Resources by CBM and non-CBM facilities (excluding water handling facilities)				

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Short term (acres)	154,072	154,072	154,072	58,086
Long term (acres)	58,123	58,123	58,123	21,944
Additional Vehicle Trips for peak year (2007)	7,627	7,627	7,627	1,649
<i>Visual Resources</i>	<p>A total of 316 wells, with their associated roads and water handling facilities would be constructed on VRM Class II areas on BLM lands. Class II management objectives would be met if mitigation were successfully implemented. Management objectives for 766 wells and associated facilities for Class III areas on BLM lands and 4,515 wells and associated facilities for BLM Class IV areas would be met. In addition, 369 wells and associated facilities would be constructed on TBNG areas managed with Scenic Integrity Objectives (SIO) of Low. Desired conditions for SIO would be met, in that facilities can be visible if they are reasonably mitigated to blend and harmonize with natural features.</p>	<p>Wells and roads are same as Alternative 1. Water handling methods would disturb 36,264 additional acres. Class II management objectives would be met if mitigation were successfully implemented.</p>	<p>Wells and roads are same as Alternative 1. Water handling methods would disturb 32,653 additional acres as in Alternative 2A. However, a smaller number of acres would be disturbed by impoundments than under Alternative 2A, with a proportionately smaller visual impact. Class II management objectives would be met if mitigation were successfully implemented.</p>	<p>No wells and associated facilities would be constructed on federal leases. Visual impacts from construction and operation would occur on state and private lands.</p>
<i>Recreational Resources</i>	<p>Construction would alter the recreational experience through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would continue to affect the natural setting of the Project Area for the life of the project. Recreation in special management areas would not be affected. BLM and FS objectives for recreation would be met.</p>	<p>The effect on recreational opportunities from construction of wells and associated facilities is the same as Alternative 1. Water handling methods would disturb an additional 36,264 acres, resulting in a greater loss of solitude and the natural setting.</p>	<p>The effect on recreational opportunities from construction of wells and associated facilities is the same as Alternative 1. Water handling methods would disturb 32,653 additional acres as in Alternative 2A. However, a smaller number of acres would be disturbed by impoundments than under Alternative 2A, with a proportionately smaller loss of solitude and the natural setting.</p>	<p>No wells and associated facilities would be constructed on federal leases. No impacts to recreation would occur on BLM lands or the TBNG. Loss of solitude and natural setting could occur on state and private lands.</p>

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
<i>Socioeconomics</i>				
Effects to Employment	<ul style="list-style-type: none"> ➤ During the peak year (2007), up to 5,579 workers would be required. ➤ Employment would be greatest between 2003 and 2011. ➤ The majority of the workers already live in the community; however, additional workers will be required. ➤ Secondary employment would be sustained for a longer period than previously anticipated and would increase as a result of new workers who move to the area. 	<ul style="list-style-type: none"> ➤ During the peak year (2007), up to 5,761 workers would be required. ➤ Employment would be greatest between 2003 and 2011. ➤ The majority of the workers already live in the community; however, additional workers will be required. ➤ Secondary employment would be sustained for a longer period than previously anticipated and would increase as a result of new workers who move to the area. 	<ul style="list-style-type: none"> ➤ During the peak year (2007), up to 5,663 workers are required. ➤ Employment would be greatest between 2003 and 2011. ➤ The majority of the workers already live in the community; however, additional workers will be required. ➤ Secondary employment would be sustained for a longer period than previously anticipated and would increase as a result of new workers who move to the area. 	<ul style="list-style-type: none"> ➤ Up to 1,481 workers would be required. ➤ Employment would be likely in first 10 years. ➤ Workers already available in the community.
Effects to Wages	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would result in an estimated net present value of \$570 million. ➤ Once the project is completed, total annual income in the four counties would decline. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would result in an estimated net present value of \$642 million. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would result in an estimated net present value of \$624 million. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would average an estimated net present value of \$374 million.

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Effects on housing and community infrastructure	<ul style="list-style-type: none"> ➤ Changes in employment/population are anticipated. Most employees are expected to be hired locally. However, during peak activity years, there would be a 7 percent increase in population. ➤ Rental vacancy rates for 2000 were 0.2 percent lower than the average for Wyoming. Additional rental units may be constructed if existing supply of vacant rental units becomes exhausted. ➤ The population influx is not expected to affect the water supply, wastewater systems, solid waste disposal, schools, fire protection, and medical facilities. ➤ The Proposed Action would result in increased traffic on roads and therefore demands for road maintenance (see transportation). 	<ul style="list-style-type: none"> ➤ No change from Proposed Action. ➤ Increase road maintenance as a result of construction and maintenance of water handling facilities. 	Same as Alternative 2A	<ul style="list-style-type: none"> ➤ Population would not change and there would be no negative housing or infrastructure effects.
Royalties and taxes generated (all net present value discounted at 10 percent)	<ul style="list-style-type: none"> ➤ Federal Royalties = \$1.7 billion ➤ State Royalties = \$252 million ➤ Sales tax (4% paid to state, 1% paid to counties) = \$124 million ➤ Severance (paid to state) = \$1.3 billion ➤ Ad Valorem (paid to four counties) ➤ Campbell Co.= \$821 million ➤ Converse Co.= \$12 million ➤ Johnson Co.= \$413 million ➤ Sheridan Co.= \$269 million 	<ul style="list-style-type: none"> ➤ Same royalties as Proposed Action ➤ More taxes would be generated because of the number and cost of water handling facilities. 	<ul style="list-style-type: none"> ➤ Same as Alternative 2A ➤ Less royalties would be lost if electric compression is used, because of loss of royalties from leasehold for natural gas. 	<ul style="list-style-type: none"> ➤ \$1.7 billion less in federal royalties ➤ \$1.4 million less in severance tax ➤ \$1.5 billion less in ad valorem tax ➤ Not drilling federal wells may result in future negative production rates from federal minerals, caused by drainage by drilling on state and private lands.

Summary

Table S-2 Summary of Effects by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Water handling cost to industry (all other development costs are constant among Alternatives 1, 2A, and 2B)	Surface Discharge = \$818 million Infiltration = \$505 million Containment = \$93 million LAD = \$26 million Injection = \$130 million TOTAL = \$1.57 billion	Surface Discharge = \$458 million Infiltration = \$1102 million Containment = \$21 million LAD = \$66.5 million Injection = \$116 million TOTAL = \$1.76 billion	Surface Discharge = \$996 million Infiltration = \$786 million Containment = \$61 million LAD = \$70 million Injection = \$111 million TOTAL = 2.0 billion	Surface Discharge = \$382 million Infiltration = \$292 million Containment = \$40 million LAD = \$13.6 million Injection = \$72 million TOTAL = \$799 million
Non-water handling costs (drilling, operation and maintenance, reclamation)	\$17.27 billion	\$17.27 billion	\$17.27 billion	\$6.84 billion
Net Cost of Alternative	\$18.8 billion	\$19.0 billion	\$19.3 billion	\$7.64 billion