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# 1.0 INTRODUCTION

The Powder River Basin (PRB) of Wyoming is a major energy development area with diverse environmental values. The PRB is the largest coal-producing region in the United States (U.S.); PRB coal is used to generate electricity within and outside of the region. The PRB also has produced and continues to produce large quantities of oil and natural gas resources. Within the last decade, this region has experienced nationally significant development of natural gas from coal seams.

The PRB Coal Review is a regional technical study to assess cumulative impacts associated with past, present, and reasonably foreseeable development (RFD) in the PRB. For the purpose of this study, the Wyoming PRB cumulative effects study area comprises the following subwatersheds<sup>1</sup> in portions of Sheridan, Johnson, Campbell, and Converse counties: Upper Powder River, Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, Antelope Creek, and Dry Fork Cheyenne River (**Figure 1-1**). These subwatersheds encompass the projected groundwater drawdown area modeled for this study to account for potentially related effects to other environmental resources. The study area includes all of the area administered by the Bureau of Land Management (BLM) Buffalo Field Office, a portion of the area administered by the BLM [High Plains District](#) Office, and a portion of the Thunder Basin National Grasslands (TBNG), which is administered by the U.S. Department of Agriculture Forest Service (FS) (**Figure 1-2**). The surface estate within the study area is owned by private individuals, the state, and the federal government (**Figure 1-3**).

As shown in **Figure 1-3**, the majority of the surface ownership in the PRB study area is private. Conversely, the majority of the mineral ownership in the study area is federal (**Figure 1-4**). Federal mineral ownership may include all minerals in some locations and only specific minerals (e.g., coal or oil and gas) in other locations. As a result, split-estates (where the surface ownership is different than the mineral ownership) exist in a large portion of the PRB. The area of potential effect (APE) for the physical, biological, and human resources analyzed in this study varies by resource and in some cases extends outside of this study area, as appropriate.

During the 1970s and early 1980s, the PRB emerged as a major coal production region. As a result, federal coal leasing became a high profile activity since over 90 percent of the PRB's coal is federally owned. The BLM is the lead agency responsible for leasing federal coal lands in the PRB study area. Between 1974 and 1982, the BLM issued three and started a fourth separate regional coal environmental impact statement (EIS), all addressing federal coal leasing and development, as well as other regional development.

In 1982, the BLM temporarily halted coal leasing. [However, mining continued on existing leases. When leasing resumed in 1990, the existing mines were mature operations, and there was no need for regional leasing to open new mines. However, many of the mines were depleting their original reserves, so there was a need for maintenance leasing to provide the reserves to enable existing mines to meet the expanding demand. At that time, the Powder River Regional Coal Team](#)

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<sup>1</sup> Per the Wyoming Geographic Information Science Center at the University of Wyoming, the 4<sup>th</sup> level hydrologic unit boundaries used in this study are defined as sub-basins. However, for consistency with the PRB Oil and Gas EIS (BLM 2003), the term subwatershed has been retained for this study.

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[\(PRRCT\) decertified the region, allowing BLM to use the lease by application \(LBA\) process to meet this need.](#)

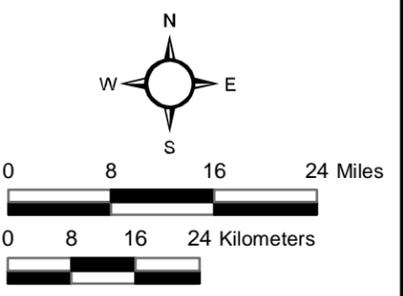
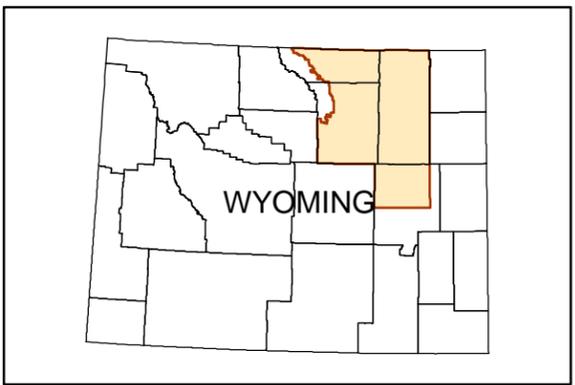
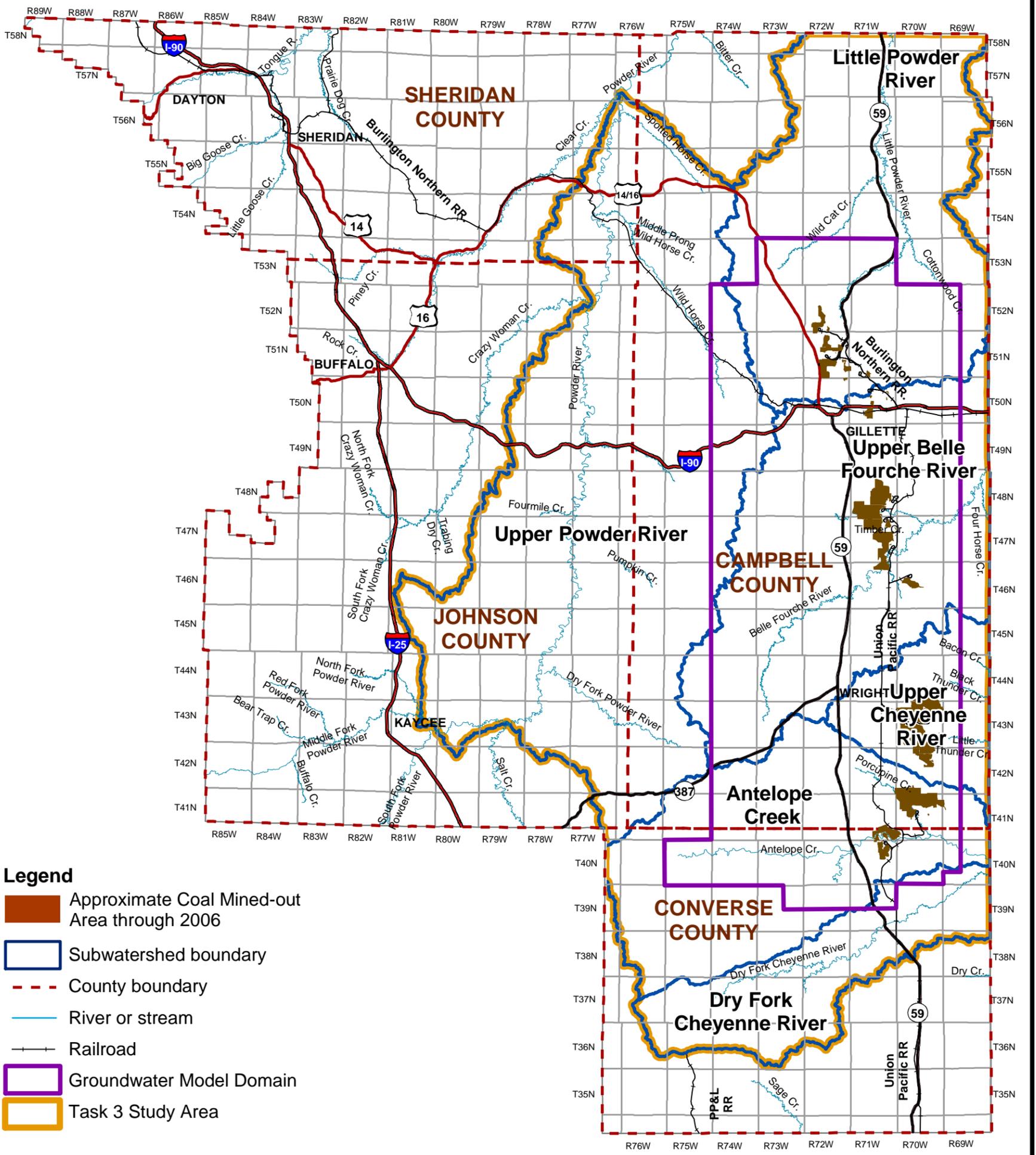
The BLM is required to complete a National Environmental Policy Act (NEPA) analysis (EIS or environmental assessment [EA]) for each coal lease application as part of the leasing process. In the coal leasing EAs and EISs that have been prepared since decertification, cumulative impacts have been addressed in a separate section of the chapter that describes the expected environmental impacts of the proposed action. This approach was designed to highlight the distinction between site-specific and cumulative impacts.

In the mid-1990s, the BLM conducted a study called the PRB Coal Development Status Check (Status Check) (BLM 1996). The purpose of the Status Check was to compare actual cumulative development in the PRB with the levels of cumulative development that were predicted for 1990 and 1995 in the regional EISs discussed above. At the time the Status Check was prepared, the actual levels of cumulative development generally were within the levels that had been predicted. The BLM continued updating key portions of the Status Check and used the results in the cumulative impact section of the coal-leasing EAs and EISs. The Status Check updates indicated that the actual levels of coal development and associated impacts began to approach the predicted levels in the late 1990s. Around that same time, impacts related to oil and gas development began increasing due to the development of coal bed natural gas (CBNG) in the PRB.

The BLM prepared the Wyodak EIS (BLM 1999) and PRB Oil and Gas EIS (BLM 2003) to address the impacts of projected CBNG development in the Wyoming PRB. Modeling was used to quantify potential cumulative impacts to air and water resources in these two EISs. Surface coal mining operations in Montana and Wyoming were included in the modeling analyses as reasonably foreseeable, non-project sources of impacts. For these analyses, future levels of coal development were estimated using market demand projections. The BLM used these cumulative impact analyses in the coal leasing EISs as well as in the CBNG EISs.

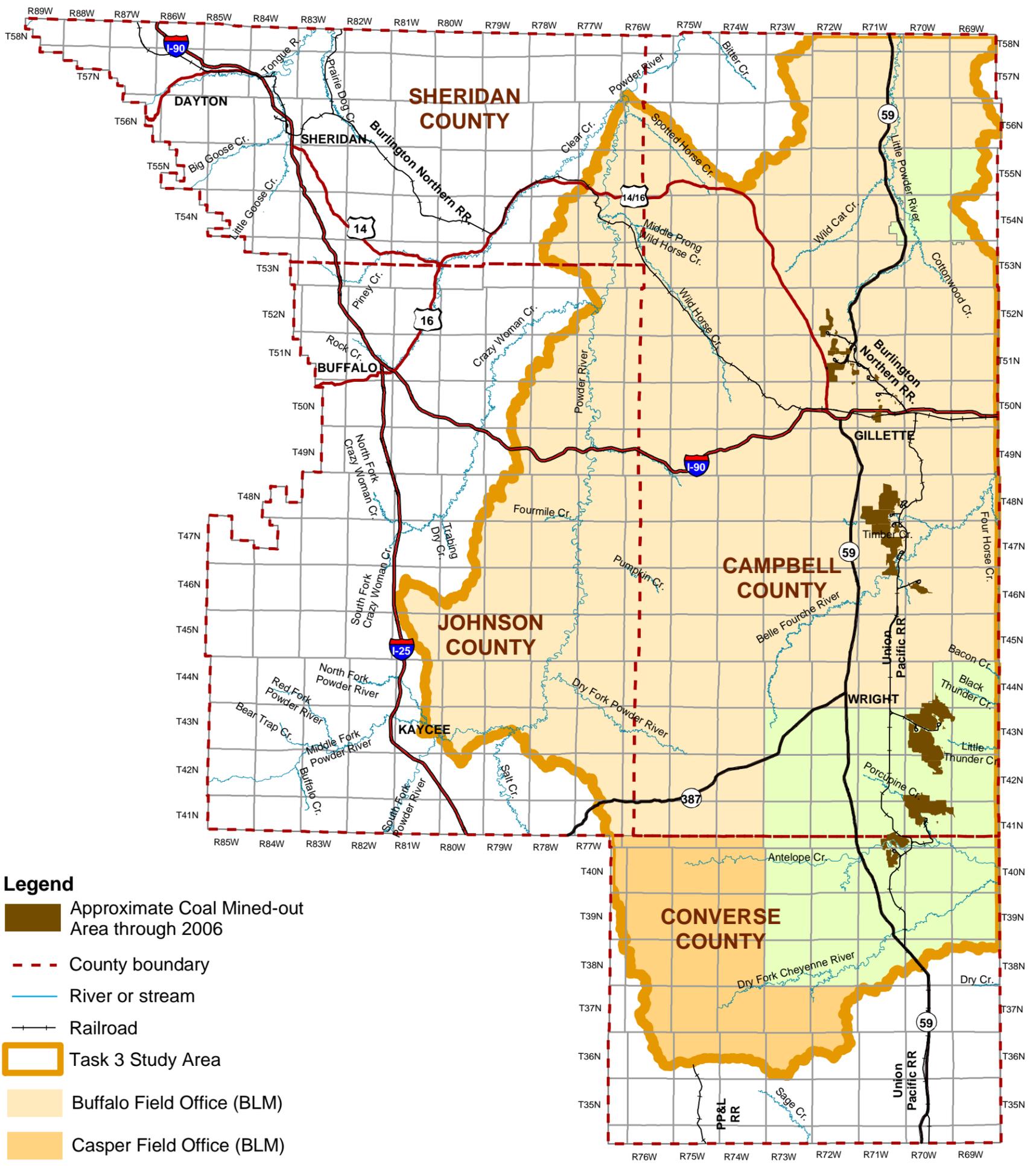
In early 2003, the BLM completed a study of PRB coal demand through 2020 (Montgomery Watson Harza 2003). The study projected production to increase at a steady pace with current mines able to meet the demand as long as the existing mines continue to have access to additional coal reserves; therefore, the need for leasing using the LBA will continue into the foreseeable future. As part of processing these LBAs, the BLM will include a current cumulative impact analysis as part of the NEPA analysis. The PRB Coal Review study, which includes the identification of base year (2003) conditions (Task 1 reports), identification of [base year \(2007\)](#) and reasonably foreseeable development (RFD) actions and future coal production scenarios ([updated](#) Task 2 report), and predicted future cumulative impacts (Task 3 reports) in the PRB, were developed to meet that need.

The Task 2 component of the PRB Coal Review defines the past and present development actions in the study area that have contributed to the current environmental and socioeconomic conditions in the PRB study area. The Task 2 report also defines the projected RFD scenarios in the Wyoming and Montana PRB for years 2010, 2015, and 2020. For the Wyoming PRB, the past and present development and RFD scenarios include coal mine development as well as coal-related activities (e.g., railroads and coal-fired power plants) and non-coal-related activities (e.g., other mines, CBNG, conventional oil and gas). Coal mine development and coal-related activities in the Montana PRB study area are included in this study to provide the basis for the analysis of cumulative air

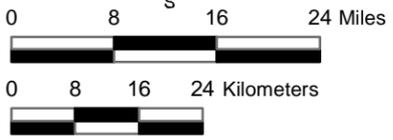
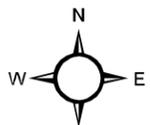
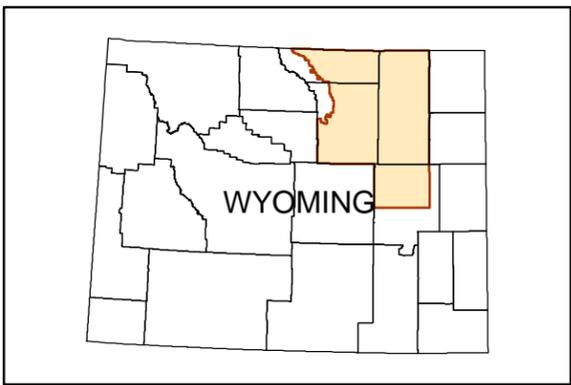


**Powder River Basin Coal Review**  
Figure 1-1  
Study Area and Subwatersheds

Source: BLM 2009a.

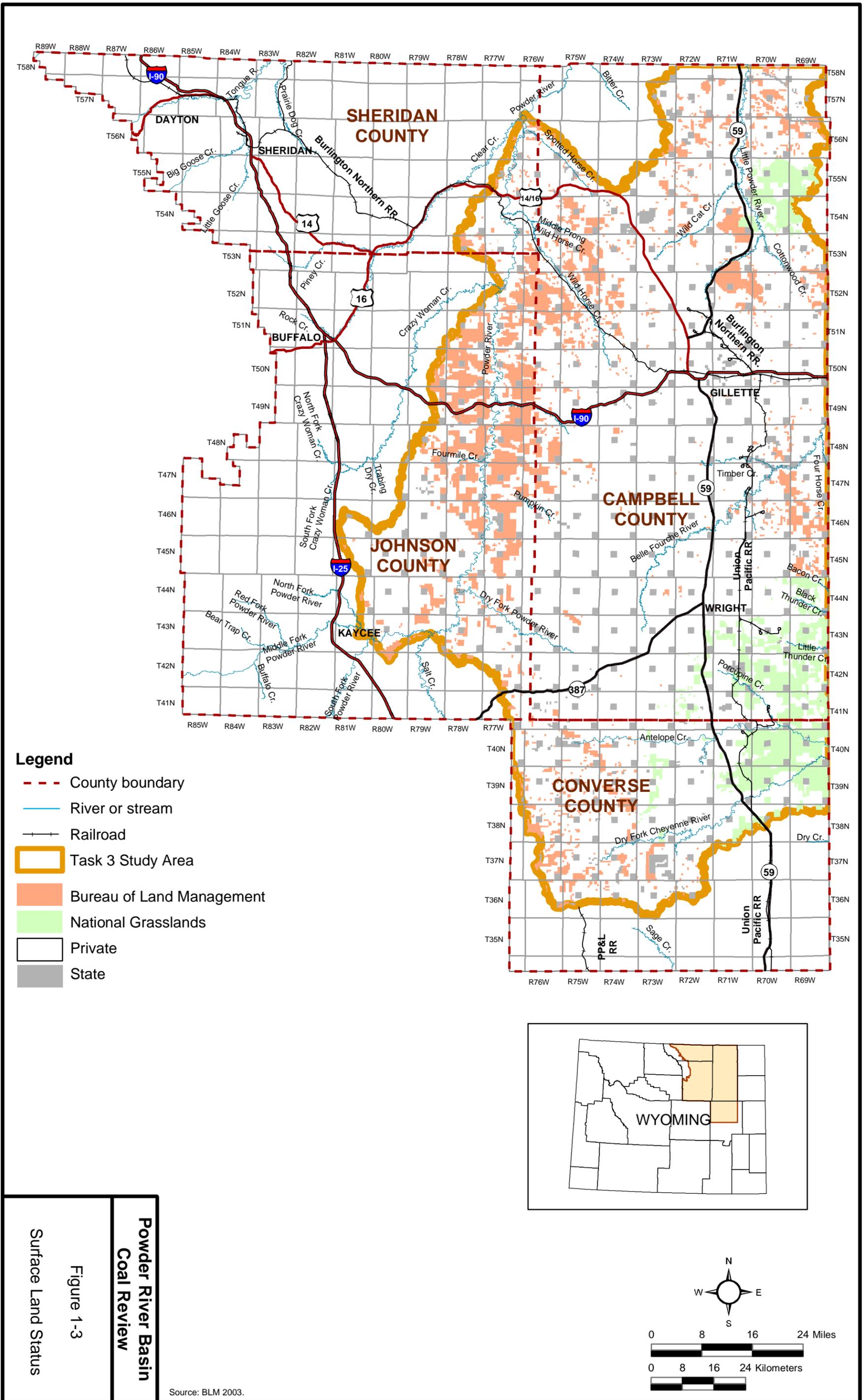


- Legend**
- Approximate Coal Mined-out Area through 2006
  - County boundary
  - River or stream
  - Railroad
  - Task 3 Study Area
  - Buffalo Field Office (BLM)
  - Casper Field Office (BLM)
  - Thunder Basin National Grasslands (FS)



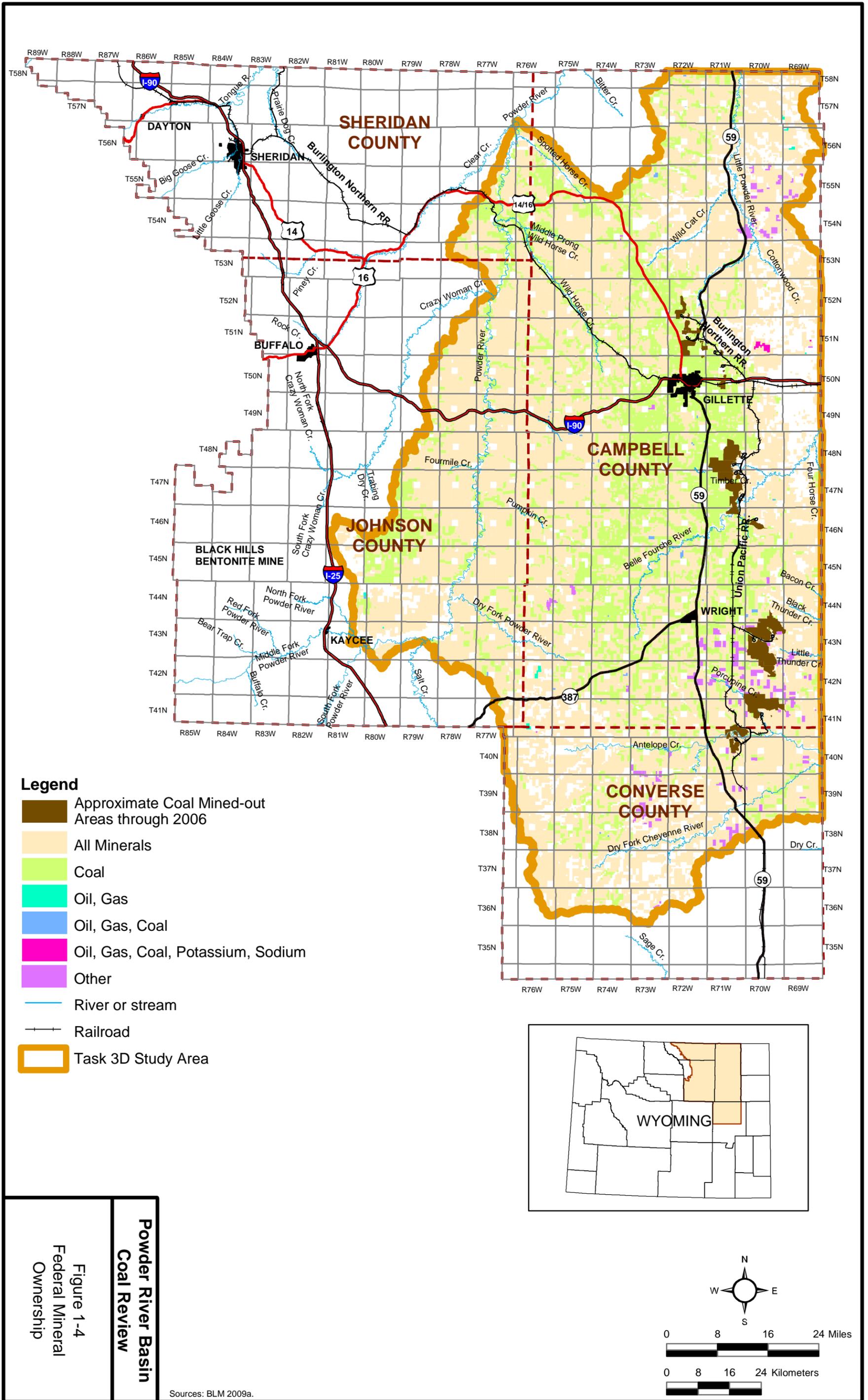
Source: BLM 2009a.

**Powder River Basin Coal Review**  
 Federal Land Management  
 Figure 1-2



**Powder River Basin Coal Review**  
 Figure 1-3  
 Surface Land Status

Source: BLM 2003.



**Powder River Basin Coal Review**  
 Figure 1-4  
 Federal Mineral Ownership

Sources: BLM 2009a.

quality impacts. The past and present activities identified in the [original](#) Task 2 report (ENSR 2005b) were based on the available data at the end of 2003 and provided the basis for the resource-specific descriptions of current conditions presented in the PRB Coal Review Task 1 reports. [The past and present activities described in the updated Task 2 report \(AECOM 2009c\) were based on the available data for energy-related development in the study area through the base year 2007 and reflect updated information on the status of existing projects, as well as identification of newly constructed and operational projects since 2003.](#)

The RFD scenarios presented in the [original](#) Task 2 report (ENSR 2005b) were based on information available through the end of 2004 and provided the basis for the analysis of potential cumulative impacts in the Task 3 component of the study. [The RFD scenarios presented in the updated Task 2 report \(AECOM 2009c\) reflect updated information available on previously identified foreseeable development, as well as information on newly identified foreseeable development projected to be operational or constructed by 2010, 2015, or 2020.](#) The accuracy of any projected cumulative impact analysis is dependent on the adequacy and accuracy of information regarding potential future development activities in the affected area. While it is impossible to identify all potential future activities over the next [10](#) years, it is possible and desirable to identify RFDs based on current industry announcements, agency plans, economic trends, and technological advances affecting major industry sectors. Information regarding potential new development constantly is changing; however, to facilitate development of the information in this study, the RFDs identified in the [updated](#) Task 2 report [\(AECOM 2009c\) reflect information available from approximately mid-2008 through mid-2009.](#)

The past and present actions in the [updated](#) Task 2 report were identified based on information in existing NEPA documents on file with federal and state agencies, and the Coal Development Status Check (BLM 1996), operating permits and annual reports on file with the state agencies, and industry contacts. The RFD scenarios in the [updated](#) Task 2 report were developed based on recent information that identifies proposed and anticipated development in the PRB, including NEPA documents; various other technical reports and studies; federal, state, and local (county) agency management plans; and permit applications. The specific development scenarios and development activities identified in these sources were assessed as to their current status prior to inclusion in the RFD scenarios for the PRB Coal Review. In addition, potential additional projects were identified through interviews with agency and industry representatives, review of published news articles and trade publications, and discussions with community leaders.

The identified RFD activities subsequently were evaluated as to their probability for occurrence. Due to the lack of detailed information for many developments beyond the next few years, the degree of uncertainty associated with the predicted developments and trends increases as the timeframe extends further into the future.

For each of the past and present and RFD projects and activities, project-specific impact-causing parameters (e.g., disturbance acreage, groundwater pumping rates, employment levels, etc.) have been compiled from the sources identified above. Where specific information was unavailable, assumptions were developed and included based on typical industry-specific standards, permit criteria for similar existing industries, and professional judgment. This information is summarized in the [updated](#) Task 2 report.

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In order to account for the variables associated with future coal production, two detailed coal production scenarios (reflecting upper and lower production estimates) were projected for this study to bracket the most likely foreseeable regional coal production level and to provide a basis for quantification of related impact-causing parameters. These future production levels were derived from the analysis of historic production levels and current PRB coal market forecasts, public and private information sources, and input from individual PRB coal operators and are summarized in the [updated](#) Task 2 report.

### 1.1 Objectives

This PRB Coal Review is a regional technical study to assess cumulative impacts associated with past, present, and RFD in the PRB. The PRB Coal Review:

- Describes past and present (through [2007](#)) development activities in the PRB that have affected the environmental conditions in the study area;
- Describes the [base year \(2007\)](#) environmental conditions in the study area and compares these conditions to the conditions described in the BLM's Coal Development Status Check (BLM 1996), as applicable;
- Estimates RFD in the study area through the year 2020, based on available information; and
- Estimates the cumulative environmental impacts associated with RFD through the year 2020.

The PRB Coal Review will provide data, models, and projections to facilitate cumulative analyses for future agency land use planning efforts and for future project-specific impact assessments for project development in compliance with NEPA. The PRB Coal Review is not a NEPA document or a policy study, or an analysis of regulatory actions, or an analysis of the impacts associated with the development of a specific project or projects in the PRB.

This report [updates and](#) summarizes Task 3D of the PRB Coal Review, a description of predicted future cumulative impacts associated with RFD activities in the PRB cumulative effects study area. This report describes the predicted cumulative environmental impacts under two coal production scenarios (lower and upper) for the years 2010, 2015, and 2020 for the following resources:

- Topography, geology, minerals, and paleontological resources;
- Soil and alluvial valley floors (AVFs);
- Vegetation including wetland and riparian areas;
- Wildlife, fisheries, and related habitat values;
- Grazing and other agricultural uses;
- Cultural resources and Native American concerns;
- Land use; and
- Transportation and utilities.

The PRB Coal Review Task 3 descriptions of predicted cumulative impacts for air quality, water resources, and social and economic conditions are presented in separate stand-alone reports.

## 1.2 Agency Outreach, Coordination, and Review

The BLM directed the preparation of this PRB Coal Review. In order to ensure the technical credibility of the data, projections, interpretations, and conclusions of the study and ensure the study's usefulness for other agencies' needs, the BLM initiated contact with other federal and state agencies early in the study. This contact included meetings, periodic briefings, and written communications.

The BLM conducted an agency outreach program to solicit input from other agencies relative to their:

- Interested role and level of involvement in the study;
- Available data for use in the study;
- Input to the technical approach for resource evaluations; and
- Review of project deliverables.

The BLM provided periodic status updates to other agencies during the PRB Coal Review.

## 1.3 Methodology

The [2007 base year](#) disturbance acreages for this study were based on the database compiled for, and summarized in, the [Update of the](#) Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Future Actions ([AECOM 2009c](#)) and, where resource-specific data were required, the associated Geographical Information System (GIS) information. The [base year \(2007\)](#) disturbance acreages generated through GIS vary from the disturbance acreages in the [updated](#) Task 2 database due to the following variables. The information in the database was compiled based on information obtained from the data sources and the applied assumptions identified in the [updated](#) Task 2 report. As a result, the database specifies a discrete disturbance acreage for each of the development activities (e.g., coal mines, individual oil and gas wells, etc.) identified for the study; however, it does not identify where those disturbance areas overlap. Conversely, the GIS analysis accounts for the spatial relationship of the various development activities, thereby avoiding double counting of disturbance acreages where mapped disturbance areas overlap. In addition, the application of the new-versus-existing well disturbance acreage assumptions varied, as follows. For the database, the number of new wells developed during [2007](#) versus the number of existing wells at the end of [2007](#) was quantified, and the appropriate acreage assumptions were applied. The observed ratio in the database between new and existing wells could be determined at the subwatershed level; however, the breakdown could not be applied to the resource-specific information within each subwatershed due to the lack of actual discrete locations for new versus existing wells in the GIS map layers. As a result, for GIS calculation purposes, the existing well acreage was applied to all (existing and new) wells in the GIS layer. Also, slight variations between the GIS study area boundary and GIS resource-specific layers resulted in some under-counting of disturbance acreages. Where disturbance acreages are presented in this study, the appropriate source is noted.

Future disturbance and reclamation acreages for the RFD scenarios in this study were based on the database compiled for, and summarized in, the [Update of the](#) Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Future Actions ([AECOM 2009c](#)) with the

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following variables and uncertainties associated with using GIS analysis for defining this information. The methodology and assumptions relative to oil and gas development (as summarized in Appendix E in the [updated](#) Task 2 report) provide a means of identifying the number of new wells to be developed and the number of existing wells to be plugged and abandoned within each of the subwatersheds for each of the target years for this study (i.e., 2010, 2015, and 2020). However, discrete locations for new and plugged and abandoned well sites for these future time periods are not available. For coal mines, the methodology and assumptions presented in Section 3.1 of the [updated](#) Task 2 report provide for calculation of future disturbance and reclamation acreages. However, although the general area of potential future coal mine-related disturbance can be identified based on projected reserves, the actual disturbance footprint associated with future mining and the actual locations of future reclaimed areas for the target years are not known. As a result, based on existing information, the spatial relationship between projected future disturbance and reclamation areas and the resource specific information in the GIS layers for these industries cannot be determined. Conversely, the database information does provide for quantification of future disturbance and reclamation acreages on a subwatershed basis and, with other information (e.g., projected locations of future coal reserves), a means of qualitatively analyzing future resource-specific impacts for those resources that are site-specific (e.g., vegetation, soils, wildlife habitat). The disturbance acreages for the RFD scenarios (based on the [updated](#) Task 2 database) are presented in Appendices A, C, and D of the [updated](#) Task 2 report. Minor discrepancies in the total acreages, as presented in the [updated](#) Task 2 appendices and in this report, are the result of rounding.