Rosebud Mine Area F
Draft Supplemental
Environmental Impact Statement

SEIS-010-08-000-1732112584

December 2024

Office of Surface Mining Reclamation and Enforcement

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Abstract: The U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement has prepared the Rosebud Mine Area F Supplemental Environmental Impact Statement (SEIS) to address the deficiencies in the 2018 *Western Energy Area F Final Environmental Impact Statement* (2018 Final EIS) identified by the United States District Court for the District of Montana (*Montana Env't Info. Ctr. v. Haaland*, No. CV 19-130-BLG-SPW, 2022 U.S. Dist. LEXIS 179417). Pursuant to 40 CFR § 1502.9(d), it supplements the 2018 Final EIS, which was prepared by OSMRE and the Montana Department of Environmental Quality (DEQ). Three alternatives are analyzed in this SEIS: Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), and Alternative 5 – Partial Mining Alternative. For all three new alternatives, the mining method, means of protecting the hydrologic balance, monitoring plans, mitigation plans, and reclamation plan would be essentially the same; all of these elements were described in full in the 2018 Final EIS for Alternative 2 – Proposed Action (pursuant to the mine permit application package). Since 2018, some modifications to these elements have been approved by DEQ through minor revisions to state operating permit C2011003F and are described in this SEIS. The primary differences among the three new SEIS alternatives are (1) total disturbance, (2) tons of coal mined, and (3) the duration of mining in the project area. Changed conditions and updates to the affected environment considered in impacts analyses are described in the SEIS along with updated impacts analyses (direct, indirect, and cumulative).

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Executive Summary

The Rosebud Mine (mine) is an existing coal mine in Colstrip (Treasure and Rosebud Counties), Montana (**Figure 1.1-1** in **Chapter 1**). The 6,773-acre Area F permit area (project area) is a portion of the mine located in Township 2 North, Range 38 and 39 East, and Township 1 North, Range 39 East, adjacent to the western boundary of Area C of the mine (**Figure 1.1-2** in **Chapter 1**). The U.S. Department of the Interior (DOI), Office of Surface Mining Reclamation and Enforcement (OSMRE) issued a Record of Decision on June 28, 2019 (OSMRE 2019a), pursuant to the National Environmental Policy Act (NEPA), selecting Alternative 2 – Proposed Action but prohibiting mining in 74 acres of Federal coal in the northwestern part (T2N, R38E, Section 12) of the Area F permit area (in the Trail Creek drainage) to prevent material damage to the hydrologic balance outside the permit area (see **Section 1.1, Introduction**). The Mining Plan Decision Document was signed by the DOI Assistant Secretary for Land and Minerals Management (ASLM) on July 15, 2019 (DOI 2019), authorizing the Federal mining plan for Federal Coal Lease MTM 082186, which encompasses 947.6 acres in Area F (**Figure 1.1-3** in **Chapter 1**).

OSMRE's purpose for preparing this Rosebud Mine Area F Supplemental Environmental Impact Statement (SEIS) is to address deficiencies in the 2018 Western Energy Area F Final Environmental Impact Statement (2018 Final EIS) identified by the United States District Court for the District of Montana (*Montana Env't Info. Ctr. v. Haaland*, No. CV 19-130-BLG-SPW, 2022 U.S. Dist. LEXIS 179417 [D. Mont. Sept. 30, 2022]). The Court held several aspects of the November 2018 Final Environmental Impact Statement (EIS) for the Rosebud Mine Area F (OSMRE and DEQ 2018) to be insufficient. Specifically, the Court remanded the Final EIS to OSMRE and ordered it to remedy the following: (1) inadequate surface water cumulative impacts analysis, (2) inadequate greenhouse gas emissions analysis, (3) inadequate analysis of indirect effects of mine expansion on water withdrawals from the Yellowstone River, and (4) failure to analyze a reasonable range of alternatives in violation of NEPA. **Table 1.1-1** in **Chapter 1** provides a brief overview of the updates this SEIS makes to the 2018 Final EIS. This SEIS addresses the deficiencies identified by the Court and supplements the 2018 Final EIS pursuant to NEPA, specifically 40 Code of Federal Regulations (CFR) 1502.9(d); see discussion in **Section 1.4, Agency Authority and Actions**. OSMRE has determined that this is an extraordinarily complex EIS, warranting preparation of an SEIS of up to 300 pages. This Draft SEIS is currently within that page limit as calculated using the definition of "page" in 40 CFR § 1508.1(bb) and Department of the Interior Environmental Statement Memorandum 13-14.

OSMRE's need for the action is to provide Westmoreland Rosebud the opportunity to exercise its rights under Federal coal lease MTM 082186, granted by the Bureau of Land Management (BLM), to access and mine undeveloped Federal coal resources located in the project area. In 2019, Westmoreland Rosebud began developing the project area, according to state operating permit C2011003F issued by the Montana Department of Environmental Quality (DEQ) in 2019, and the Federal mining plan approved by the DOI ASLM. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles (see **Figure 2.2-1** in **Chapter 2**; Westmoreland Rosebud 2024a). Approximately 8.5 million tons of coal have been produced in the project area within this timeframe (Westmoreland Rosebud 2024a) and sold to the Colstrip Power Plant and the Rosebud Power Plant. Ongoing mining in the project area and other approved permit areas of the Rosebud Mine is described in **Section 2.2, Description of Past and Existing Mine and Reclamation Operations.**

The project area is situated in the northern Powder River Basin generally east and north of the Little Wolf Mountains. Tributaries of Horse Creek and West Fork Armells Creek, including Black Hank Creek, Donley Creek, Robbie Creek, and McClure Creek (all of which lie within the drainage of the Yellowstone

River), drain the project area. A ridge in the western portion of the project area divides the Horse Creek and West Fork Armells Creek drainages. The surface of the project area is entirely privately owned, but the subsurface mineral estate is both privately (3,479 acres) and federally (3,294 acres) owned. Westmoreland Rosebud holds leases for the Federal (MTM 082186) and private coal (1001 and 1001-A)[1] in the project area (**Figure 1.1-3**). The resource-specific analysis areas and the affected environment considered in the SEIS are described in **Chapter 3**.

Three alternatives are analyzed in this SEIS and described in **Chapter 2**: Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), and Alternative 5 – Partial Mining Alternative. The three alternatives are introduced in **Section 2.3, Summary of SEIS Alternatives**; in that section, **Table 2.3-1** provides a comparison of the components of each alternative, and **Table 2.3-2** compares annual production and associated disturbance across alternatives. The alternatives are described in more detail in **Chapter 2** (see **Sections 2.4** through **2.6**); descriptions include the underlying assumptions used in the analysis for each alternative.

For all three alternatives analyzed in this SEIS, the mining method, reclamation plan, means of protecting the hydrologic balance, monitoring plans, and mitigation plans would be essentially the same; all of these elements were described in full in the 2018 Final EIS for Alternative 2 (see **Section 2.4, Alternative 2 – Proposed Action** in the 2018 Final EIS). Modifications made to these elements since 2018 due to changed conditions are described in **Section 2.2.2.2, Area F Operations and Development**. The primary differences among the three SEIS alternatives are (1) total disturbance, (2) tons of coal mined, and (3) the duration of mining in the project area (see **Table 2.3-2**). Under Alternative 1, mining would end in 2025; during the 6-year mine life, about 17.1 million tons of coal would be mined, and approximately 1,021 acres would be disturbed in the project area. Under Alternative 4, mining would end in 2039; during the 20-year mine life, about 71.3 million tons of coal would be mined, and approximately 4,288 acres would be disturbed in the project area. Under Alternative 5, mining would end in 2030; during the 11-year mine life, about 37.1 million tons of coal would be mined, and approximately 2,495 acres would be disturbed in the project area.

Impacts (direct and indirect) of the three SEIS alternatives are described in **Chapter 4** and summarized in **Chapter 2** (**Table 2.8-1**). Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**. The environmentally preferable alternative is Alternative 1 – No Action; see discussion in **Section 2.8, Summary of Impacts and Identification of Preferred and Environmentally Preferable Alternative**.

Past, present, and reasonably foreseeable future actions considered in the cumulative effects analyses have been updated in this SEIS and are provided in **Chapter 5** (**Table 5.2-1**) along with updated cumulative impacts analyses.

Supporting analyses, including an analysis of the social costs of greenhouse gas emissions, updated water quality tables, and an updated analysis of socioeconomic effects (IMPLAN), are provided in Appendices to this SEIS along with analysis definitions, acronyms, and a glossary. Acronyms are defined at their first use in each chapter.

[1]. These leases were referred to as G-002 and G-002A in the 2018 Final EIS.

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CHAPTER 1. PURPOSE AND NEED

1.1 INTRODUCTION

The U.S. Department of the Interior (DOI), Office of Surface Mining Reclamation and Enforcement (OSMRE) has prepared the Rosebud Mine Area F Supplemental Environmental Impact Statement (SEIS) to address the deficiencies in the 2018 *Western Energy Area F Final Environmental Impact Statement* (2018 Final EIS) identified by the United States District Court for the District of Montana (*Montana Env't Info. Ctr. v. Haaland,* No. CV 19-130-BLG-SPW, 2022 U.S. Dist. LEXIS 179417 [D. Mont. Sept. 30, 2022]). This document supplements the 2018 Final EIS prepared by OSMRE and the Montana Department of Environmental Quality (DEQ; OSMRE and DEQ 2018).

On November 2, 2011, Western Energy (now Westmoreland Rosebud Mining, LLC, a subsidiary of Westmoreland Mining, LLC) submitted a mine permit application package (PAP), to the DEQ for a new permit area (C2011003F), known as Area F (project), at the Rosebud Mine, an existing surface coal mine that surrounds the city of Colstrip and the Colstrip Steam Electric Station (Colstrip Power Plant) in Rosebud and Treasure Counties, Montana (**Figure 1.1-1** and **Figure 1.1-2**).

In compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act, OSMRE and DEQ (collectively, the agencies) prepared an Environmental Impact Statement (EIS) to analyze potential environmental effects of the proposed new Area F permit area (C2011003F). After issuance of a Draft EIS (January 2018) and consideration of public comments, the agencies issued the Final EIS in November 2018 (OSMRE and DEQ 2018). Each agency subsequently issued a Record of Decision (ROD), selecting the Proposed Action (Alternative 2). DEQ issued its ROD and Written Findings on April 18, 2019 (DEQ 2019a), pursuant to the Montana Strip and Underground Mine Reclamation Act (MSUMRA) (Administrative Rules of Montana [ARM] 17.24.404(3)), and, after Westmoreland Rosebud Mining, LLC (Westmoreland Rosebud) posted the required reclamation bond, issued a state operating permit for Area F (C2011003F). OSMRE issued its ROD on June 28, 2019 (OSMRE 2019a), for the Federal mining plan required under the Mineral Leasing Act of 1920, as amended. The Mining Plan Decision Document (MPDD) was signed by the DOI Assistant Secretary for Land and Minerals Management (ASLM) on July 15, 2019 (DOI 2019), authorizing the Federal mining plan for Federal Coal Lease MTM 082186, which encompasses 947.6 acres in Area F (**Figure 1.1-3**). To comply with MSUMRA and the Surface Mining Control and Reclamation Act of 1977 (SMCRA), neither ROD authorized surface-disturbing activity in 74 acres of Federal coal in the northwestern part (T2N, R38E, Section 12) of the Area F permit area in the Trail Creek drainage: both agencies removed this acreage from the authorized mining area to prevent material damage[2] to the hydrologic balance outside the permit area.[3] Westmoreland Rosebud began developing Area F in 2019 according to its state

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2. Material damage is defined in Section 82-4-203, Montana Code Annotated, as "with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage."

3. Pursuant to ARM 17.24.405(6)(c), DEQ cannot approve a permit application if the hydrologic consequences and cumulative hydrologic impacts would result in material damage to the hydrologic balance outside of the permit area. As described in Section 9.6.5 of the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), which is also referred to as the CHIA in this SEIS, DEQ determined that the proposed mining plan (Alternative 2), if implemented in T2N, R38E, Section 12, would likely result in a change in water quality in the Rosebud Coal outside the permit boundary, which could result in material damage. To remove the potential for material damage, DEQ did not approve mine passes in that area (DEQ 2019a). The surface acreage remained in the permit and disturbance boundary and may still be disturbed for stockpiles and project-related surface disturbances. Westmoreland Rosebud may at any time reapply to mine the excluded coal provided they affirmatively demonstrate no material damage would occur.

operating permit (C2011003F) and Federal mining plan (see **Section 2.2.2.2, Area F Operations and Development**).

On November 18, 2019, a group of plaintiffs led by the Montana Environmental Information Center filed a lawsuit against DOI with the United States District Court for the District of Montana (the Court), arguing that the MPDD and OSMRE ROD violated NEPA and the Endangered Species Act (ESA). On September 30, 2022, the court held that the 2018 Final EIS was deficient in several analyses. Specifically, the Court remanded the 2018 Final EIS to OSMRE and ordered it to remedy the following: (1) inadequate surface water cumulative impacts analysis, (2) inadequate greenhouse gas emissions analysis, (3) inadequate analysis of indirect effects of mine expansion on water withdrawals from the Yellowstone River, and (4) failure to analyze a reasonable range of alternatives in violation of NEPA.

OSMRE has prepared this Supplemental Environmental Impact Statement (SEIS) to address the deficiencies identified in the 2022 court order. This SEIS also updates and supplements analyses related to potential impacts on other resources as determined necessary by OSMRE, pursuant to NEPA, specifically 40 Code of Federal Regulations (CFR) 1502.9(d); see discussion in **Section 1.4, Agency Authority and Actions**.

1.1.1 Document Structure

This SEIS is organized similarly to the 2018 Final EIS: in most cases, the resource headings and numbering match the 2018 Final EIS. In some cases, such as this section, new headings are included to provide new information. **Table 1.1-1** provides an overview of changes made between the 2018 Final EIS and this SEIS.

Acronyms are defined at their first use in each chapter. Tables and figures in the SEIS are labeled to distinguish them from 2018 Final EIS figures and tables: each table and figure in the SEIS has a two-part number indicating the section (Heading Level 2) that they appear in and the sequential order within that section. For example, **Table 1.1-1** is in **Section 1.1** and is the first (and only) table presented in that section. Similarly, Appendices to the SEIS are numbered to distinguish them from 2018 Final EIS appendices, which are assigned letters of the alphabet. OSMRE has determined that this is an extraordinarily complex EIS, warranting preparation of an EIS of up to 300 pages.

Table 1.1-1. Sections Updated in the SEIS.

Chapter or Appendix	Content and Overview of Changes Made
Executive Summary	Updated from the 2018 Final EIS. Provides a brief overview of the proposed project, alternatives, and effects and includes the table of contents and lists of SEIS figures, tables, and appendices.
Chapter 1	Updated from the 2018 Final EIS to update background and project information, and to clarify the agency decisions to be made. Includes the following: background and overview of the proposed project; the purpose of and need for the proposed project; agencies' roles, responsibilities, and decisions; and an overview of public notice and participation.
Chapter 2	Updated from the 2018 Final EIS. Describes existing operations at the Rosebud Mine and provides a detailed description of three updated and/or new alternatives: Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), and Alternative 5 – Partial Mining Alternative. Also describes alternatives considered but eliminated from further analysis in the SEIS.
Chapter 3	Updated from the 2018 Final EIS (primarily minor updates and clarifications). Describes the existing conditions and the direct and indirect effects analysis areas used for the resource-specific analyses in **Chapter 4**. For most resources, the entire **Chapter 3** and **4** resource sections from the 2018 Final EIS are not included in the SEIS; for these, OSMRE identified any new information and clearly cited the subsections and page numbers in the 2018 Final EIS where applicable resource information can be found. The following resource sections have been entirely updated in the SEIS **Chapters 3 and 4**: **Climate and Climate Change**; **Water Resources – Surface Water**; **Special Status Species**; and **Socioeconomics**.
Chapter 4	Updated from the 2018 Final EIS. Describes and discloses the direct and indirect environmental impacts of implementing the three alternatives analyzed in the SEIS. For most resources, the entire **Chapter 3** and **4** resource sections from the 2018 Final EIS are not included in the SEIS; for these, OSMRE identified any new information and clearly cited the subsections and page numbers in the 2018 Final EIS where applicable resource information can be found. The following resource sections have been entirely updated in the SEIS **Chapters 3 and 4**: **Climate and Climate Change**; **Water Resources – Surface Water**; **Special Status Species**; and **Socioeconomics**.
Chapter 5	Updated from the 2018 Final EIS. Describes and discloses the cumulative environmental impacts of implementing the three alternatives analyzed in the SEIS, as well as irreversible and irretrievable commitments of resources. Includes an updated list of past, present, and reasonably foreseeable actions since the issuance of the 2018 Final EIS
Chapter 6	Updated from the 2018 Final EIS. Provides a list of preparers and agencies consulted, describes formal consultation with Indian Tribes, and describes consultation conducted with the U.S. Fish and Wildlife Service (USFWS) regarding special status species.
Chapter 7	Updated from the 2018 Final EIS. Only references used in the preparation of the SEIS are provided in this chapter. Please refer to **Chapter 7** of the 2018 Final EIS for the references used in preparation of that document.
Appendices A - H	These appendices have not been updated but are cited as needed in the SEIS.
Appendix 1	New appendix. To streamline this SEIS, acronyms, abbreviations, and analysis definitions were moved to an appendix.
Appendix 2	New appendix. The social costs of greenhouse gas (GHG) emissions were calculated by BBC Research & Consulting (BBC) for the SEIS alternatives (BBC 2024a). **Appendix 2** contains methods and results.
Appendix 3	New appendix. To streamline this SEIS, water quality tables were moved to an appendix. DEQ's water quality standards in Circular 7 were updated in 2019 after the issuance of the 2018 Final EIS. The tables have been updated using the new standards.
Appendix 4	New appendix. A new IMPLAN analysis (was completed by BBC for the SEIS due to changed economic conditions (BBC 2024b). **Appendix 4** contains methods and results.

1.1.2 Terms Used in This EIS

Terms used in this SEIS are defined in the **Analysis Definitions**, which can be found in **Appendix 1**. In this SEIS, the terms "effect" and "impact" are used interchangeably and synonymously. An environmental impact or effect is any change from the present condition of any resource or issue that may result from the decision by OSMRE to implement the Proposed Action or an alternative to the Proposed Action. An environmental impact may be adverse, beneficial, or both. A glossary of technical terms is in the 2018 Final EIS, beginning on page xxii.

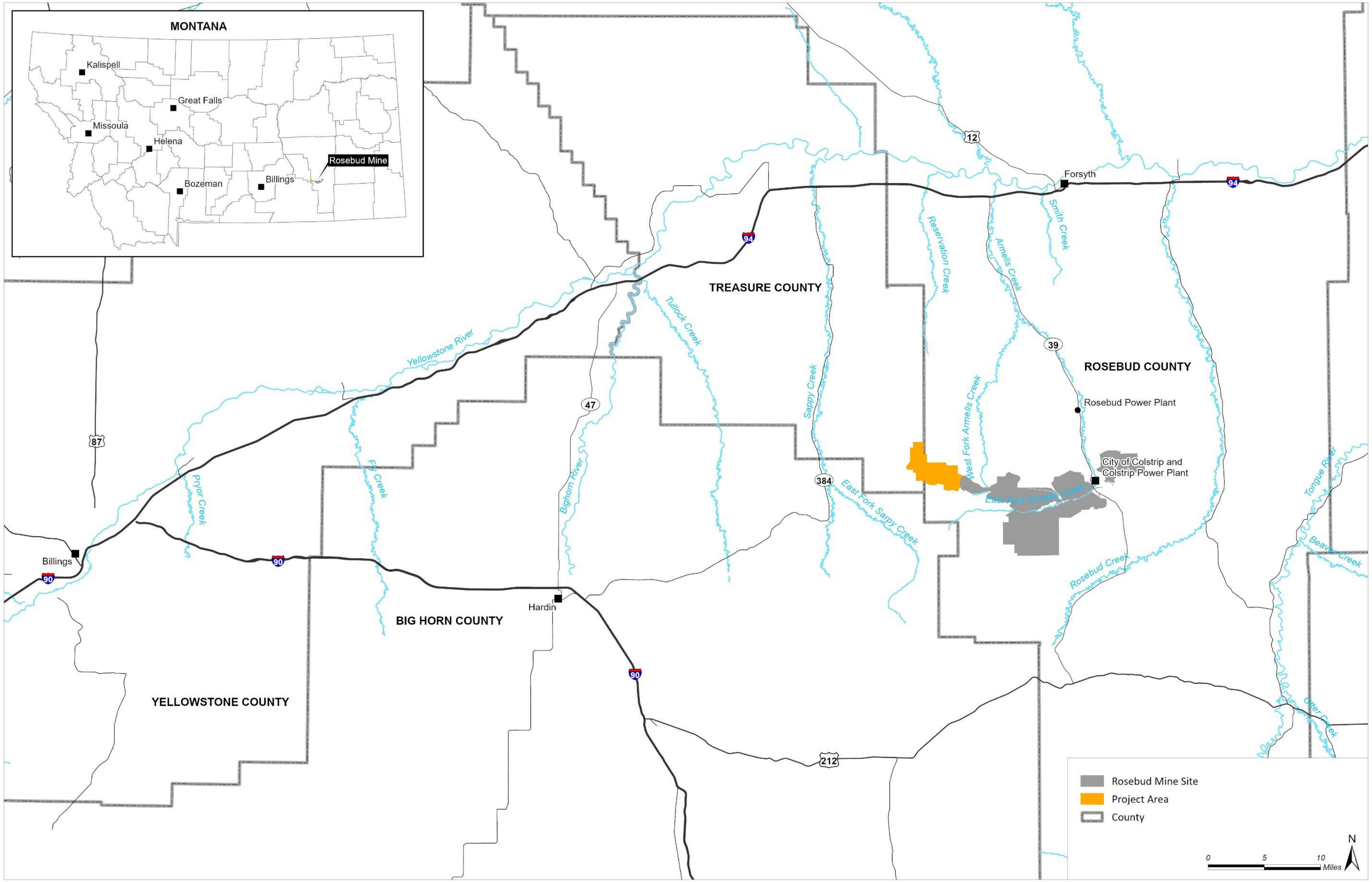

Figure 1.1-1. Project Location

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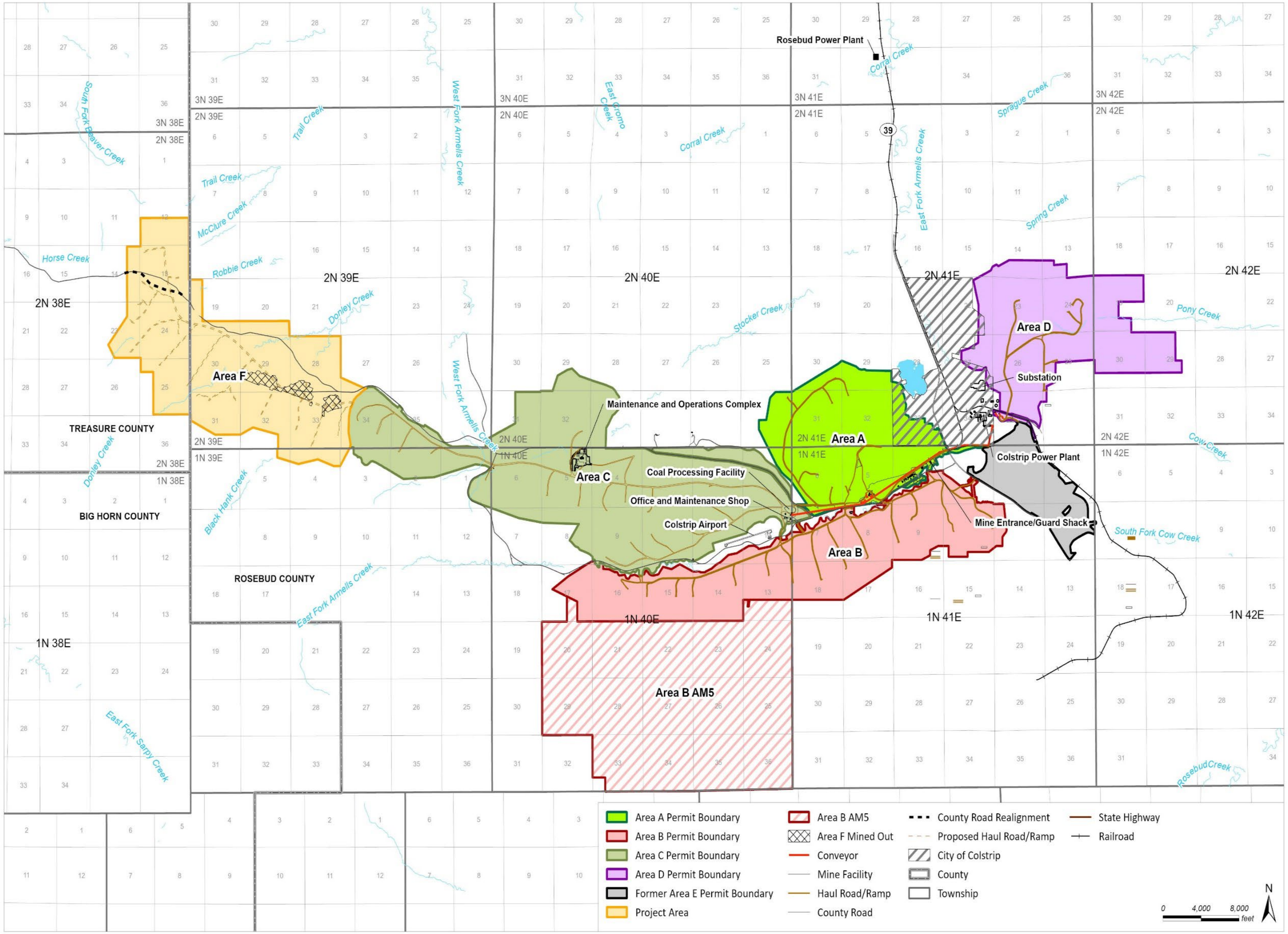

Figure 1.1-2. Location of Mine Facilities and Permit Areas

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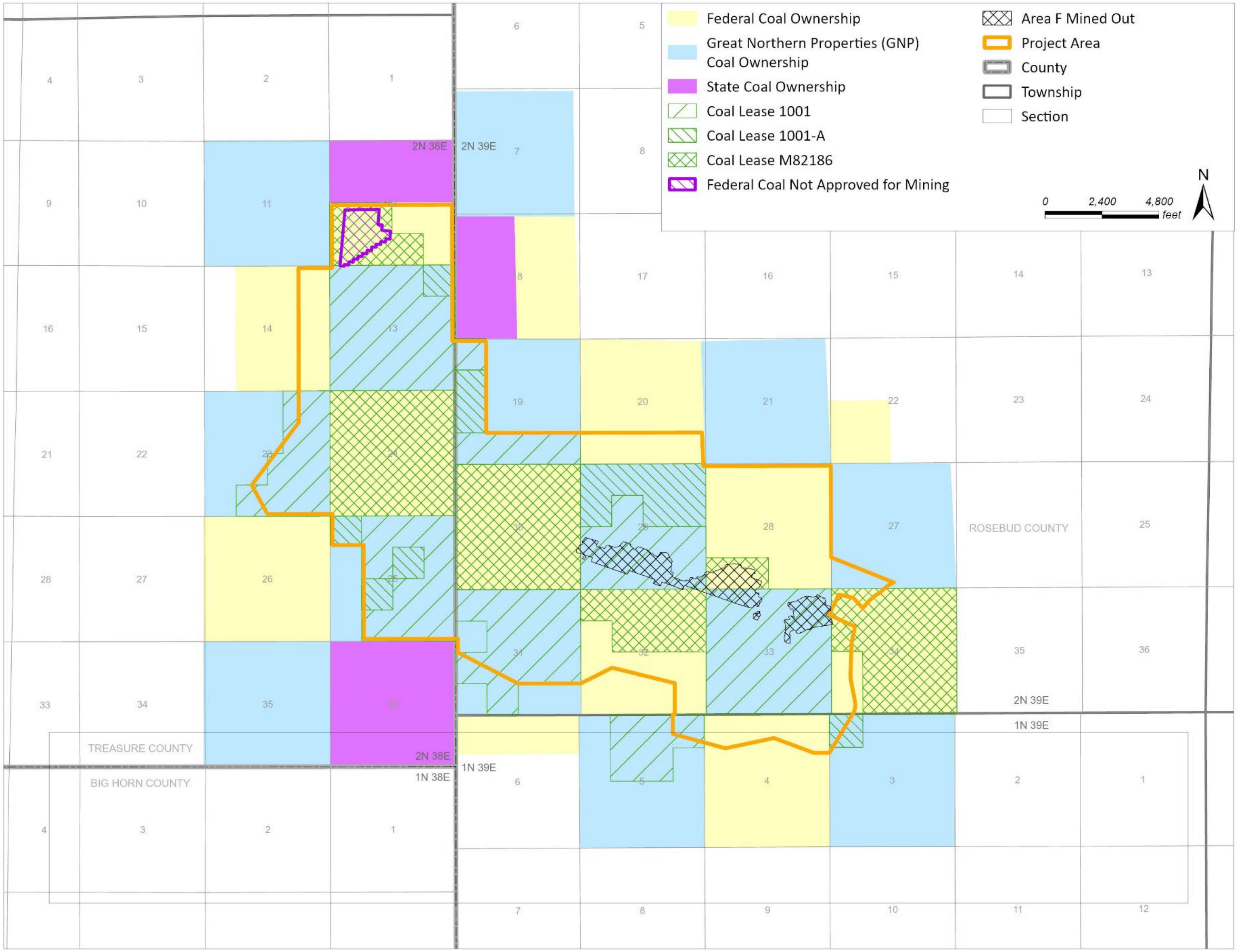

Figure 1.1-3. Coal Ownership and Leases with Extent of Mining in Project Area as of December 31, 2023

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1.2 BACKGROUND AND OVERVIEW

1.2.1 History of Mine Operations at Colstrip

Colstrip, Montana, is situated in the northern Powder River Basin, generally east and north of the Little Wolf Mountains. Coal has been mined in the vicinity of Colstrip for more than 90 years. The Northern Pacific Railway established the city of Colstrip and its associated mine in the 1920s to access coal from the Fort Union Formation.

In 1968, the Montana Power Company began production at the Rosebud Mine (mine) to serve the Colstrip Power Plant (described in **Section 1.2.2.1**). In 2001, Westmoreland Coal Company purchased the mine, and its subsidiary, Western Energy, began operating the mine. In 2019, Westmoreland Coal Company sold the Rosebud Mine to its creditors (organized as Westmoreland Mining LLC) as part of bankruptcy proceedings. The mine is now operated by Westmoreland Rosebud Mining, LLC (previously defined as Westmoreland Rosebud), a subsidiary of Westmoreland Mining LLC. Currently, Westmoreland Rosebud holds four active permits issued by DEQ for the mine: Area A (permit C1986003A), Area B (permit C1984003B), Area C (permit C1985003C), and Area F (permit C2011003F, which is analyzed in this SEIS). Coal removal is finished in Area D (permit C1986003D), and the area is being reclaimed. Area E (permit C1981003E), a former permit area, has received full bond release and is no longer a permitted coal mine. Current mine operations are described in detail in **Section 2.2.2, Existing Disturbance and Reclamation** and briefly summarized below.

Although the Rosebud Mine has shipped coal by rail as recently as 2010, all coal produced by the mine is currently consumed locally at the Colstrip Power Plant and the Rosebud Power Plant under contracts that Westmoreland Rosebud has with the power plant operators (see **Section 1.2.2, Coal Combustion**). To meet operators' coal requirements, such as sulfur and other qualities (e.g., sodium, mercury, etc.), Westmoreland Rosebud often mixes coal from two or more permit areas; for example, Area F coal may be mixed with Area B coal to meet the right value of sulfur needed for the Colstrip Power Plant. Whether mixed or not, low-sulfur (0.64 percent) subbituminous coal mined in the project area currently is being burned in Units 3 and 4 of the Colstrip Power Plant, and high-sulfur "waste coal" from the project area is being burned in the Rosebud Power Plant.

Between 1975 and 2023, just under 514 million tons of coal were recovered from the mine's Permit Areas A, B, C, D, E, and F (Westmoreland Rosebud 2024a). Production from the Rosebud Mine is limited by the conditions of its DEQ-issued air quality permits, but actual production rarely reaches the limits set by the air quality permits. Montana Air Quality Permit (MAQP) #1483-09 limits annual combined coal production from Areas A, B, and D to 13 million tons per year. Combined coal production from Areas C and F is limited to 8 million tons per year per MAQP #1570-09, with an Area F–specific production cap of 4 million tons per year.[4] In recent years, total mine production has ranged from a low around 5.4 million tons (Peterson 2022) to a high around 7.1 million tons in 2023 (Westmoreland Rosebud 2024a). Future production from the Rosebud Mine will depend on a number of factors, including market conditions (see additional discussion in **Section 2.2.6, Life of Operations** and in **Section 4.3.3.1, Direct Impacts** (Air Quality).

4. Note that 2023 production in Area F (about 4.6 million tons as shown in **Table 2.2-2**) was greater than the production limit (4 million tons) in MAQP #1570-09. Westmoreland Rosebud is working with DEQ to prevent future exceedances. Overall production was still below the combined limit for Areas C and F.

1.2.2 Coal Combustion

Since 2010, all coal produced by the mine has been consumed locally at the Colstrip Power Plant and the Rosebud Power Plant (**Figure 1.1-2**). The 2018 Final EIS **Section 1.2.2, Coal Combustion**, provides a detailed history of the two power plants' operations. The sections below provide brief summaries of these operations and update relevant details that have changed since 2018. Where relevant, more detailed information is also provided in the resource sections of **Chapter 3, Affected Environment**; **Chapter 4, Environmental Consequences**; and **Chapter 5, Cumulative Impacts** in this SEIS.

1.2.2.1 Colstrip Power Plant

The Colstrip Power Plant, a coal-fired facility consisting of two active units (Units 3 and 4), is located in the city of Colstrip. It is currently operated by Talen Montana, a subsidiary of Talen Energy (Talen Energy 2024). Talen Energy declared bankruptcy on May 9, 2022, and the U.S. Bankruptcy Court in Houston, Texas, approved a Chapter 11 plan of reorganization on December 15, 2022. Talen Montana now has a 15 percent ownership stake in Units 3 and 4 (Criswell 2024), consisting of a 30 percent ownership stake in Unit 3 and none in Unit 4 (Talen Energy 2024); the remaining ownership stake in both units is currently held by five other owners: Puget Sound Energy Inc., Portland General Electric Company, Avista Corporation, PacifiCorp, and NorthWestern Energy. None of the six co-owners has a majority stake in the Colstrip Power Plant. Power generated by the Colstrip Power Plant currently serves the owners' customers in Montana (NorthWestern Energy), Washington (Avista and Puget Sound Energy Inc.), and Oregon (Portland General Electric and PacificCorp).[5]

Historically, the Colstrip Power Plant consisted of four units. Colstrip Units 1 and 2, which each had 307 megawatts (MW) of generating capacity, were constructed in 1972. These units began operating in 1975 and 1976, respectively, and were retired from use on January 2, 2020, and January 3, 2020, respectively.[6] Colstrip Units 3 and 4, which each have about 740 MW of generating capacity, started operating in 1984 and 1986, respectively, and are currently generating power by combustion of low-sulfur coal from the Rosebud Mine, including coal from the project area. At least one owner, NorthWestern Energy, has indicated that Units 3 and 4 would operate through at least 2042 (Ernst 2024). As discussed in **Appendix 4**, the Colstrip Power Plant employs 250 to 260 workers, of which 22 are Native American (Criswell 2024), and currently supports about $545 million in total annual economic output across the analysis area (includes direct, indirect, and induced impacts; see definitions in **Section 4.15**, **Socioeconomic Conditions**). Most power plant workers (maintenance crews and non-union support personnel) work in 4-day/10-hour shifts, although some non-union workers work a 5-day/10-hour shift (Olsen 2024).

The Colstrip Power Plant and the operations of its associated facilities (such as a paste plant and ponds) are governed by a certificate issued by DEQ under the Major Facility Siting Act (MFSA), 75-20-101, Montana Code Annotated (MCA) et seq. (Certificate). As noted in the 2018 Final EIS **Section 1.2.2.1**,

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5. As noted in **Section 1.2.2.1** of the 2018 Final EIS, Washington and Oregon passed laws in 2016 that require suppliers of power to these states (Avista, Puget Sound Energy, Inc., and PacifiCorp) to eliminate coal as a power source and to stop making investments that would increase the lifespan of a coal-fired facility. Puget Sound Energy, Inc. currently owns about 25 percent of Units 3 and 4 (Ernst 2024). The company attempted to sell all of its shares in Unit 4 to NorthWestern Energy in 2019 but the deal fell through in 2020. Similarly, Talen Energy attempted to acquire Puget Sound Energy's shares in Units 3 and 4 but the deal fell through in early 2024 (Ernst 2024). Portland General Electric holds 296 MW worth of shares in Units 3 and 4 but plans to divest these no later than 2035 (Portland General Electric Company 2024). PacificCorp intends to end its ownership of Unit 3 (74 MW) by 2025 and of Unit 4 (74 MW) by 2029 (PacificCorp 2023). NorthWestern Energy will acquire Avista's ownership of Colstrip Units 3 and 4 (a total of 222 MW), with no purchase price, effective on January 1, 2026. NorthWestern Energy will be responsible for operational costs for the 15 percent shares of Colstrip Units 3 and 4 when Avista's ownership is transferred (NorthWestern Energy 2024).

6. Impacts analyses in the 2018 Final EIS assumed that Units 1 and 2 would cease operations in 2022 based on information available at that time (see **Section 1.2.2.1** of the 2018 Final EIS). Instead, the units were retired in early 2020.

Colstrip Power Plant Units 3 and 4 were originally limited to burning coal from Areas C, D, and E, but in 2015, DEQ approved an amendment to the MFSA Certificate to allow the flexibility to also use non-Rosebud seam coal obtained from mines other than the Rosebud Mine. After issuance of the 2018 Final EIS, Talen Energy rescinded the 2019 amendment request and was once again limited to using Rosebud seam coal from the Rosebud Mine. A statutory amendment to MFSA in 2021, however, now allows operators (in this case, Talen Montana) to change their fuel source without amending the MFSA Certificate (Section 75-20-228, MCA). Currently, the Colstrip Power Plant exclusively uses coal from the Rosebud Mine; coal is processed primarily in Area C but also in Area A. After being processed in the Area C crusher, crushed coal is sent from the Rosebud Mine to the Colstrip Power Plant via an existing 4.2-mile conveyor. If processed in the Area A crusher, which is adjacent to the Colstrip Power Plant, coal is sent on an existing short conveyor.

Emissions from the Colstrip Power Plant, which is a major source pursuant to Title V of the Clean Air Act, are regulated by the applicable requirements outlined in Title V operating permit OP0513-18 and MAQP #0513-16[7]; see more discussion of emissions in the Air Quality sections of **Chapters 3 through 5**.

Water piped from the Yellowstone River is the source of water to the Colstrip Power Plant, which operates as a zero-discharge facility; process water is contained in ponds on the plant site. Additional detail on current use of Yellowstone River water at the Colstrip Power Plant is provided in **Section 3.7, Water Resources – Surface Water**, and indirect effects of the project from water withdrawals from the Yellowstone River are analyzed in **Section 4.7, Water Resources – Surface Water**.

In August 2012, DEQ and PPL Montana (now Talen Energy) entered into an Administrative Order of Consent to address seepage from coal-ash ponds at the Colstrip Power Plant. Water seeping out of the ponds has impacted groundwater with boron, chloride, and sulfate, as well as other constituents (see discussion in 2018 Final EIS **Section 3.8, Water Resources – Groundwater**). Talen Montana uses an extensive well network to monitor the impacts and to capture and return impacted water to the ponds. Because project coal is combusted in Units 3 and 4, seepage from the coal-ash ponds is analyzed as an indirect effect in **Section 4.8, Water Resources – Groundwater**.

1.2.2.2 Rosebud Power Plant

The Rosebud Power Plant is a 24 MW coal-fired power plant located about 6 miles north of the city of Colstrip in Rosebud County. Colstrip Energy Limited Partnership (CELP) has owned and operated the plant since May 1990 (the original MAQP #2035 for the facility was issued in 1985). The Rosebud Power Plant was designed to burn low-Btu (British thermal unit) “waste coal” or “culm” from the Rosebud Mine (and other nearby mines). This waste coal is coal not suitable for use at the Colstrip Power Plant due to the high sulfur content and low calorific value; at the Rosebud Mine, waste coal is typically found in the first 1-foot layer and the very bottom of the Rosebud Coal deposit. Currently, the Rosebud Power Plant exclusively uses coal from the Rosebud Mine. Waste coal from permit areas A, B, C, and F is currently used in the plant. Pursuant to MAQP #2035, up to 364,000 tons per year can be burned in the power plant. The Rosebud Mine sends 300,000 tons of coal via covered trucks annually to the Rosebud Power Plant using a fleet of five covered haul trucks. Three of the five trucks operate daily, with each truck delivering an average of 6.5 loads, for an average total of 19.5 loads daily. The power plant is estimated to employ about 100 workers (**Appendix 4**).

[7]. The most current versions of air quality permits for the Colstrip Power Plant are available on DEQ’s website: https://deq.mt.gov/air/assistance.

Emissions from the Rosebud Power Plant, which is a major source pursuant to Title V of the Clean Air Act, are regulated by the applicable requirements outlined in Title V OP2035-05 and MAQP #2035-08[8] (see emissions discussion in the Air Quality sections of **Chapters 3** through **5**).

Deep groundwater wells provide water to the Rosebud Power Plant. Colstrip Energy Limited Partnership is permitted under Montana Pollutant Discharge Elimination System (MPDES) Permit MT-0031780 (renewed in 2022 until December 31, 2026)[9] to discharge water from a storm-water control pond to an unnamed ephemeral tributary to East Fork Armells Creek. The discharge must meet effluent limitations and conditions.

1.3 PURPOSE AND NEED

As described above, the Court identified several deficiencies in the NEPA analysis completed in 2018 that OSMRE must remedy. OSMRE's purpose in preparing this SEIS is to fully analyze the environmental impacts associated with the proposed Federal mining plan modification for Rosebud Mine Area F. This analysis addresses the deficiencies identified by the United States District Court for the District of Montana, and updates other relevant information and analysis, so that OSMRE can make an informed recommendation to the ASLM (in the form of a MPDD) to do one of the following: (1) disapprove the proposed Federal mining plan (as described in **Section 2.4, Alternative 1 – No Action**), (2) approve the Proposed Action (as described in **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, or (3) conditionally approve a new Federal mining plan for the project area, informed by the alternatives analysis in this SEIS. The ASLM will decide whether the mining plan is disapproved, approved, or approved with conditions.

Westmoreland's need for the action is to exercise its valid existing rights granted by the Bureau of Land Management (BLM) under Federal coal lease MTM 082186 to access and mine undeveloped Federal coal resources located in the project area. For Westmoreland Rosebud to access private and Federal coal within the project area, Westmoreland Rosebud is required to (1) obtain a surface-mine operating permit (pursuant to MSUMRA) from DEQ (issued in 2019) and (2) obtain approval of a Federal mining plan (30 Code of Federal Regulations [CFR] 746) to access Federal coal reserves in the project area. In addition, to comply with 30 United States Code (USC) § 207 Conditions of Lease, coal must be actively mined from a coal lease, since "any lease which is not producing in commercial quantities at the end of ten years shall be terminated."

1.4 AGENCY AUTHORITY AND ACTIONS

OSMRE's roles and regulatory responsibilities are discussed in the following sections. Decisions by other agencies also are described below in agency-specific sections. **Table 1.4-1** provides a summary of the required Federal permits, licenses, and approvals, and **Table 1.4-2** provides a summary of state requirements. Agency decision making is governed by each agency's laws, including statutes, rules, and regulations that form the legal basis for the conditions that the project must meet to obtain necessary permits, approvals, or licenses. Tribal consultation and consultation under Section 106 of the National Historic Preservation Act with the Montana State Historic Preservation Office (SHPO) is discussed in **Chapter 6, Coordination and Consultation**.

8. The most current versions of Rosebud Power Plant's air quality permits are available on DEQ's website: MAQP permits (https://deq.mt.gov/air/assistance).
9. The most current versions of Rosebud Power Plant's MPDES Permits are available on DEQ's website: https://deq.mt.gov/water/assistance.

1.4.1 Lead Agency

For the 2018 Final EIS, DEQ was a co-lead agency. A discussion of DEQ's role in that environmental review process is in **Section 1.4.1, Lead Agencies** of the 2018 Final EIS. For this SEIS, OSMRE is the sole lead agency and is responsible for the analysis of the project. The BLM is acting as a cooperating agency as it did for the 2018 Final EIS.

Table 1.4-1. Federal Permits, Consultations, Licenses, and Approvals.

Permit, License, or Approval	Purpose
U.S. Department of the Interior (ASLM/OSMRE)	
Federal Mining Plan (30 CFR § 746)	To approve, disapprove, or conditionally approve Westmoreland Rosebud's plan for mining Federal coal lease MTM 082186. Review of the proposed plan is coordinated with DEQ and Federal agencies such as BLM. OSMRE recommends approval, disapproval, or conditional approval of the mining plan to the DOI ASLM.
U.S. Department of the Interior (BLM)	
Resource Recovery and Protection Plan (30 § CFR 746.13)	To allow Westmoreland Rosebud to mine Federal coal lease MTM 082186. BLM must make a finding and recommendation to OSMRE with respect to Westmoreland Rosebud's Resource Recovery and Protection Plan and other requirements of Westmoreland Rosebud's lease. BLM will submit a recommendation regarding the Federal mining plan. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal.
U.S. Fish and Wildlife Service	
ESA Section 7 Consultation (16 USC § 1536)	OSMRE consults with USFWS to ensure protection of threatened and endangered species and any designated critical habitat.
U.S. Army Corps of Engineers	
Federal Water Pollution Control Act (Clean Water Act [CWA]) Section 404 Permit (33 USC § 1344)	To allow discharge of dredged or fill material into wetlands and waters of the U.S., OSMRE consults with the U.S. Army Corps of Engineers (USACE) regarding Section 404 permits to prevent loss of or damage to fish or wildlife resources. Subject to review by the U.S. Environmental Protection Agency (EPA), USFWS, OSMRE, and DEQ.

Table 1.4-2. State Permits, Licenses, and Approvals.

Permit, License, or Approval	Purpose
Montana Department of Environmental Quality	
MSUMRA (Section 82-4-201 et seq., MCA) Surface Mine Operating Permit	A state operating permit allows surface coal mining consistent with the Montana regulatory program, approved by OSMRE under SMCRA. The project area is covered by Westmoreland Rosebud's state operating permit (C2011003F). Depending on the alternative selected, revision of C2011003F may be needed. Any revisions needed would be determined by DEQ after review of the MPDD. Proposed activities must comply with state environmental standards and criteria. Approval may include stipulations for final design of facilities and monitoring plans. A sufficient reclamation bond must be posted with DEQ before implementing an operating permit modification.
Clean Air Act of Montana (Section 75-2-102 et seq., MCA) Air Quality Permit	To control particulate emissions of more than 25 tons per year.
Montana Water Quality Act (Section 75-5-201 et seq., MCA) MPDES Permit	To establish effluent limits, treatment standards, and other requirements for point source discharges, which includes storm-water discharges to state waters including groundwater. Coordinate with EPA.
CWA 401 Certification (33 USC § 1341)	To ensure that any activity that requires a Federal license or permit (such as the Section 404 permit from the USACE) complies with Montana water quality standards.
Hazardous Waste and Solid Waste Registration (various laws)	To ensure safe storage and transport of hazardous materials to and from the site and proper storage, transport, and disposal of solid wastes.
Montana State Historic Preservation Office	
National Historic Preservation Act of 1966 Cultural Resource Clearance (Section 106 Review) (16 USC § 470)	To review and comment on Federal compliance with the National Historic Preservation Act. Consult with Montana State Historic Preservation Office. See discussion in **Section 6.1.3** regarding the programmatic agreement, which covers Section 106 compliance for the project.

1.4.1.1 Office of Surface Mining Reclamation and Enforcement

Applicable Statutes and Regulations

National Environmental Policy Act

As described in **Section 1.1, Introduction**, OSMRE has prepared this SEIS to address the deficiencies identified in the 2022 court order. Pursuant to NEPA regulations, specifically 40 CFR § 1502.9(d), this SEIS also updates analyses related to potential impacts on other resources as determined necessary by OSMRE. Pursuant to NEPA (effective as of July 2024), agencies:

> (1) Shall prepare supplements to either draft or final environmental impact statements if a major Federal action is incomplete or ongoing, and:
> (i) The agency makes substantial changes to the proposed action that are relevant to environmental concerns; or
> (ii) There are substantial new circumstances or information about the significance of adverse effects that bear on the analysis.
> (2) May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so.
> (3) Shall prepare, publish, and file a supplement to an environmental impact statement (exclusive

of scoping (§ 1502.4 of this subchapter)) as a draft and final environmental impact statement, as is appropriate to the stage of the environmental impact statement involved, unless the Council approves alternative arrangements (§ 1506.11 of this subchapter).

This SEIS has been prepared in compliance with NEPA, 42 USC § 4321 et seq.; the Council on Environmental Quality's 2024 NEPA regulations, 40 CFR §§ 1500 to 1508; DOI's NEPA regulations (43 CFR § 46) and Departmental Manual 516; and the OSMRE *NEPA Handbook* (OSMRE 2019b). The BLM NEPA Handbook (BLM 2008) also was considered in the preparation of the document.

Connected Actions

OSMRE has evaluated the project and the Colstrip Power Plant as potentially connected actions. OSMRE determined in a letter dated April 24, 2014, that the project and the Colstrip Power Plant are not connected actions by applying the Council on Environmental Quality's 2024 NEPA regulations (40 CFR §§ 1500 to 1508) regarding connected actions at 40 CFR § 1501.3(b).[10] In the 2014 letter, OSMRE concluded that "Area F and the power plants are not connected actions because the power plant[s] are existing operational facilities, and no pending actions or reasonably foreseeable future actions are currently proposed for the power plant[s]. Therefore, Area F is the only proposed action and, as such, is not connected to a currently existing and operational power plant facility, regardless of the power plant facility's physical location" (OSMRE 2014). A similar argument would also apply to the Rosebud Power Plant. Effects of combustion of project area (Area F) coal in the two power plants were considered indirect effects in this analysis; see **Chapter 4**. Combustion of coal from all other permit areas of the Rosebud Mine (e.g., Area B) in the two power plants were considered cumulative effects; see **Chapter 5**.

State-Federal Cooperative Agreement

Under Section 1273(c) of SMCRA, a state with a permanent regulatory program approved by the DOI Secretary, such as DEQ, can elect to enter into a cooperative agreement for state regulation of surface coal mining and reclamation operations on Federal lands within the state. OSMRE granted DEQ this authority, and DEQ regulates permitting and operation of surface coal mines on Federal lands within Montana under the authority of MSUMRA, Section 82-4-221, MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality** of the 2018 Final EIS). The state-Federal Cooperative Agreement (Agreement) between DEQ and OSMRE is codified in 30 CFR § 926.30. Under the Agreement, DEQ reviews an operator's (in this case, Westmoreland Rosebud's) PAP to ensure the permit application for the proposed action complies with the permitting requirements and that the coal-mining operation would meet the performance standards of the approved Montana program (see **Section 1.4.1.2, Montana Department of Environmental Quality** of the 2018 Final EIS for a description of this process). OSMRE, BLM, and other Federal agencies such as the USFWS review the proposed action to ensure it complies with the terms of the coal lease, the Mineral Leasing Act (MLA), NEPA, and other Federal laws and regulations. DEQ makes a decision to approve or disapprove, in whole or in part, the permit application component of the PAP in accordance with MSUMRA's implementing rules, ARM 17.24.405 (DEQ approved the Proposed Action, minus the 74 acres of Federal coal in T2N, R38E, Section 12, in its 2019 ROD and Written Findings). OSMRE, in accordance with 30 CFR §§ 746.1 through 746.18, reviews DEQ's permit, considers other applicable Federal laws and information, and recommends approval, disapproval, or conditional approval of the mining plan to the DOI ASLM.

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10. 40 CFR § 1501.3(b) states, "[t]he agency also shall consider whether there are connected actions, which are closely related Federal activities or decisions that should be considered in the same NEPA review that: (1) Automatically trigger other actions that may require NEPA review; (2) Cannot or will not proceed unless other actions are taken previously or simultaneously; or (3) Are interdependent parts of a larger action and depend on the larger action for their justification."

Decision

The decision to be made is the selection of an action that meets the legal rights of Westmoreland Rosebud while protecting the environment and that is in compliance with applicable laws, regulations, and policies. The following are possible OSMRE decisions and would be documented in a ROD:

- Recommendation that the DOI ASLM approve a mining plan based on the Proposed Action.
- Recommendation that the DOI ASLM deny a mining plan based on the Proposed Action.
- Recommendation that the DOI ASLM conditionally approve a mining plan based on a preferred alternative.

As required by 30 CFR § 746.13, OSMRE would base its recommendation to the DOI ASLM on the following factors:

- Westmoreland Rosebud's PAP, including the Resource Recovery and Protection Plan, and the approved DEQ operating permit C2011003F;
- Information in the 2018 Final EIS and in this SEIS prepared in compliance with NEPA;
- Documentation ensuring compliance with the applicable requirements of other Federal laws, regulations, and executive orders;
- Comments and recommendations or concurrence of other Federal agencies, as applicable, and the public;
- The findings and recommendations of BLM with respect to the Resource Recovery and Protection Plan and other requirements of Westmoreland Rosebud's lease and the MLA;
- The findings and recommendations of DEQ with respect to the permit application (documented in DEQ's April 2019 ROD and Written Findings, including the Cumulative Hydrologic Impact Assessment for Area F); and
- The findings and recommendations of OSMRE with respect to the additional requirements of 30 CFR § 746.

The ASLM will document the decision regarding OSMRE's recommendations in a new MPDD, which will be issued along with the OSMRE ROD after the Final SEIS is published.

1.4.2 Cooperating Agency

1.4.2.1 Bureau of Land Management

Applicable Statutes and Regulations

BLM is responsible for leasing Federal coal lands under the MLA. The Federal subsurface mineral estate mined by Westmoreland Rosebud at the Rosebud Mine, including Area F, is administered by the BLM Miles City Field Office. As a cooperating agency, BLM will provide information, comments, and technical expertise to OSMRE regarding those elements of the EIS, and the data and analyses supporting them, in which BLM has jurisdiction or special expertise, or for which OSMRE requests their assistance (BLM and OSMRE 2022).

Recommendation

Unlike OSMRE and DEQ, BLM will not issue a decision but, instead, will make a recommendation to OSMRE. Westmoreland Rosebud proposes to mine Federal coal lease MTM 082186. For OSMRE to make a recommendation on the MPDD to the DOI ASLM, BLM must review and approve Westmoreland

Rosebud's Resource Recovery and Protection Plan (which is included in the PAP) and other requirements of Westmoreland Rosebud's lease (43 CFR § 3482.2).

1.4.3 Other Federal Agencies

The following Federal agencies are not cooperating agencies in the preparation of the SEIS, but they do have review roles relevant to this EIS (see also **Table 1.4-1**).

1.4.3.1 U.S. Fish and Wildlife Service

USFWS has responsibilities under the ESA (16 USC § 1536 et seq.), Migratory Bird Treaty Act (16 USC § 703 et seq.), and Bald and Golden Eagle Protection Act (16 USC § 668). Under Section 7 of the ESA, USFWS must determine if implementation of a project would jeopardize the continued existence of any species listed or proposed as threatened and endangered under the ESA, or adversely modify critical or proposed critical habitat. Before issuance of its 2019 ROD, OSMRE completed informal Section 7 consultation with USFWS for whooping crane, black-footed ferret, northern long-eared bat, and pallid sturgeon; this consultation is documented in **Section 6.1.2, U.S. Fish and Wildlife Section 7 Process** of the 2018 Final EIS. OSMRE reinitiated consultation with the USFWS on August 19, 2024 with submittal of a Biological Assessment (BA). The BA updates the analysis of effects on pallid sturgeon resulting from indirect effects of mine expansion on water withdrawals from the Yellowstone River as well as for other species that have experienced a change in status since the last consultation process. The details of this consultation are documented in this SEIS in **Section 6.1.2, U.S. Fish and Wildlife Section 7 Process**.

1.4.3.2 U.S. Army Corps of Engineers

Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Responsibility for administering and enforcing Section 404 is shared by the USACE and EPA. The USACE administers the day-to-day program, including individual permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. EPA develops and interprets environmental criteria used in evaluating permit applications, identifies activities that are exempt from permitting, reviews and comments on individual permit applications, enforces Section 404 provisions, and has authority to veto USACE permit decisions.

Western Energy (now Westmoreland Rosebud) submitted a wetland delineation report for the project (Cedar Creek Associates, Inc. 2013) to the USACE in December 2013; see **Section 3.11, Wetlands and Riparian Zones** of the 2018 Final EIS for a description of the wetlands analysis area. The USACE prepared an approved jurisdictional determination for the project based on the 2013 wetland delineation report and determined that the 11 wetlands in the analysis area are isolated and therefore not jurisdictional waters of the U.S. under the authority of Section 404 of the CWA (USACE File No. NWO-2012-01315-MTB) (USACE 2014). Regarding other waters of the U.S., the USACE determined that Trail Creek, McClure Creek, Robbie Creek, and Donley Creek are not waters of the U.S. because no defined bed and bank were observed within these drainages. The seeps and springs associated with the wetlands in the analysis area also were determined to not be jurisdictional waters of the U.S. The only two potential waters of the U.S. identified in the 2013 wetland delineation report (Stock Pond F043 and a stock pond near Wetland A) were determined by the USACE to be isolated and non-jurisdictional (USACE 2014).

1.4.3.3 U.S. Environmental Protection Agency

EPA does not have a decision making role but has responsibilities under the Clean Air Act (42 USC § 309) to review each major Federal action potentially affecting the quality of the human environment. EPA evaluates the adequacy of information in the EIS and the overall environmental impact of the Proposed Action and alternatives. EPA also reviews CWA Section 404 permit applications, provides comments to the USACE, and has veto authority under the CWA for decisions made by the USACE on CWA Section 404 permit applications. EPA has oversight responsibility for CWA programs delegated to and administered by DEQ. EPA may also intervene to resolve interstate disputes if discharges of pollutants in an upstream state may affect water quality in a downstream state.

1.5 PUBLIC OUTREACH

1.5.1 Scoping

Scoping completed for the original NEPA process is described in the 2018 Final EIS in **Section 1.5**. Pursuant to 40 CFR § 1502.9(d)(3), a new scoping process for this SEIS is not required by NEPA.

1.5.2 Scoping Issue Identification

Eight key issues identified during scoping for the original NEPA process are described in detail in the 2018 Final EIS in **Section 1.5.2**. In summary, these issues included the following: (1) effects on surface water quality and quantity, (2) effects on groundwater quality and quantity, (3) effects on wetlands and non-wetland waters of the U.S., (4) effects on wildlife and their habitats, (5) effects of the project on climate change, (6) effects of the power plants on climate change and environmental resources, (7) effects on human health and environment, and (8) reclamation. The following two issues were dismissed from detailed analysis because they were covered by existing laws and regulations or were not applicable to the proposed project: (1) bonding and financial assurance and (2) analysis of the Colstrip and/or Rosebud Power Plants as connected actions under NEPA.

1.5.3 Public Comment Period for the Draft SEIS

OSMRE is accepting public comments on this draft SEIS for a 45-day comment period beginning the date that the EPA’s Notice of Availability (NOA) was published in the *Federal Register*. Notice of the comment period was also provided on the OSMRE website (https://www.osmre.gov/laws-and-regulations/nepa/projects) and in a press release statement. Details on how to submit comments and attend the public comment meeting are included in the NOA.

1.6 FINANCIAL ASSURANCE

OSMRE and DEQ’s performance bonding requirements are described in detail in the 2018 Final EIS in **Section 1.6**; other agencies, such as the BLM, may have additional financial assurance requirements, but these are not described here. Westmoreland Rosebud was required to post a bond with DEQ before commencing development of Area F in 2019. The amount of financial assurance that Westmoreland Rosebud had to provide was based on DEQ’s estimated cost (with OSMRE’s concurrence) to complete site reclamation, restoration, and abatement work in the event that Westmoreland Rosebud could not or would not perform the required reclamation. In addition to estimating direct and indirect reclamation costs, which are based on current industry standards, the bond amount covers the estimated cost for DEQ to contract, manage, and direct construction at the site during reclamation, plus any contingencies (e.g., hiring a third-party contractor, interim and long-term site monitoring, and maintenance) and inflation (see ARM 17.24.1102). The principal amount of the performance bond had to be sufficient to cover the estimated cost to DEQ to ensure compliance with state reclamation requirements and Federal reclamation requirements under SMCRA. The current posted bond amount for Area F is $16,150,000 (Westmoreland Rosebud 2024a); this bond amount is reviewed by DEQ every 5 years (see also **Table 2.2-4**).

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CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter provides detailed information on Westmoreland Rosebud's existing operations at the Rosebud Mine (mine), including ongoing operations in Area F (project area), providing the context and assumptions for the alternatives considered by Office of Surface Mining Reclamation and Enforcement (OSMRE) and U.S. Department of the Interior (DOI) decision makers in this Supplemental Environmental Impact Statement (SEIS). This chapter also describes the three alternatives: Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), and Alternative 5 – Partial Mining Alternative.

2.1.1 Alternatives Development

The alternatives considered in this SEIS have been updated from the 2018 Final Environmental Impact Statement (EIS).

- Alternative 1 – No Action has been updated to consider mining that has been occurring in the Area F permit area since 2020; current operations in Area F are described in **Section 2.2.2.2, Area F Operations and Development**, and Alternative 1 is described in **Section 2.4**.
- Alternative 2 – 2018 Final EIS Proposed Action (pursuant to the mine permit application package [PAP]) is no longer consistent with the approved Montana Department of Environmental Quality (DEQ) operating permit C2011003F and is not analyzed further in this SEIS (see discussion in **Section 2.7, Alternatives Considered but Eliminated from Further Analysis**). Alternative 2 is used in this SEIS as a basis of comparison for Alternative 4.
- Alternative 3 – Proposed Action Plus Environmental Protection Measures has no new or additional analysis in this SEIS; a brief discussion is included in **Section 2.7, Alternatives Considered but Eliminated from Further Analysis** to help the reader understand why additional analysis was not warranted.
- Alternative 4 – Proposed Action is a new proposed action analyzed in this SEIS. While very similar to Alternative 2 – 2018 Final EIS Proposed Action, this new alternative is consistent with the approved DEQ operating permit C2011003F and the 2019 Assistant Secretary for Land and Minerals Management–approved Federal mining plan. Westmoreland Rosebud is currently mining Area F as described in **Section 2.2.2.2, Area F Operations and Development**. Alternative 4 represents maximum mining and is the basis of comparison for all SEIS alternatives.
- Alternative 5 – Partial Mining Alternative is a new alternative action analyzed in this SEIS, which is described in **Section 2.6, Alternative 5 – Partial Mining Alternative**. Alternative 5 is consistent with the approved DEQ operating permit C2011003F and the 2019 Assistant Secretary for Land and Minerals Management–approved Federal mining plan, but is for a shorter mining term of only 5 years. Alternative 5 was developed for analysis in this SEIS to further explore a reasonable range of possible alternatives to allow for meaningful public input and informed agency decision making.

The alternatives development process used by DEQ and OSMRE for the 2018 Final EIS is provided in **Section 2.1.1** in the 2018 Final EIS.

2.2 DESCRIPTION OF PAST AND EXISTING MINE AND RECLAMATION OPERATIONS

A brief history of the development and operations of the Rosebud Mine is provided in **Section 1.2.1** in **Chapter 1**. The following sections provide an overview of the current state of operations at the mine. The conditions described here provide the context for the analysis of alternatives in this SEIS and provide some of the underlying assumptions.

2.2.1 Past and Existing Production

The Rosebud Mine (mine) is operated by Westmoreland Rosebud Mining, LLC (Westmoreland Rosebud), a subsidiary of Westmoreland Mining LLC. The Rosebud Mine operates 24 hours per day, 7 days per week, and as of 2023, employs around 320 people. Of these, about 35 salaried staff members work 5 days a week; most others work 16 days a month on a 12-hour rotation (Batie 2024).

Westmoreland Rosebud has four active mine areas at the Rosebud Mine operating under permits issued by the DEQ: Area A (permit C1986003A), Area B (permit C1984003B), Area C (permit C1985003C), and Area F (permit C2011003F, which is analyzed in this SEIS). These active permit areas have been mined since 1976 (Areas A and B) and 1983 (Area C). Pre-mining development in preparation for mining in Area F began in 2019, and coal recovery began in August 2020. Two mine areas are no longer actively mined: Area D (4,475 acres, permit C1986003D) is being reclaimed, and Area E (1,026 acres, former permit C1981003E) was released from DEQ jurisdiction in 2019. Mining occurred in Area D from 1986 to 2013 and in Area E from 1976 (or prior) to 1988. Reclamation has occurred concurrently with mine operations in all permit areas as required by the Montana Strip and Underground Mine Reclamation Act (MSUMRA).

Although the Rosebud Mine has shipped coal by rail as recently as 2010,[11] all coal produced by the mine is currently consumed locally at the Colstrip Power Plant and the Rosebud Power Plant under contracts that Westmoreland Rosebud has with the power plant operators (see **Section 1.2.2, Coal Combustion**). To meet operators' coal requirements, such as sulfur and other qualities (e.g., sodium, mercury, etc.), Westmoreland Rosebud often mixes coal from two or more permit areas; for example, Area F coal may be mixed with Area B coal to meet the right value of sulfur needed for the Colstrip Power Plant. Whether mixed or not, low-sulfur (0.64 percent) subbituminous coal from the Rosebud Mine, including the project area, currently is sent to the Colstrip Power Plant via conveyors and burned in Units 3 and 4. High-sulfur "waste coal" is sent via covered truck and burned in the Rosebud Power Plant.

Between 1975 and 2023 (**Table 2.2-1**), just under 514 million tons of coal were recovered from the mine's Permit Areas A, B, C, D, E, and F; in 2023 (**Table 2.2-2**), about 7.1 million tons of coal were recovered (Westmoreland Rosebud 2024a). Production from the Rosebud Mine is limited by the conditions of its DEQ-issued air quality permits, but actual production rarely reaches the air quality permits' limit levels. Montana Air Quality Permit (MAQP) #1483-09 limits annual combined coal production from Areas A, B, and D to 13 million tons per year. Combined coal production from Areas C and F is limited to 8 million tons per year per MAQP #1570-09, with an Area F–specific production cap of 4 million tons per year.

[11]. In the past (as recently as 2010), a railroad spur in Area D was used to ship 5,000 to 10,000 tons per year to small customers using a few coal cars at a time. In Area A, a rail loop was used to load large trains with about 2 million tons per year for shipment to larger customers (Mahrt 2017). Westmoreland Rosebud no longer ships coal from the Rosebud Mine by train.

Table 2.2-1. Total Coal Produced by the Rosebud Mine between 1975 and 2023.

Permit Area	Permit Number	Coal Sold (Tons)
A	C1986003A	71,753,968
B	C1984003B	85,176,647
C	C1985003C	231,791,501
D	C1986003D (currently in reclamation)	82,894,405
E	C1981003E (no longer a mine permit area)	33,339,045
F	C2011003F	8,529,503
	Total	**513,485,069**

Note: Table includes permit areas and coal mined prior to MSUMRA (i.e., pre-1977 mining in Pit 6).
Source: Westmoreland Rosebud 2024a.

In the decade prior to retirement of the Colstrip Power Plant's Units 1 and 2 (see **Section 1.2.2.1, Colstrip Power Plant**), the mine produced between 8 and 13 million tons of low-sulfur subbituminous coal annually, which was supplied to the Colstrip Power Plant, and 300,000 tons of high-sulfur "waste coal" annually, which was supplied to the Rosebud Power Plant (Western Energy 2018). Average annual production from the mine over that 10-year period was 9.9 million tons. Production has decreased overall in more recent years, ranging from a low around 5.4 million tons (Peterson 2022) to a high around 7.1 million tons in 2023 (Westmoreland Rosebud 2024) as shown in **Table 2.2-2**.

Table 2.2-2. Coal Produced by the Rosebud Mine in 2023 (January 1–December 31).

Permit Area	Permit Number	Coal Produced (Tons)
A	C1986003A	0
B	C1984003B	2,478,747
C	C1985003C	0
D	C1986003D (currently in reclamation)	0
F	C2011003F	4,549,133
	Total	**7,027,880**

Source: Westmoreland Rosebud 2024a.

2.2.2 Existing Disturbance and Reclamation

2.2.2.1 Rosebud Mine

Currently, the Rosebud Mine includes 40,127 permitted and bonded acres within five permit areas (A, B, C, D, and F), of which 19,062 acres are currently disturbed (Westmoreland Rosebud 2024a). See **Table 4.3-1** for a summary of permitted and disturbed acres. **Table 2.2-4** provides an overview of reclamation and bond release by permit area.

Table 2.2-3. Rosebud Mine Permitted and Disturbed Acreage as of 2023.

Permit Area	Permit Number	Year Mine Disturbance Began	Permitted Acreage[1]	Active Mining 2023 (acres)	Facilities (acres)[2]	Disturbance (acres)[3]
A	C1986003A	1976	4,303	862	501	3,206
B	C1984003B	1976	15,194	2,942	469	5,137
C	C1985003C	1983	9,382	1,869	780	7,100
D	C1986003D	1986	4,475	0	0	3,037
F	C2011003F	2019	6,773	494	88	582
		Rosebud Mine Total	**40,127**	**6,167**	**1,838**	**19,062**

1. Total acreage includes minor revisions (incidental boundary changes) and final bond release. Note: Westmoreland Rosebud added 31 acres back into the Area B permit in 2023 from previously released areas (Westmoreland Rosebud 2024a).
2. Includes roads, mine offices, equipment storage areas, coal storage barns, dams and impoundments, conveyor routes or other routes, power lines, pipelines, etc. Note: Westmoreland Rosebud added acreage into the Area F permit on the east side that overlapped Permit Area C (Westmoreland Rosebud 2024a).
3. Includes all surface that has been disturbed (Disturbance = Facilities + Active Mining + Complete Backfill and Grading).
Source: Westmoreland Rosebud 2024a. Data are for reporting year January 1, 2023–December 31, 2023. Please note that DEQ Coal Section data may be slightly different. Numbers have been rounded to the nearest whole number.

Table 2.2-4. Reclamation Bond Amount and Phased Bond Release by Area of the Rosebud Mine as of 2023.

Permit Area	Permit Number	Acres Released from Phase I[1]	% of Disturbance Area Released from Phase I	Acres Released from Phase II[1]	% of Disturbance Area Released from Phase II	Acres Released from Phase III[1]	% of Disturbance Area Released from Phase III	Acres Released from Phase IV[1]	% of Permit Area Released from Phase IV[2]	Bond Retained by DEQ
A	C1986003A	1,827	57	1,682	52	1510	47	0	0	$32,750,000
B	C1984003B	1,589	31	1106	22	1240	24	186	4	$86,650,000
C	C1985003C	4,256	60	4,143	58	1141	16	50	1	$41,250,000
D	C1986003D	3,006	99	2,223	73	500	16	27	1	$7,950,000
F	C2011003F	0	0	0	0	0	0	0	0	$16,150,000
Rosebud	**Mine Total**	**10,678**	56	**9,154**	48	**4,391**	23	**263**	1	**$184,750,000**

1. Bond-release phases are tied to reclamation. Please see the 2018 Final EIS Section 1.6.4, Bond Release for a description of bond-release phases.
2. Phase IV has been demonstrated as a percentage of the Life of Mine Permit Area, as it includes both disturbed and undisturbed acres.
Source: Westmoreland Rosebud 2024a. Data are for reporting year January 1, 2023–December 31, 2023. Numbers have been rounded to the nearest whole number. Please note that DEQ Coal Section data may be slightly different.

2.2.2.2 Area F Operations and Development

Westmoreland Rosebud began developing Area F in 2019 according to approved state operating permit C2011003F and the 2019-approved Federal mining plan; coal recovery began in August 2020. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles (see **Figure 2.2-1** in **Chapter 2**; Westmoreland Rosebud 2024a). Approximately 8.5 million tons of coal have been produced in the project area within this timeframe (Westmoreland Rosebud 2024a) and sold to the Colstrip Power Plant and the Rosebud Power Plant. The following sections describe how existing Area F operations have evolved from those described for Alternative 2 (Proposed Action pursuant to the PAP) in the 2018 Final EIS.

Conditions of Approval

The agencies outlined conditions of approval and modifications to Alternative 2 – Proposed Action in the 2018 Final EIS in their respective RODs (DEQ 2019a, OSMRE 2019a). These conditions and modifications (**Table 2.2-5**) were incorporated into the state operating permit C2011003F and the Federal mining plan.

Table 2.2-5. DEQ and OSMRE ROD conditions.

Condition	Source
ARM 17.24. 318, 1131: Treatment of cultural resources within state operating permit C2011003F is covered by a memorandum of agreement developed under the provisions of Section 106 of the National Historic Preservation Act and pursuant regulations (36 CFR § 800). Treatment of all cultural resources, including incidental discoveries during the course of mining, must be handled according to the provisions of the memorandum of agreement.	DEQ 2019a
ARM 17.24.405(6)(c): As described in Section 9.6.5 of the Cumulative Hydrologic Impact Analysis (Appendix I to the 2019 DEQ ROD), based on information contained in the permit application, DEQ has determined that the proposed mining plan in T2N, R38E, Section 12 is likely to result in a change in water quality in the Rosebud Coal outside the permit boundary, which could result in material damage. As such, the application does not affirmatively demonstrate that the hydrologic consequences and cumulative hydrologic impacts of mining in Section 12 will not result in material damage to the hydrologic balance outside the permit area. Therefore, in accordance with ARM 17.24.405(4), DEQ does not approve mine passes proposed in T2N, R38E, Section 12.	DEQ 2019a
ARM 17.24.510(1): The proposed use of bottom and fly ash within the proposed project area is prohibited. These waste materials are derived from activities conducted outside the permit area and have not been demonstrated, in the Area F application, to not adversely affect water quality, public health or safety, or other environmental resources. Any reference to bottom ash and fly ash must be removed from the Area F permit application (specifically references on pages 313-1, 313-2, 321-1, 321-2, 501-1, and 510-1) within 45 days of issuance of permit C2011003F.	DEQ 2019a
The Selected Alternative is Alternative 2 – Proposed Action as described in **Section 2.4** of the 2018 Final EIS with the exception of 74 acres of Federal coal in T2N, R38E, Section 12, which was not approved for mining.	OSMRE 2019a

Annual Reporting

Pursuant to its operating permit, Westmoreland Rosebud submits an Annual Mining Report for Area F to DEQ. Each report covers January 1 through December 31 of the previous year and is typically submitted in June or July. The most recent report covers January 1 through December 31, 2023 (Westmoreland 2024b) and was used in the preparation of this SEIS. The report discloses mining, disturbance, and reclamation that occurred during the reporting period and provides updates on monitoring and mitigation, including those that were conditions of permit approval. Other reports, such as the Annual Wildlife Report (ICF 2024), the Annual Hydrology Report (WET 2024), and the Annual Hazard Waste Report (Westmoreland Rosebud 2024c), are submitted on the same reporting schedule as the Annual Mining Report and also were used in the preparation of this SEIS (see discussions in relevant **Chapter 3** resource sections).

Minor Revisions to State Operating Permit C2011003F

As is typical for surface coal mines, on-the-ground conditions in the project area have necessitated minor changes to the operating permit as Area F has been developed and coal recovered; these changes have been handled by DEQ as minor revisions (MRs) to the state operating permit. Each MR was reviewed and approved by DEQ pursuant to MSUMRA and the Montana Environmental Policy Act. **Table 2.2-6** below describes each MR that has occurred since project implementation through December 31, 2023;[12] noteworthy changes include a slight revision to the permit boundary where it intersects Area C, adjustments to the disturbance area, and new routes for the Horse Creek Road relocations described in the 2018 Final EIS. Updated features (permit boundary, disturbance area, road relocations, etc.) are shown on **Figure 2.2-1**.

Table 2.2-6. Minor Revisions to Permit C2011003F (Area F) Approved by DEQ.

MR Name	Revision Subject
MR1	Permit language proposing the use of bottom ash removed from the narrative (DEQ ROD condition).
MR2	Authorized Ramp CW6a for mobile equipment access to cuts FA-1 through FA-5 prior to construction of the haul road.
MR3	Authorized a contract miner to operate in the area as Westmoreland works on the permit transfer.
MR4	Authorized the transfer of the surface mine permit from Western Energy Company to Westmoreland Rosebud Mining LLC.
MR5	Denied request for spoil movement from one operating permit to another operating permit.
MR6	Authorized the change of mining sequence and additional ramp access to mining.
MR7	Authorized an additional soil pile FT19 for which a portion of the area will be designated for the soil study area.
MR8	As-built for Pond F-02.
MR9	Authorized additional mine passes, FA-5 and FA-6, associated with the reroute of the 115 kV overhead powerline.
MR10	Updated the bond calculation (still open).
MR11	Denied request for spoil movement from one operating permit to another operating permit.
MR12	Authorized the realignment of mine passes in the FA pit.
MR13	Authorized an incidental boundary change for approximately 28 acres; includes approximately 27 acres of Federal coal that was previously part of Permit Area C. *Please note that the 27 acres of Federal coal will not be mined or have already been mined as part of Area C operations.*
MR14	Authorized to reorient a haul road through Black Hank Creek drainage channel and add a culvert to extend ramp F1a, adding an additional 39 acres of disturbance.
MR15	Authorized to reorient the county road and haul road.
MR16	Authorized change of soil pile location, eliminating the need for three out of pit overburden stockpile footprints, reducing surface disturbance.
MR17	Authorized realignment of the haul road, reducing the disturbance footprint.
MR18	Approved the as-built for Pond F-07.
MR19	Approved the as-built for Pond F-08.
MR20	Approved change in the designs for Pond F-6A and Pond F-6B.

12. To move forward with SEIS analyses, a data cut-off date of December 31, 2023, was implemented to provide a snapshot in time of mine operations that would be consistent throughout the environmental review process. Westmoreland Rosebud prepares annual mine reports. The most recent annual reports were issued in 2024 and cover the January 1, 2023, through December 31, 2023, reporting period.

Current Area F Operating Permit versus Alternative 2 – 2018 Final EIS Proposed Action

As noted above, minor adjustments to mining operations are typical as a mine is developed and operated. For the project area, these adjustments have been driven by on-the-ground conditions and other actions, such as market conditions and the rate of mining in other permit areas. **Table 2.2-7** through **Table 2.2-9** compare key components of the currently approved operating permit (as modified through MR19) to Alternative 2 from the 2018 Final EIS. **Figure 2.2-1** shows the extent of mining that has occurred in Area F since 2020 as well as showing the slightly modified permit boundary that bounds the SEIS project area and the 74 acres where mining is prohibited to protect the hydrologic balance. **Figure 2.2-2** shows the original permit boundary (Alternative 2 project area) from the 2018 Final EIS. Since 2019, the following conditions have impacted Westmoreland Rosebud's mining operations in Area F:

- MRs to operating permit C2011003F (described in **Table 2.2-6**) have been proposed by Westmoreland to address on-the-ground conditions and have been approved by DEQ.
- Development of the Rosebud Mine (Area F and other permit areas) has not occurred as quickly as described in the 2018 EIS. For example, Area B has not been developed to the extent anticipated in the 2018 Final EIS for Area F for several reasons, including the following: (1) DEQ only authorized about half of the acreage in Amendment 5 (AM5) to the Area B permit that was considered in the 2018 Final EIS for Area F, (2) a court recently remanded the DEQ authorization for Amendment 4 to the Area B permit, and (3) ongoing litigation of Area B AM5 makes future mining of that area uncertain. The net result of these changes to Area B (or any other permit areas of the mine) is that Westmoreland Rosebud has made changes (or may need to make changes in the future) to the mining rate for Area F based on operational needs.
- Westmoreland must deliver coal to the Colstrip Power Plant that meets certain operational requirements (e.g., low sulfur content, high calorific value, etc.). Although Westmoreland has predicted the quality of the coal in Area F and other permit areas based on testing and modeling, on-the-ground conditions may vary. To overcome these variances, Westmoreland Rosebud blends coal from multiple permit areas to create a consistent quality coal for the Colstrip Power Plant. The need to blend coal can affect the permit areas that are used and the rate at which Westmoreland Rosebud mines.
- The operational needs (e.g., production rate, coal quality, etc.) of the Rosebud Mine dictate the sequence of mining passes in the Area F permit area. For example, moving a dragline is a very costly and time-consuming process. Westmoreland Rosebud has adjusted the sequence of passes in the project area from those described in the 2018 Final EIS to more efficiently use and move its draglines based on current operating conditions.

Disturbance

Table 2.2-7 compares currently approved disturbance acreages to those described in the 2018 Final EIS for Alternative 2 – 2018 Final EIS Proposed Action.

Table 2.2-7. Comparison of Area F Permit Area Surface Disturbance Estimates.

Disturbance Area	Alternative 2 – 2018 Final EIS Proposed Action Acres	DEQ-Approved (MR16) Acres
Mining area	2,159	2,175
Soil storage area	197	227
Scoria pits	45	45
Haul roads	211	191
Other disturbances[1]	1,748	1,746
Acreage with two or more types of disturbance	(-99)	(-96)
Total disturbance	**4,260**	**4,288**

1. Other disturbances mostly include undisturbed ground near or adjacent to other disturbed areas including ponds, sediment traps, and ditching associated with surface-water sediment controls; ramps connecting haul roads to the mining area; and electrical substations.
Source: Table is based on Table 303-1 from Western Energy's PAP and Table 303-1 from C2011003F MR16 (2022). Acreages are rounded to the nearest whole number in the text of this SEIS.

Coal Recovery

Table 2.2-8 compares the estimated recoverable coal reserves in each of the Area F leases (private and Federal) from MR16 to those described in the 2018 Final EIS for Alternative 2 – 2018 Final EIS Proposed Action. Adjustments to these numbers reflect MRs (see **Table 2.2-6**). Two distinct coal seams underlie Area F, the Rosebud and McKay, and are presently mineable by surface technology. Westmoreland Rosebud, however, is only mining the Rosebud seam, which is the highest coal seam in the project area stratigraphic sequence. The Rosebud Coal seam averages 18.6 feet thick with a maximum thickness of 26.0 feet. The McKay seam is 67 feet below the Rosebud seam, is about 9 feet thick, and is of poorer quality. Recoverable coal means the amount of coal remaining after deducting the tonnage that represents a cleaning loss of 1.5 feet of coal, which results in a 94 percent recovery factor. Not all coal within the lease boundaries will be mined due to operational limitations such as protection of drainages, poor coal quality, high stripping ratios, equipment maneuverability, location of existing utilities, and the 94 percent coal-recovery factor.

Table 2.2-8. Comparison of Area F Estimated Coal Reserve Volumes (Tons).[1]

Coal Reserve	Source	Coal Lease 1001 (Private)	Coal Lease 1001a (Private)	Coal Lease MTM 082186 (Federal)	Total
Total coal within lease area	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	100,390,436	1,436,280	62,138,589	**163,965,305**
Loss attributable to recovery factor[2]	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	2,361,000	3,000	2,163,000	**4,527,000**
Coal not mined due to undisturbed stream corridors	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	12,323,193	0	829,781	**13,152,974**
Coal not mined due to existing utilities	MR16	*1,608,940	0	6,065,170	***7,674,110**
	**Alternative 2 – 2018 Final EIS Proposed Action	*2,161,658	0	6,065,170	***8,226,828**
Coal not mined due to poor quality	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	19,629,169	0	2,529,222	**22,158,391**
Coal not mined due to equipment maneuverability	MR16	*2,627,150	0	1,338,779	***3,965,929**
	**Alternative 2 – 2018 Final EIS Proposed Action	*2,599,661	0	1,338,779	***3,938,440**
Coal not mined due to high stripping ratio	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	24,318,470	1,394,450	15,463,661	**41,176,581**
Previously mined coal	Same numbers in MR16 and Alternative 2 – 2018 Final EIS Proposed Action	0	0	0	**0**
Mineable coal reserves in lease	MR16	*37,522,514	38,830	33,748,976	***71,310,320**
	**Alternative 2 – 2018 Final EIS Proposed Action	*36,997,285	38,830	33,748,976	***70,785,091**

* These values changed between the 2018 Final EIS and MR16.

** Information from this row is based on Table 322-2: Coal Volumes from Western Energy's PAP.

1. Coal reserves within the project area coal lease boundaries were calculated by Westmoreland Rosebud using grid files in SurvCADD/AutoCADD. This process yields a volume of coal to which an in situ density of 1.1 tons per cubic yard was applied to determine available reserves.

2. About 2.7 percent of total coal: unrecoverable based on 94 percent coal-recovery factor.

Source: Table 322-2 from C2011003F MR16 (2022).

Mining Plan and Annual Production

Westmoreland Rosebud is using the same surface mining method (U.S. Patent 2,291,669; August 4, 1942) in Area F as in all other permit areas of the Rosebud Mine. Mining operations run 24 hours a day, 7 days a week. The surface mining method uses dragline excavation and box-cuts as described for Alternative 2 in the 2018 Final EIS **Section 2.4**. As described above, the sequence of mine operations in the project area under the approved DEQ operating permit differs slightly from what Westmoreland Rosebud proposed in Alternative 2 due to on-the-ground conditions.

Annual production (annual tons of coal recovered and associated disturbance) values provided in both this SEIS and the 2018 Final EIS are estimates only. Actual production and associated disturbance can vary due to the factors discussed above.[13] **Table 2.2-9** compares actual annual production (annual tons of coal recovered and associated disturbance) to annual production estimates from MR16, which was approved by DEQ in 2022 and is Westmoreland Rosebud's most recent mining timetable, to annual production estimates from the 2018 Final EIS for Alternative 2 (**Section 2.4**).

Road Construction and Relocations

Construction of access roads, haul roads, ramp roads, and service roads is proceeding in the project area as described in the 2018 Final EIS **Section 2.4.3.4** with a few minor adjustments as noted in the MRs listed in **Table 2.2-6**. Pursuant to MR 16, approximately 200,000 to 300,000 cubic yards of initial box-cut overburden was used as fill for the construction of the Area F haul road between the first two ramps, with the remainder placed in overburden stockpiles.

The biggest change since the 2018 Final EIS is that the Horse Creek Road alignment shown for Alternative 2 (**Figure 2.2-2**) was modified slightly from what Westmoreland Rosebud had proposed to accommodate on-the-ground conditions (**Figure 2.2-3**). Specifically, a 4.2-mile segment in the northeast/north-central portion of the project area (owned and maintained by Rosebud County) and a 1.3-mile segment in the northwestern portion of the project area (owned and maintained by Treasure County) were modified. The longer segment, which is in Rosebud County, was relocated during the initial development of the project in 2019. The west end of the realignment, which is in Treasure County, will be relocated when mining moves into the northwestern corner of the project area (in about 5 to 7 years based on current estimates).

Fugitive Dust Control

Measures to control fugitive dust are being implemented as described in the 2018 Final EIS **Section 2.4.3.4**. Westmoreland Rosebud currently maintains a Fugitive Dust Control Plan in accordance with Administrative Rules of Montana (ARM) 17.24.761 and the work practice standards and Best Available Control Technology established within its current MAQP #1570-09; see **Section 2.2.3, Other Existing Permits**.

[13.] For example, as of December 31, 2023, Westmoreland Rosebud has mined less coal in Area F in four years of production (2020 to 2023) than predicted by the mine production estimates provided in **Table 2.2-9**. Based on total production tonnages provided in **Table 2.2-1**, only about 8.5 million tons of coal have been produced from Area F between 2020 and 2023 as compared to the predicted 9.1 million tons in **Table 2.2-9**. At the same time, 2023 production in Area F (about 4.6 million tons) was greater than the 4 million tons predicted in **Table 2.2-9**.

Table 2.2-9. Comparison of Estimated and Actual Annual Production by Year and Acres Disturbed.

Operation Year	Alternative 2 2018 Final EIS Estimated Tons Mined (×1,000)	MR16 Estimated Tons Mined (×1,000)	Actual Tons Mined (×1,000)	Alternative 2 2018 Final EIS Estimated Annual Disturbance (acres)	Alternative 2 2018 Final EIS Estimated Total Disturbance (acres)	MR16 Estimated Annual Disturbance (acres)	MR16 Estimated Total Disturbance (acres)	Actual Annual Disturbance (acres)	Actual Total Disturbance (acres)
1 (2020)	4	.2	0.25	600	600	35.7	35.7	74	74
2	4	.9	0.98	114.8	714.8	26.4	62.1	73	147
3	4	4	2.6	114.8	829.6	614.88	676.9	394	541
4 (2023)	4	4	4,6	114.8	944.4	114.8	791.7	41	582
5	4	4		514.8	1,459.1	114.8	906.5		
6	4	4		114.8	1,573.9	114.8	1,021.2		
7	4	4		114.8	1,688.7	114.8	1,136.0		
8	4	4		514.8	2,203.5	514.8	1,650.8		
9	4	4		114.8	2,318.3	614.8	2,265.6		
10	4	4		114.8	2,433.1	114.8	2,380.4		
11	4	4		114.8	2,547.8	114.8	2,495.2		
12	4	4		114.8	2,662.6	114.8	2,609.9		
13	3.3	4		493.3	3,155.9	114.8	2,724.7		
14	3.2	4		93.3	3,249.2	414.8	3,139.5		
15	3.3	4		93.3	3,342.4	364.8	3,504.3		
16	3.2	4		493.3	3,835.7	114.8	3,619.1		
17	3.3	4		93.3	3,928.9	114.8	3,733.9		
18	3.2	4		93.3	4,022.2	114.8	3,848.6		
19	3.3	4		93.3	4,115.5	193.5	4,042.1		
20 (2039)	0.0	1.6		72.4	4,187.9	245.9	4,288.0		
21 (2040)	0.0	-		72.4	**4,260.3**	-	**4,288.0**		

Note: Acres disturbed and tons mined per year are estimates only. Actual production and disturbance may vary.
Source: Table is based on Table 303-2 from the Western Energy PAP (Alternative 2 – Proposed Action from the 2018 Final EIS),Table 303-2 from C2011003F MR16 (2022), and Westmoreland Rosebud's Annual Mining Reports (Reporting periods January 1, 2020 through December 31, 2023).

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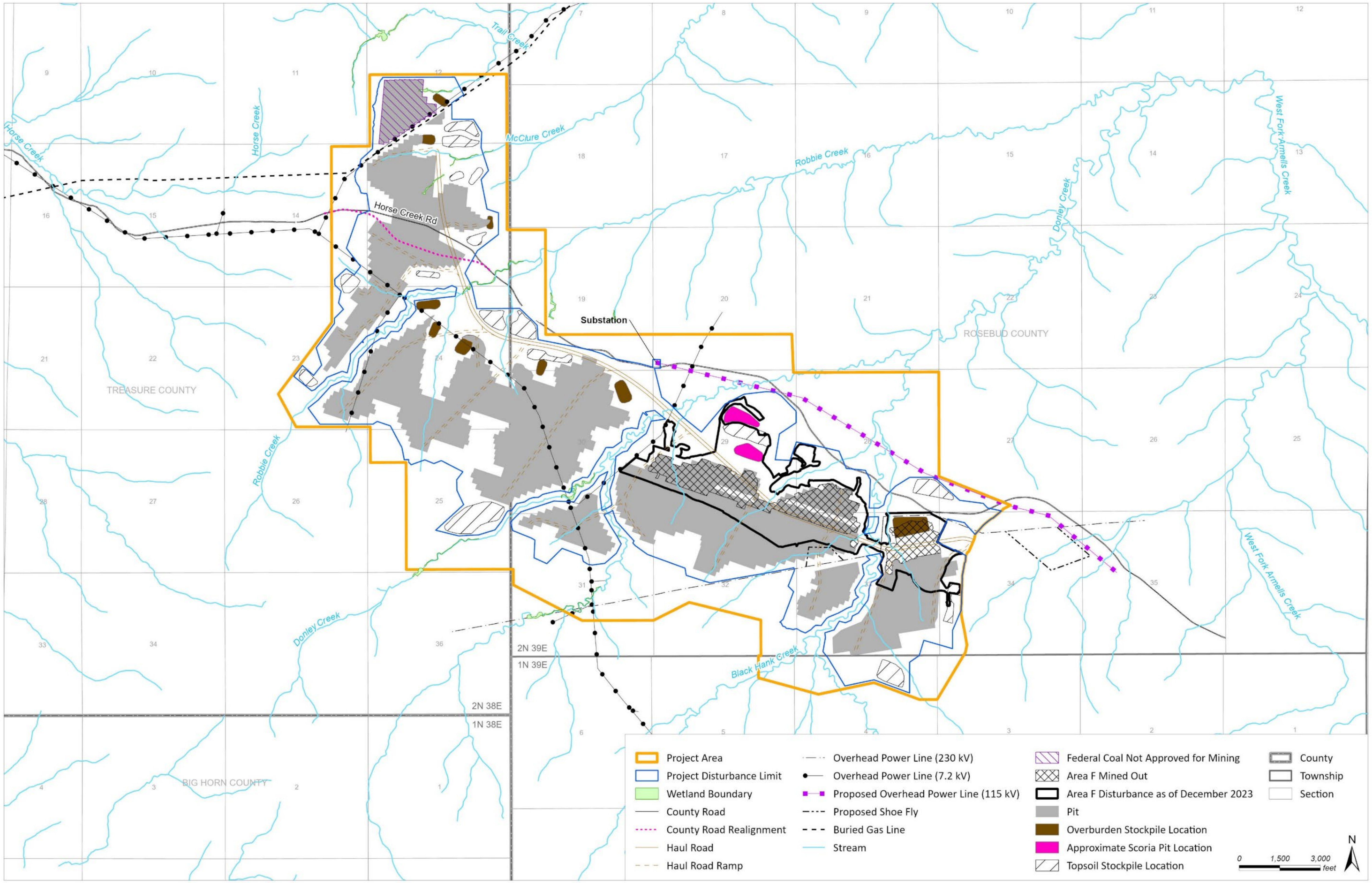

Figure 2.2-1. Operating Permit C2011003F Features and Extent of Mining in Project Area as of December 31, 2023

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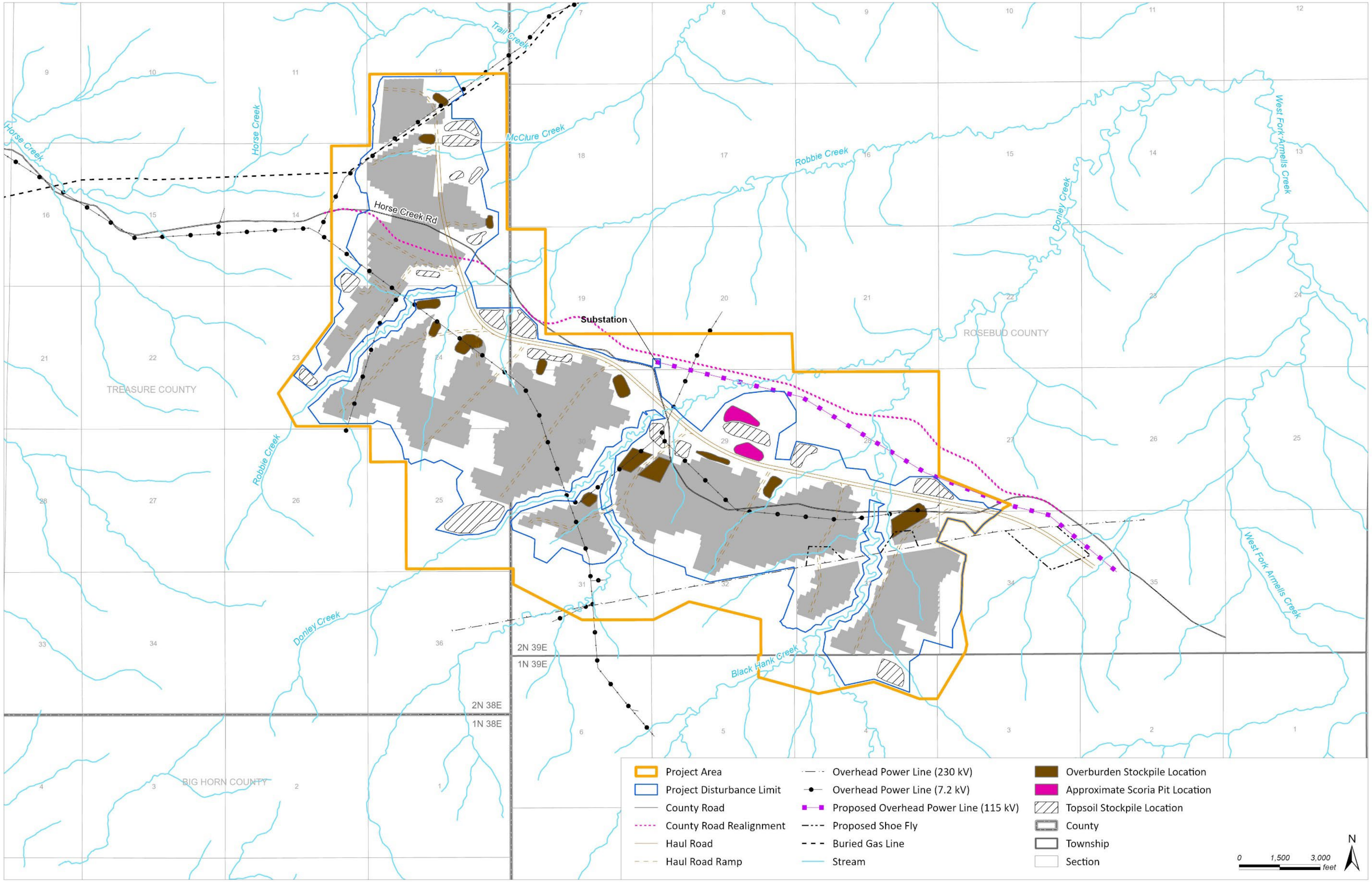

Figure 2.2-2. Alternative 2 Project Area from the 2018 Final EIS

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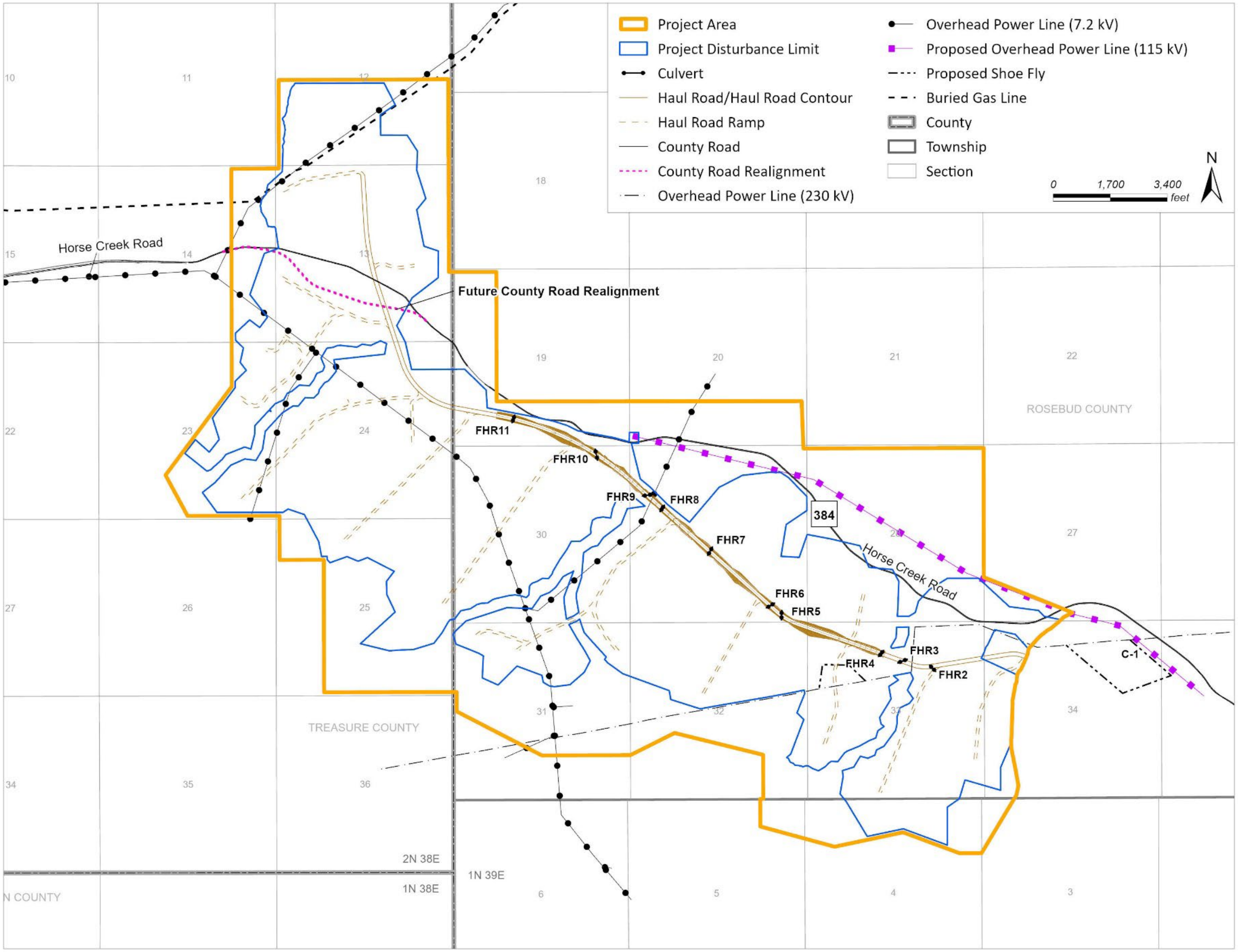

Figure 2.2-3. Roads in the Project Area

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Protection of the Hydrologic Balance

Measures to protect the hydrologic balance, including management of surface water, groundwater, and sediment in the project area, are being implemented as described in the 2018 Final EIS **Section 2.4.5** with a few minor adjustments as noted in **Table 2.2-6**. Locations of Montana Pollutant Discharge Elimination System (MPDES) Permit MT-0031828 outfalls and sediment ponds and traps are shown on **Figure 2.2-4**.

The biggest change from the 2018 Final EIS in terms of the hydrological balance is the prohibition of mining in 74 acres of Federal coal in T2N, R38E, Section 12. Westmoreland Rosebud, however, may still disturb the surface above the 74 acres of Federal coal for mining-related activities (e.g., spoil and topsoil stockpiles). Westmoreland Rosebud estimates that there is approximately 1.9 million tons of recoverable coal (based on modeling using expected coal thickness and quality) that will not be mined in T2N, R38E, Section 12. Westmoreland Rosebud may at any time reapply to OSMRE and DEQ to mine the excluded 74 acres of Federal coal provided they affirmatively demonstrate that no material damage would occur.

Reclamation and Postmining Topography

Reclamation is occurring in Area F contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). As described above under **Mining Plan and Annual Production**, the sequence of mine operations (and reclamation) in the project area has been slightly modified in Westmoreland's approved operating permit from what was described for Alternative 2 in the 2018 Final EIS **Section 2.4.4, Reclamation**. Pursuant to its approved reclamation plan (Exhibit J as revised by MR 12 and MR 17; **Figure 2.2-5**)[14] and postmining topography (Exhibit B as revised by MR 15; **Figure 2.2-6**), Westmoreland Rosebud continues to reclaim all mining-related land disturbances in the project area to a use equal to or better than what existed prior to mining as provided for in Sections 82-4-231 and 232, Montana Code Annotated (MCA).

As described in the 2018 Final EIS for Alternative 2 (**Section 2.4.3.6, Soil Removal and Stockpiling**), Westmoreland Rosebud uses direct haul (hauling soil directly from the stripping area to graded areas ready for soil replacement) whenever possible. The initial stages of reclamation (grading, application of soil, and seeding) begin within 2 years of mining and continue as subsequent mine passes are completed in the project area until Phase IV bond release (bond-release phases are discussed in the 2018 Final EIS **Section 1.6.4, Bond Release**).[15] Seeding and revegetation are occurring in the project area as described in the 2018 Final EIS **Sections 2.4.4.7, Seeding**, and **2.4.4.8, Revegetation Plan**. The status of reclamation in the project area (current as of December 31, 2023) is shown in **Table 2.2-4**. Reclamation facilitates the following postmining land uses: grazing land, cropland, and wildlife habitat as described in the 2018 Final EIS **Section 2.4.4.1, Postmining Land Uses**.

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14. As noted above, Westmoreland Rosebud currently is prohibited from mining 74 acres of Federal coal in T2N, R38E, Section 12, but may at any time reapply to OSMRE and DEQ to mine that area provided they affirmatively demonstrate that no material damage to the hydrologic balance would occur. Mine passes (and reclamation order) are shown for this area on Westmoreland Rosebud's approved reclamation plan (Exhibit J as revised by MR 12 and MR 17). To clearly demonstrate that this SEIS assumes mining would not occur within those 74 acres of Federal coal, the mine passes (and reclamation order) for that area are not shown on **Figure 2.2-5**.

15. As described in the 2018 Final EIS **Section 1.6.4, Bond Release**, reclamation occurs in four phases. Phase I includes pit backfilling and grading to meet the postmine topography. Phase II consists of surface stabilization to prevent accelerated erosion, soil application, revegetation, and sediment-control measures. Phase III ensures that the postmining land uses have been met and includes extensive monitoring of the reclaimed landscape, including monitoring of vegetation, soil, and surface water and groundwater resources. Phase IV ensures the restoration of the hydrologic balance, among other final reclamation measures.

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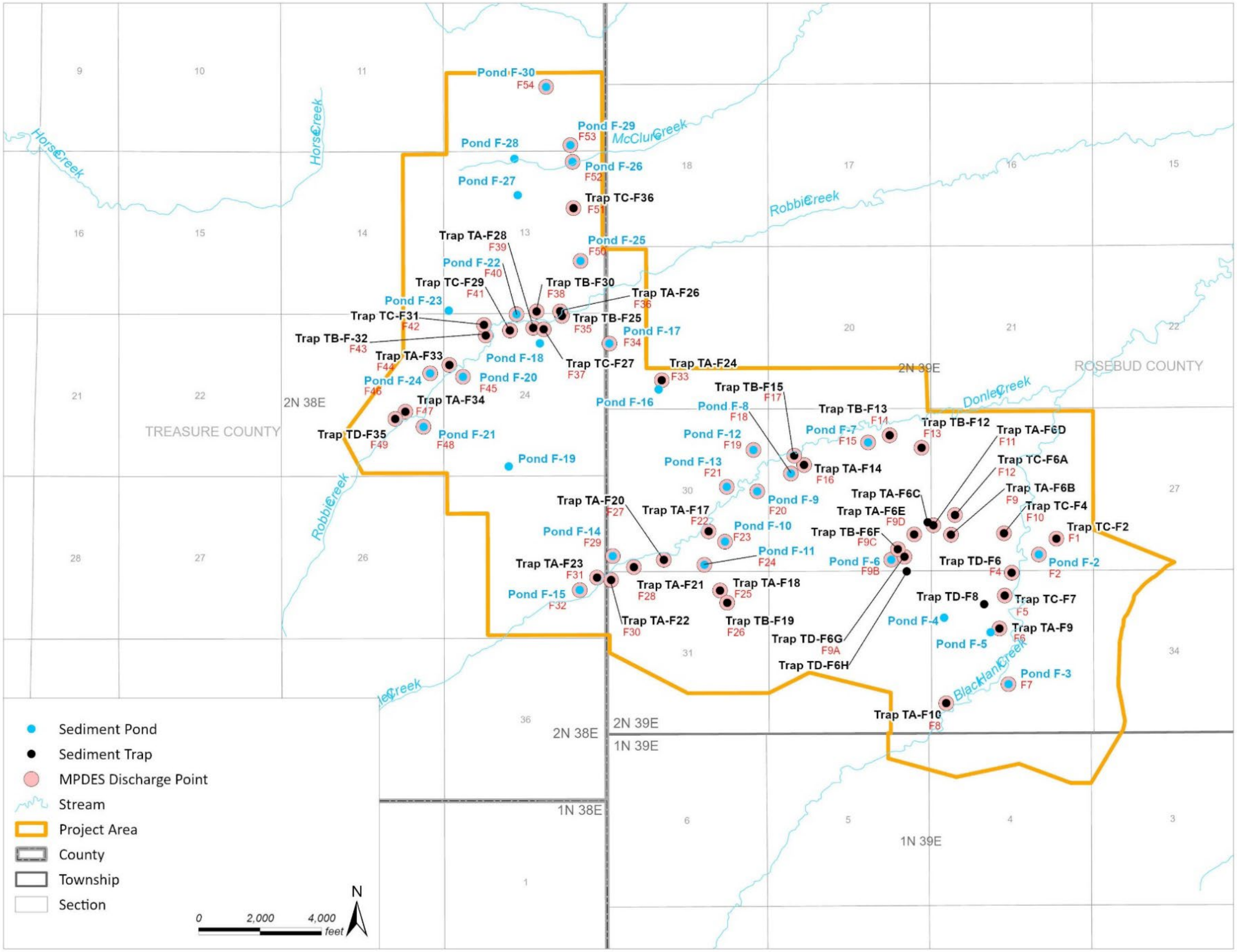

Figure 2.2-4. MPDES Outfalls (MT-0031828) and Sediment Ponds and Traps (MR15)

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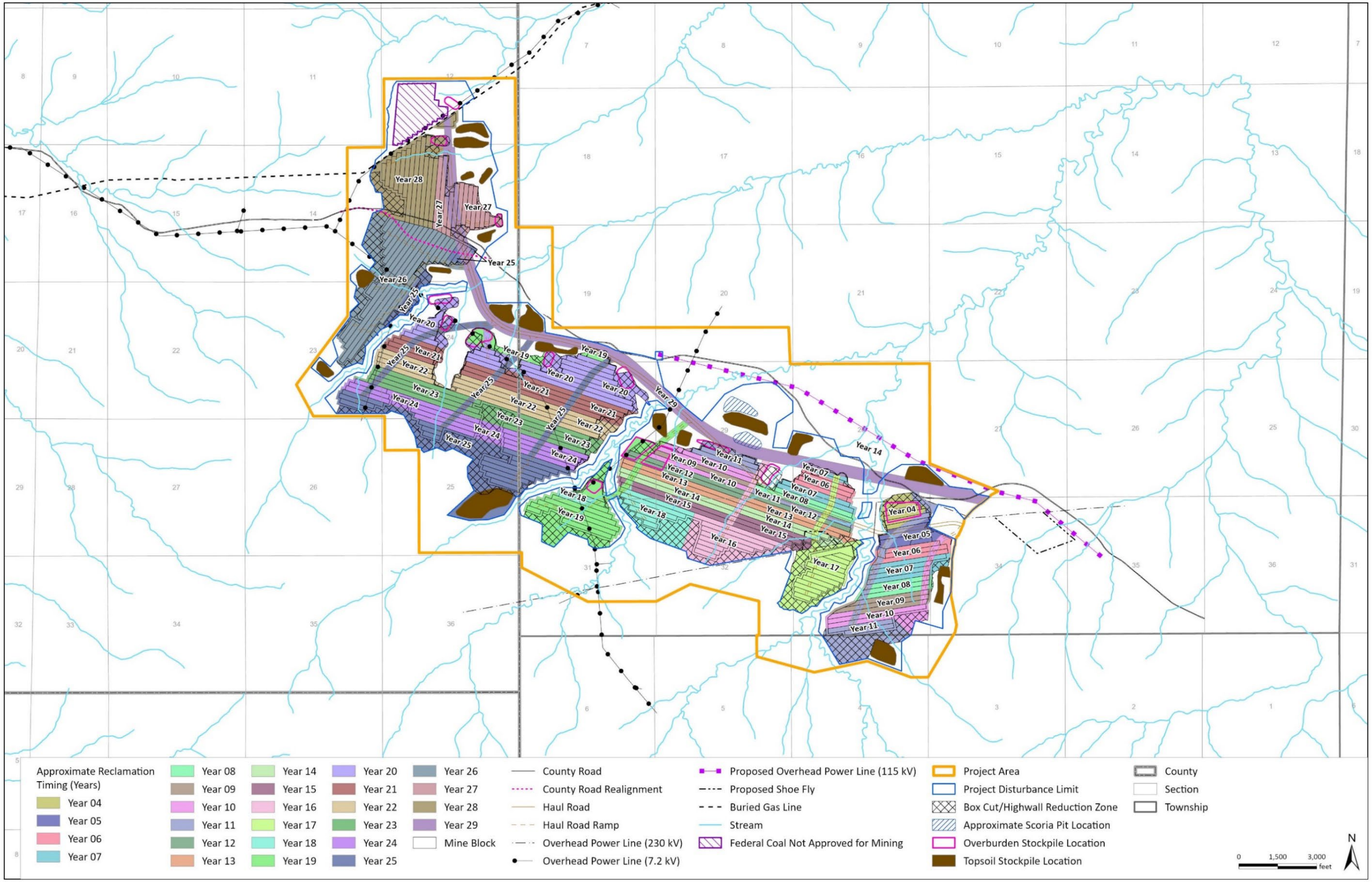

Figure 2.2-5. Currently Approved Reclamation Plan (MR12 and MR17)

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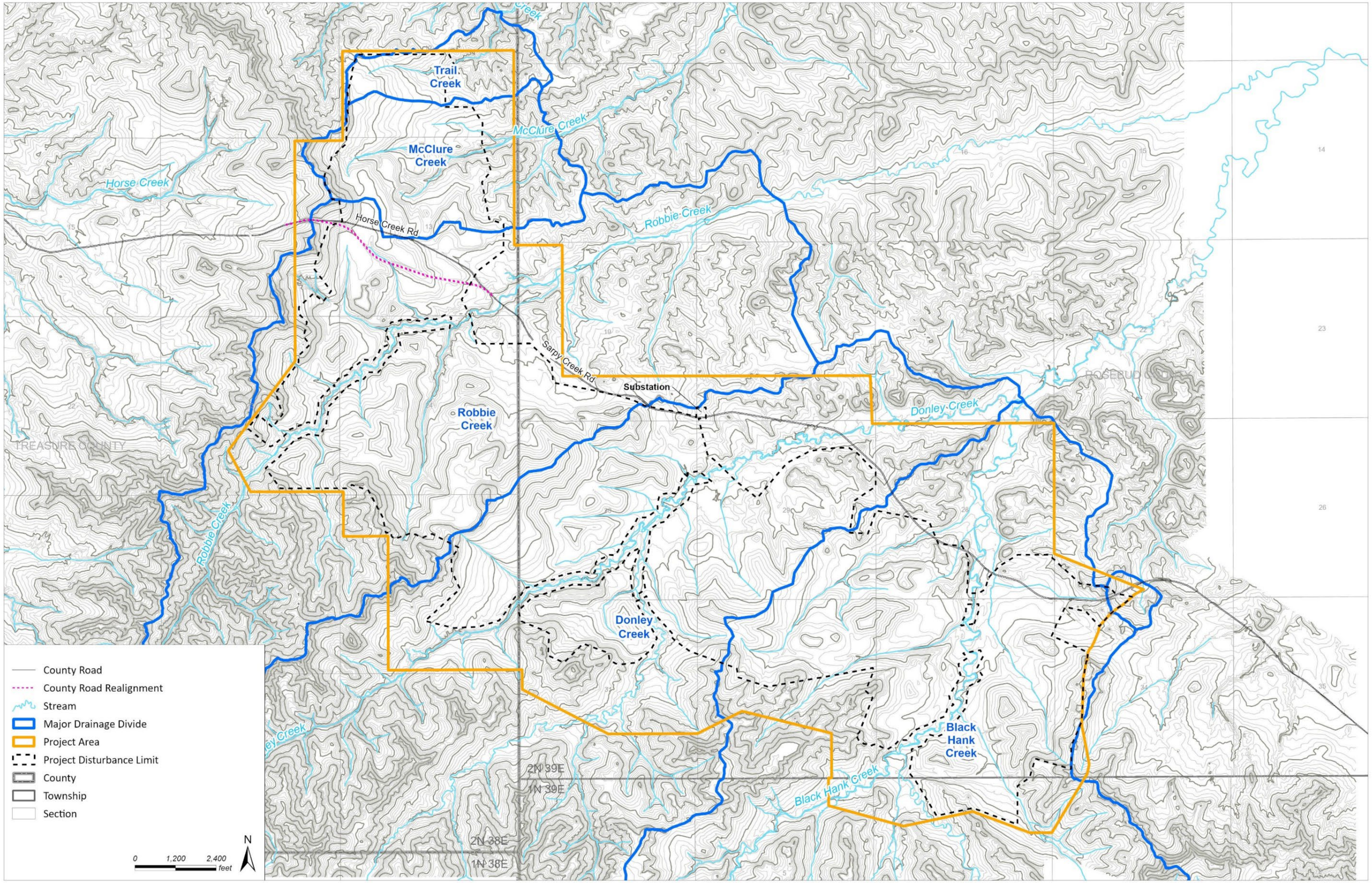

Figure 2.2-6. Currently Approved Postmining Topography (MR15)

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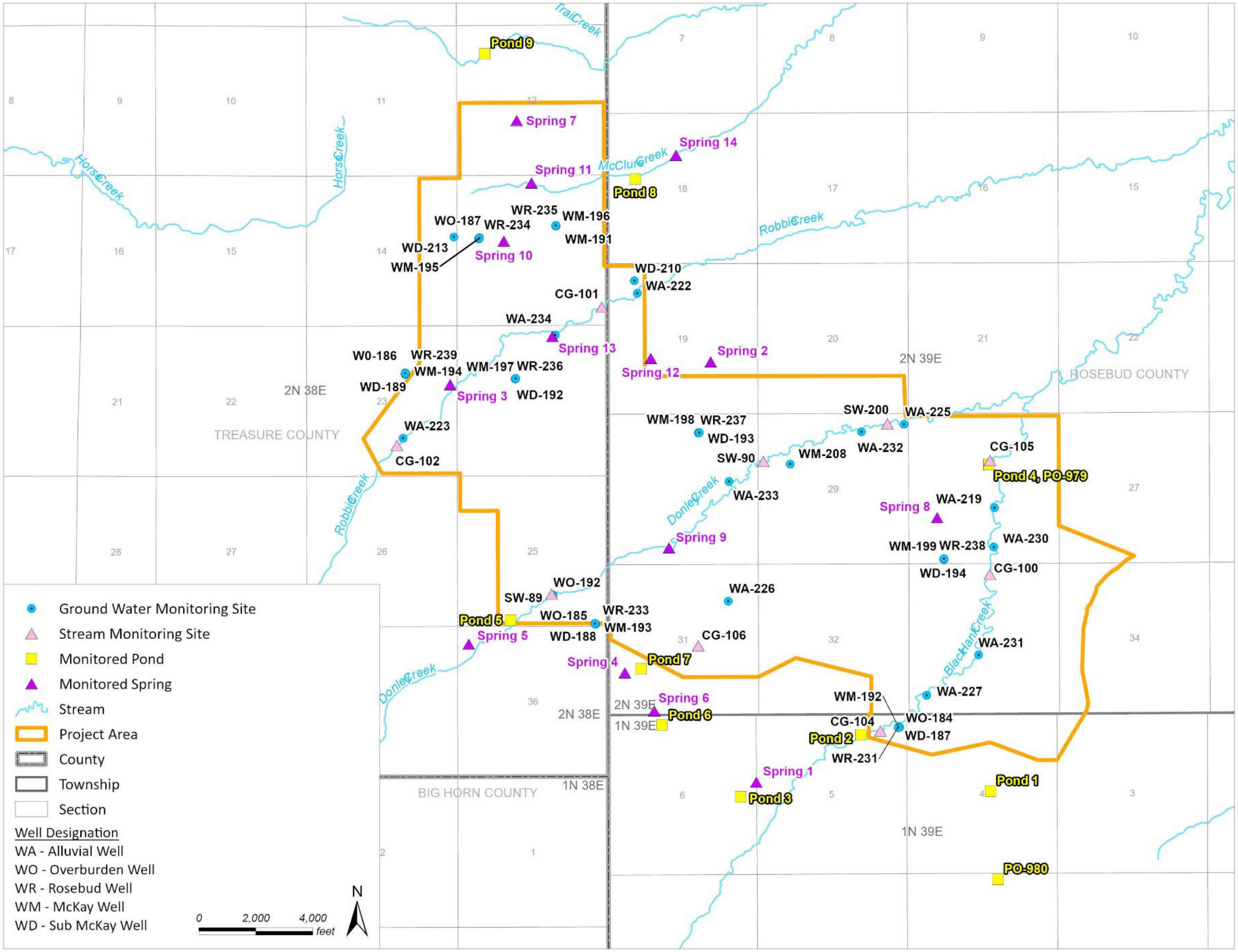

Figure 2.2-7. Surface Water and Groundwater Monitoring Locations

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Monitoring

Westmoreland Rosebud has implemented a monitoring program in the project area, which is detailed in its approved Monitoring and Quality Assurance Plan; monitoring results are reported on annually in Westmoreland Rosebud's various reports (see **Annual Reporting**). Westmoreland Rosebud's monitoring program is largely consistent with what was described in the 2018 Final EIS **Section 2.4.7, Monitoring Plans** and is outlined in **Table 2.2-10**. The affected environment sections in this SEIS (**Chapter 3**) cover any updates and include discussions of resources based on the most recent annual reports.

Table 2.2-10. Overview of Parameters Monitored in the Project Area.

Monitoring Type	Description	Relevant Plan	Report/Reporting Interval
Stream monitoring	Surface water monitoring (**Figure 2.2-7**) is undertaken in drainages, including drainages that contain wetlands (Robbie Creek, Trail Creek, and Donley Creek). At all surface water monitoring sites, flow, field parameter data and crest gage readings are collected monthly. Water quality samples are taken on a quarterly, event-based basis. Sediment samples are collected monthly and after major precipitation and snowmelt events.	Monitoring and Quality Assurance Plan	Annual Hydrology Report (January 1-December 31)
Pond monitoring	Pond monitoring (**Figure 2.2-7**) includes monitoring of Pond 5, which feeds wetland F049. Water level measurements are collected monthly throughout the year, and field parameters are collected monthly from March through November. Water quality samples are collected semiannually.	Monitoring and Quality Assurance Plan	Annual Hydrology Report (January 1-December 31)
Spring monitoring	Springs, including those that feed wetlands, are monitored monthly (**Figure 2.2-7**). Spring flow data and field parameter data are collected monthly from March through November. During winter months, springs are typically frozen. Water quality samples are collected semiannually. The frequency of spring sampling increases to quarterly once mining commences in the drainage in which the spring is located.	Monitoring and Quality Assurance Plan	Annual Hydrology Report (January 1-December 31)
Groundwater monitoring	Groundwater monitoring wells are located throughout the project area (**Figure 2.2-7**), including upgradient and downgradient of the proposed disturbance area. Water level measurements are collected quarterly, except for the majority of alluvial wells, where measurements are taken monthly. Water quality samples are collected semiannually, annually, or every third year, dependent on well characteristics.	Monitoring and Quality Assurance Plan	Annual Hydrology Report (January 1-December 31)
Wildlife surveys	Annual wildlife monitoring for Rosebud Mine, including the project area, is undertaken for big game, upland game birds, raptors, and songbirds.	Wildlife Monitoring Plan	Annual Wildlife Report (January 1-December 31)
Aquatic macroinvertebrate surveys	Aquatic macroinvertebrate surveys undertaken in 2023 during the permit renewal cycle. Surveys followed the 2012 DEQ protocol, *Sample Collection, Sorting, Taxonomic Identification, and Analysis of Benthic Macroinvertebrate Communities Standard Operating Procedure*.	Area F Benthic Macroinvertebrate Monitoring Report	2023

Mitigation

Westmoreland Rosebud has implemented the mitigation plans described in the 2018 Final EIS **Section 2.4.8, Mitigation Plans** and the agency RODs (see **Conditions of Approval** above). Mitigation is completed in the project area for the following resources as needed or as directed in the approved DEQ operating permit: air quality, cultural resources, water rights, and wetlands. The affected environment sections in this SEIS (**Chapter 3**) cover any updates (as applicable).

2.2.3 Other Existing Permits

Other permits, such as those for air quality and surface water discharges, provide sideboards for Westmoreland's operations at the Rosebud Mine beyond those outlined in their state operating permits and Federal mining plans. Since the issuance of the 2018 Final EIS, the statuses of several of Westmoreland Rosebud's other permits have changed. The following list describes other permits held by Westmoreland Rosebud as of December 31, 2023[16] (see also **Section 5.2, Related Past, Present, and Reasonably Foreseeable Future Actions**):

- MAQP #1570-09. After the issuance of the 2018 Final EIS and DEQ 2019 ROD for Area F. MAQP #1570-07 was issued to include Area F; subsequently, the ownership transfer incremented the permit number to MAQP #1570-09. MAQP #1570-08 was issued prior to MAQP #1570-07 due to the delay associated with the Area F Final EIS. Combined coal production from Areas C and F is limited to 8 million tons per year per MAQP #1570-09, with an Area F–specific production cap of 4 million tons per year.
- MAQP #1483-09 (previously #1483-08), issued June 19, 2019, for Areas A, B, and D and former Area E, transferred ownership from Western Energy Company to Westmoreland Rosebud Mining LLC. Annual combined coal production from Areas A, B, and D is limited to 13 million tons per year.
- MAQP #4436-01, issued July 11, 2019, permits operation of a portable crusher facility.
- MPDES Permit MT-0031828, effective June 1, 2020 (expires May 31, 2025), regulates discharges of mine drainage from 55 outfalls associated with Area F. The receiving waters include Black Hank Creek, Donley Creek, Robbie Creek, McClure Creek, and Trail Creek.
- MPDES Permit MT-0023965 (Modification 2) regulates discharges of mine drainage and drainage from coal preparation plant and coal preparation plant associated areas, as those terms are defined at 40 Code of Federal Regulations (CFR) Part 434, including Areas A, B, C, and D. MT-0023965 became effective on August 1, 2021 (expires July 31, 2026), and provides effluent limits, monitoring requirements, and other special conditions for discharges from 153 outfalls. The receiving waters include East Fork Armells Creek, Stocker Creek, Lee Coulee, West Fork Armells Creek, Black Hank Creek, Donley Creek, Cow Creek, Spring Creek, and Pony Creek.
- MPDES Permit MT-0032042 (Modification 2), effective October 1, 2022 (expires September 30, 2027), regulates discharges of mine drainage from 18 outfalls associated with Area B AM5. Receiving waters include Lee Coulee and Richard Coulee, which are both tributaries to Rosebud Creek.

[16]. The most current versions of Rosebud Mine MAQP and MPDES Permits are available on DEQ's website: MAQP (https://deq.mt.gov/air/assistance) and MPDES Permits (https://deq.mt.gov/water/assistance).

2.2.4 Existing Rosebud Mine Support Facilities

The Rosebud Mine includes the following existing facilities (shown on **Figure 1.1-2** in **Chapter 1**) and equipment, which are currently being used for mine operations, including those in Area F:

- A coal-processing facility (crusher) in Area C
- Conveyor-belt systems in Areas A and C to the Colstrip Power Plant
- Maintenance and operations complexes
- Haul roads with scoria surface
- Scoria pits (mined for use on road surfaces)
- Mine offices
- A mine-entrance guard shack and vehicle-weighing scale
- Four electric-powered draglines for removal of overburden, coal excavation, backfilling, and grading
- Front-end loaders, excavators, dozers, motor graders, and a fleet of haul trucks for removal of overburden, coal excavation, coal transportation to the conveyor-belt system, soil salvage, and soil application
- A fleet of five covered trucks (owned by the Rosebud Power Plant) that haul coal to the Rosebud Power Plant; three trucks operate daily, with each truck delivering 6.5 loads daily (19.5 total loads daily)
- Area D railroad spur (not used since 2010); when it operated, it was used to ship a few cars of coal at a time to small customers

2.2.5 General Sequence of Operations

The general sequence of operations for surface mining is similar in all active permit areas of the mine. In advance of each mining pass, soil is removed from the disturbance area and stockpiled according to type for later use during reclamation. Next, the overburden (sedimentary rock material covering the coal seams) is drilled and blasted. A dragline is then used to strip the overburden from succeeding mine passes. Spoil is cast into the mined-out pit created by the preceding pass.

After the dragline exposes the coal seam in each pass, the coal is drilled and blasted. A loading shovel, front-end loader, or backhoe loads the coal into coal haulers. The coal is transported on an established haul road to Area C or Area A for crushing (**Figure 1.1-2** in **Chapter 1**). After being processed in the Area C crusher, crushed coal is sent to the Colstrip Power Plant via an existing 4.2-mile conveyor. If processed in the Area A crusher, which is adjacent to the Colstrip Power Plant, it is sent on an existing short conveyor. Coal with higher sulfur content and low calorific value, which is typically the first 1-foot layer encountered in the deposit and is known as “waste coal,” is trucked to the Rosebud Power Plant. Neither the Rosebud Power Plant nor the Colstrip Power Plant is owned or operated by Westmoreland Rosebud or its parent company, Westmoreland.

As described in MR 16 Table 303-3, the mining sequence in Area F is broken into eight blocks. Block 1 (a small section east of Black Hank Creek and north of the haul road) was mined in 2020. Mining has since moved into Block 2 (east of Black Hank Creek) and Block 4 (area between Donley Creek and Black Hank Creek) as mining in the project area has progressed through 2023. Mining is expected to continue in Block 2 and Block 4 for the next few years before moving into Block 3 (south of the 230 kV line and northwest of Black Hank Creek). More than a decade into Area F operations, mining would move into Blocks 5 and 6 between Robbie and Donley creeks. Block 7 (between Robbie and McClure creeks) would not be mined until the latter years of mining. Block 8 (between McClure and Trail creeks) largely overlaps the 74 acres of Federal coal where mining is currently prohibited and would not be mined without a change to the Federal mining plan and state operating permit.

2.2.6 Life of Operations

The analyses in this SEIS are based on the assumptions below regarding the operational life of the Rosebud Mine. The operational life of Permit Area F under its approved state operating permit C2011003F and the 2019-approved Federal mining plan is expected to be about 20 years (through 2039) based on current production estimates (**Table 2.2-9**). In 2023, Area F produced nearly 4.6 million tons of coal, accounting for approximately 65 percent of the Rosebud Mine's total production (just under 7.1 million tons) (**Table 2.2-2**). Area B was the only other permit area with coal production in 2023 (about 2.5 million tons).

Future production from the Rosebud Mine will depend on a number of factors, including market conditions. Projections of future annual coal production from the project area (Area F) and the other areas of the Rosebud mine were provided in **Table 99** in **Section 4.3.3.1** of the 2018 Final EIS. Based on available updated information,[17] revised annual production estimates are provided in **Table 4.3-1** in **Section 4.3.3.1, Direct Impacts** (Air Quality). In this SEIS, the Rosebud Mine is assumed to continue operations through 2045. During this time the mine is expected to produce up to 112.5 million tons of coal.[18] Changes to production rates, additions of other mine permit areas, reduced mining in Area F, or changed market conditions may influence the operational life of the Rosebud Mine as a whole or of individual permit areas. See the discussion in **Section 2.2.2.2, Area F Operations and Development**, regarding the types of conditions that could alter the operational timeline.

2.3 SUMMARY OF SEIS ALTERNATIVES

This section offers an introduction to the three alternatives (Alternatives 1, 4, and 5) considered in the SEIS and highlights common elements and key differences. Additional details for each alternative are provided in **Sections 2.4** through **2.6**. Impacts of the SEIS alternatives are summarized in **Table 2.8-1** in **Section 2.8, Summary of Impacts and Identification of Preferred and Environmentally Preferable Alternative**, and detailed in **Chapters 4** and **5**.

2.3.1 Elements Common to All Alternatives

For all three alternatives analyzed in this SEIS, the mining method, reclamation plan, means of protecting the hydrologic balance, monitoring plans, and mitigation plans would be essentially the same; all of these elements were described in full in the 2018 Final EIS for Alternative 2 (see **Section 2.4, Alternative 2 – Proposed Action** in the 2018 Final EIS). Modifications made to these elements since 2018 due to changed conditions are summarized in **Section 2.2.2.2, Area F Operations and Development**. The beginning year for all alternatives analyzed in this SEIS is 2019 (the year development of Area F began

[17]. Available information includes 2023 actual production, production estimates for the currently approved Area F operating permit (**Table 2.2-9**), and production estimates for Area B, pursuant to Amendment 5 (AM5), as provided in DEQ's *Rosebud Mine Area B AM5 Final Environmental Impact Statement.*

[18]. BLM developed reasonably foreseeable development scenarios (based on a 17-year time horizon) for the Rosebud Mine in its recent *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). BLM estimates there are sufficient leased coal reserves within the Federal subsurface mineral estate to meet forecasted production levels (112.5 million tons) at the Rosebud Mine through 2060 (BLM 2024a); however, not all of the Federal coal is currently permitted. BLM would reevaluate land use allocations at the end of the planning period in 2038. For Westmoreland to mine all of its coal leases, it is assumed that additional permitting would be needed. For additional discussion of the BLM SEIS, see **Table 5.2.-1** in **Chapter 5**.

pursuant to approved state operating permit C2011003F and the 2019-approved Federal mining plan); therefore, the mine life provided for all alternatives includes years of mining that have already occurred.

As described in Section 9.6.5 of the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), DEQ determined that Westmoreland Rosebud's proposed mining plan put forth in its permit application package (Alternative 2 in the 2018 Final EIS), if implemented in T2N, R38E, Section 12, would likely result in a change in water quality in the Rosebud Coal outside the permit boundary, which could result in material damage. To remove the potential for material damage, DEQ did not approve mine passes in that area in its 2019 ROD and Written Findings (DEQ 2019a). Pursuant to OSMRE's ROD (OSMRE 2019b), the Assistant Secretary for Lands and Minerals Management (ASLM) similarly prohibited mining in this area under the Federal mining plan (DOI 2019). Under any of the SEIS alternatives, mining would be prohibited in 74 acres of Federal coal in T2N, R38E, Section 12 to prevent material damage outside of the Area F permit area. Westmoreland Rosebud, however, would still be able to disturb the surface above the 74 acres of Federal coal for mining-related activities (e.g., spoil and topsoil stockpiles). Westmoreland Rosebud estimates that there is approximately 1.9 million tons of recoverable coal (based on modeling using expected coal thickness and quality) that will not be mined in T2N, R38E, Section 12. Westmoreland Rosebud may at any time reapply to OSMRE and DEQ to mine the excluded 74 acres of Federal coal provided they affirmatively demonstrate that no material damage would occur.

For all alternatives, avoidance and minimization measures designed to protect insect special status species would be implemented. These measures include the following:

- Clearing and grubbing activities would occur from September 1 through June 1, avoiding the monarch butterfly and western regal fritillary active season from June through August.
- Noxious weeds would be controlled and managed to reduce their spread by timing weed spraying to avoid the monarch butterfly and western regal fritillary breeding season (June through August), when feasible, and conducting spot spraying to limit impacts on flowering nectar plants.

2.3.2 Key Differences Among Alternatives

The key differences among the three SEIS alternatives are (1) total surface disturbance, (2) tons of coal mined, and (3) the duration of mining in the project area. Under Alternative 1, mining would end in 2025; during the 6-year mine life, about 17.1 million tons of coal would be mined, and approximately 1,021 acres would be disturbed in the project area. Under Alternative 4, mining would end in 2039; during the 20-year mine life, about 71.3 million tons of coal would be mined, and approximately 4,288 acres would be disturbed in the project area. Under Alternative 5, mining would end in 2030; during the 11-year mine life, about 37.1 million tons of coal would be mined, and approximately 2,495 acres would be disturbed in the project area. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**. **Table 2.3-1** provides a comparison of the components of each alternative, and **Table 2.3-2** compares annual production and associated disturbance across alternatives.

Table 2.3-1. Comparison of SEIS Alternatives by Components.

Alternative Component	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Area F operational life[1]	6 years Coal removal began in 2020. Mining would cease after issuance of a new Mining Plan Decision Document (MPDD) in 2025.[*]	20 years Coal removal began in 2020 and would end in 2039.	11 years Coal removal began in 2020. A new 5-year mining term would be authorized after issuance of a new MPDD, which is assumed to occur in 2025.[*]
Last year of mining	2025	2039	2030
Area F permit area[2]	6,773 acres	6,773 acres	6,773 acres
Area F total disturbance area[3]	1,021 acres	4,288 acres	2,495 acres
Coal recovery[4]	17.1 million tons	71.3 million tons	37.1 million tons
Use of bottom ash	None	None	None
Drainages disturbed by mining operations or other related disturbance	None; in addition, 74 acres of Federal coal (1.9 million recoverable tons) in the northwestern part (T2N, R38E, Section 12) of the permit area (in the Trail Creek drainage) are excluded from mining to prevent material damage to the hydrologic balance outside the permit area.	None; in addition, 74 acres of Federal coal (1.9 million recoverable tons) in the northwestern part (T2N, R38E, Section 12) of the permit area (in the Trail Creek drainage) are excluded from mining to prevent material damage to the hydrologic balance outside the permit area.	None; in addition, 74 acres of Federal coal (1.9 million recoverable tons) in the northwestern part (T2N, R38E, Section 12) of the permit area (in the Trail Creek drainage) are excluded from mining to prevent material damage to the hydrologic balance outside the permit area.
Permitted discharges	55 outfalls (MPDES MT-0031828)	55 outfalls (MPDES MT-0031828)	55 outfalls (MPDES MT-0031828)
Surface ownership (permit area)	6,773 acres privately owned	6,773 acres privately owned	6,773 acres privately owned
Subsurface mineral estate ownership (permit area)	3,479 acres privately owned and 3,294 acres federally owned	3,479 acres privately owned and 3,294 acres federally owned	3,479 acres privately owned and 3,294 acres federally owned
Ownership of coal leases to be mined[3]	Federal (MTM 082186) and private coal (1001 and 1001-A)	Federal (MTM 082186) and private coal (1001 and 1001-A)	Federal (MTM 082186) and private coal (1001 and 1001-A)

Note: For all alternatives, acres disturbed and tons mined per year are estimates only. Actual production and disturbance may vary. See discussion in **Section 2.2.2.2, Area F Operations and Development**.

[*] Estimated disturbance and associated mine production tonnage estimates for Area F are only available on an annual basis. Pursuant to an extension granted by the District Court, completion of the National Environmental Policy Act (NEPA) process must occur within the first quarter of 2025. The entire 2025 year of mining is included in this SEIS for Alternative 1 as a conservative measure of effects because annual production values are estimates only.

[1.] Based on C2011003F MR16.

[2.] An incidental boundary change was approved by DEQ in MR13; this boundary change took 27 acres in Federal coal ownership from the Area C permit area and assigned them to the Area F permit area. All 27 acres of Federal coal have either been previously mined as part of Area C operations or would not be mined under Alternative 1, 4, or 5.

[3.] Based on Table 303-1 from C2011003F MR16. Acreages are rounded to the nearest whole number.

[4.] Based on Table 303-2 from C2011003F MR16.

Table 2.3-2. Comparison of SEIS Alternatives by Estimated Annual Production and Acres Disturbed.

Operation Year	Alternative 1 – No Action			Alternative 4 – Proposed Action (Current Federal Mining Plan)			Alternative 5 – Partial Mining Alternative		
	Tons (×1,000)	Annual Acres Disturbed	Total Acres Disturbed	Tons (×1,000)	Annual Acres Disturbed	Total Acres Disturbed	Tons (×1,000)	Annual Acres Disturbed	Total Acres Disturbed
1 (2020)	0.2	35.7	35.7	0.2	35.7	35.7	0.2	35.7	35.7
2	0.9	26.4	62.1	0.9	26.4	62.1	0.9	26.4	62.1
3	4	614.88	676.9	4	614.88	676.9	4	614.88	676.9
4	4	114.8	791.7	4	114.8	791.7	4	114.8	791.7
5	4	114.8	906.5	4	114.8	906.5	4	114.8	906.5
6 (2025)	4	114.8	**1,021.2**	4	114.8	1,021.2	4	114.8	1,021.2
7	-	-	-	4	114.8	1,136.0	4	114.8	1,136.0
8	-	-	-	4	514.8	1,650.8	4	514.8	1,650.8
9	-	-	-	4	614.8	2,265.6	4	614.8	2,265.6
10	-	-	-	4	114.8	2,380.4	4	114.8	2,380.4
11 (2030)	-	-	-	4	114.8	2,495.2	4	114.8	**2,495.2**
12	-	-	-	4	114.8	2,609.9	-	-	-
13	-	-	-	4	114.8	2,724.7	-	-	-
14	-	-	-	4	414.8	3,139.5	-	-	-
15	-	-	-	4	364.8	3,504.3	-	-	-
16	-	-	-	4	114.8	3,619.1	-	-	-
17	-	-	-	4	114.8	3,733.9	-	-	-
18	-	-	-	4	114.8	3,848.6	-	-	-
19	-	-	-	4	193.5	4,042.1	-	-	-
20 (2039)	-	-	-	1.6	245.9	**4,288.0**	-	-	-

Note: For all alternatives, acres disturbed and tons mined per year are estimates only. Actual production and disturbance may vary. See discussion in **Section 2.2.2.2, Area F Operations and Development**.
Source: Estimated acreage and tonnage are based on Table 303-2 from Area F Operating Permit Minor Revision 16 (2022).

2.4 ALTERNATIVE 1 – NO ACTION

Alternative 1 – No Action has been updated from the 2018 Final EIS and considers a scenario where Federal and private coal in the project area would no longer be mined in Area F after the issuance of a new MPDD in 2025.[19] As noted previously in this SEIS, Westmoreland Rosebud began developing Area F in 2019 according to its state operating permit and approved Federal mining plan; mine production began in 2020. Ongoing mining in Area F is described in **Section 2.2.2.2, Area F Operations and Development**, including estimated annual tons of coal mined and acres disturbed.

2.4.1 Area F Mine Operations and Reclamation

Under Alternative 1, the Federal mining plan approval for Area F would no longer be valid, and Westmoreland Rosebud would no longer be able to mine Federal coal lease MTM 082186 (see **Table 2.3-1** and **Table 2.3-2**). Analysis in this SEIS for this alternative assumes that without a valid Federal mining plan, Westmoreland Rosebud also would cease to mine private coal leases 1001 and 1001a for the following reasons:

- Federal coal lease MTM 082186 is not in continuous ownership blocks; instead, the lease areas are in a checkerboard pattern (see **Figure 1.1-3** in **Chapter 1**). Mining only private coal would be logistically challenging – if not operationally impossible in some areas – due to the checkerboard nature of the coal ownership (the surface is entirely private). Smaller box cuts and setbacks would have to be used to avoid disturbing the Federal coal resource. This practice would necessitate leaving large wedges of private coal in place (perhaps as much as half of the private coal), in violation of MSUMRA's requirements for coal recovery and conservation (ARM 17.24.322).
- Mining only the private leases would not be consistent with the Purpose and Need (see Section **1.3, Purpose and Need**). Westmoreland Rosebud holds valid existing rights granted by the Bureau of Land Management under Federal coal lease MTM 082186 to access and mine undeveloped Federal coal resources located in the project area pursuant to reasonable environmental controls. Bureau of Land Management regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal.

If Alternative 1 were selected, however, Westmoreland Rosebud would still have a valid state operating permit for Area F and would assess at that time whether they would continue to mine private coal. For analysis of Alternative 1 effects in this SEIS, it is assumed that mining would not continue beyond 2025.[20]

It is assumed in this SEIS that under Alternative 1 around 17.1 million tons of coal would be mined from Federal and private coal leases and approximately 1,021 acres would be disturbed in Area F over a 6-year mine life that began in 2019 and would end in 2025 (see **Table 2.3-1** and **Table 2.3-2**). It is assumed that mining would occur between Donley and Black Hank creeks and between Black Hank Creek and the eastern edge of the permit area; mining is not expected to proceed west of Donley Creek (**Figure 2.4-1**).

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19. Estimated disturbance and associated mine production tonnage estimates for Area F are only available on an annual basis. Pursuant to an extension granted by the District Court, completion of the NEPA process must occur within the first quarter of 2025. The entire 2025 year of mining is included in this SEIS for Alternative 1 as a conservative measure of effects because annual production values are estimates only. However, if the mining plan is vacated by the District Court before December 2025, mining of Federal coal will need to end on the date of vacatur and impacts discussed under this alternative could be reduced accordingly.

20. Effects of continued mining of private coal beyond 2025, if Westmoreland Rosebud decided to do so, would be similar to or less than the effects of Alternative 4 (full mine development).

Mining (including disturbance, coal recovery, and production rates),[21] fugitive dust control, protection of the hydrologic balance, monitoring, and mitigation would proceed as described in the 2018 Final EIS in **Section 2.4, Alternative 2 – Proposed Action** and in this SEIS in **Section 2.2.2.2, Area F Operations and Development**, until a new MPDD has been issued in 2025. It is assumed that mining would be limited to the southeastern portion of the project area in Rosebud County as shown in **Figure 2.4-1**.[22] Under Alternative 1, Westmoreland Rosebud would not fully develop or maximize economic recovery of coal from Federal coal lease MTM 082186. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased due to the new MPDD, reclamation of disturbed areas (1,021 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and postmining topography (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**; modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development.**

Selection of Alternative 1 would end the project operational life of Area F 14 years earlier than the timetable in Westmoreland Rosebud's approved operating permit (**Table 2.2-9**) and may lead to closure of the Rosebud Mine as a whole prior to 2045 (see **Section 2.2.6, Life of Operations**).

2.4.2 State Operating Permit C2011003F

Selection of Alternative 1 may require revision of Westmoreland Rosebud's state operating permit for the project area (C2011003F). Any revisions needed would be determined by DEQ after review of the MPDD.

2.4.3 Power Plants

Under Alternative 1, Area F coal (Federal and state) would be available for combustion in the Colstrip Power Plant and the Rosebud Power Plant for a total of 6 years (2019 to 2025); current operations for both power plants are described in **Section 1.2.2, Coal Combustion**. Once Area F coal is no longer available, the power plants, if they continue to operate, could burn coal from other Rosebud Mine permit areas (thereby potentially changing the rate at which those areas are mined as described in **Section 2.2.6, Life of Operations**). The power plants could also use coal from sources other than the Rosebud Mine. The indirect effects of the combustion of Area F coal at the power plants are considered in the indirect effects analyses and described in **Chapter 4** of this SEIS; combustion of other coal (whether from the Rosebud Mine or other sources) are considered in the cumulative impacts analysis in **Chapter 5** of this SEIS.

2.4.4 Other Rosebud Mine Permit Areas

Selection of Alternative 1 may impact the rate of mining of other permit areas, such as Area B, of the Rosebud Mine that are currently permitted and being mined and/or reclaimed by Westmoreland Rosebud (see **Section 2.2, Description of Past and Existing Mine and Reclamation Operations**). As described in **Section 2.2.2.2, Area F Operations and Development**, Westmoreland Rosebud makes adjustments to

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21. As with all alternatives, mining would be prohibited in 74 acres of Federal coal in T2N, R38E, Section 12 (see details in **Section 2.3.1, Elements Common to All Alternatives**).
22. Please note **Figure 2.4-1** shows an estimate of mining and associated disturbance under Alternative 1. The mine pit footprint is based on the mining schedule provided in MR 16. The extent of disturbance boundary shown is the current extent (as of December 23, 2023) and does not encompass the full 1,021 acres (gray shaded area) that may be disturbed under Alternative 1. Finally, not all scoria pits, topsoil stockpiles, and overburden stockpiles shown on **Figure 2.4-1** would be needed under Alternative 1. Likely, only the ones closest to the mine pit footprint would be used under this alternative; any northwest of Donley Creek would not likely be needed.

the production rates for its various permit areas from time to time for a number of operational reasons, including demand from the power plants, coal quality targets, and on-the-ground conditions. Existing permit areas are considered in the cumulative effects analyses and described in **Chapter 5** of this SEIS.

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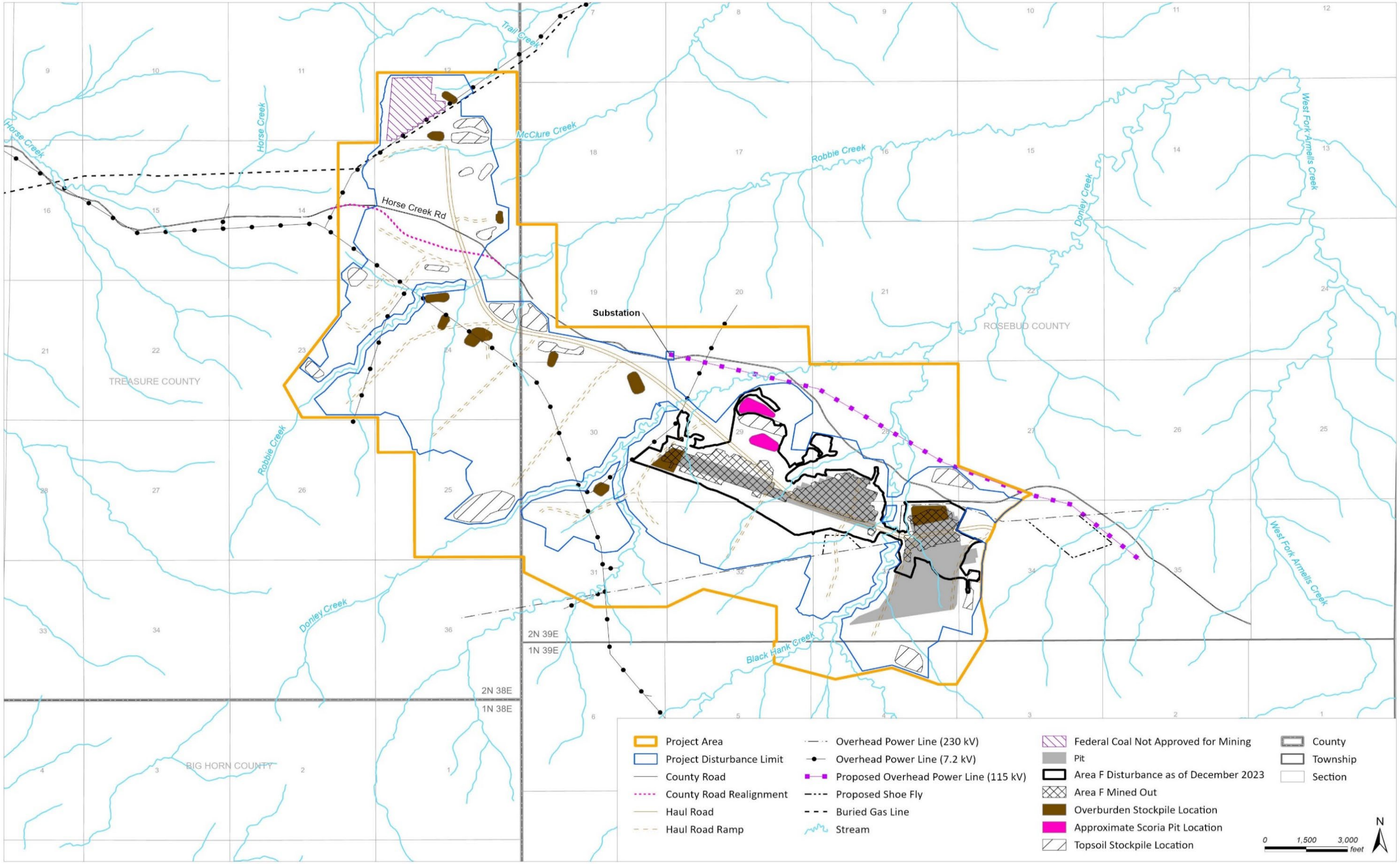

Figure 2.4-1. Alternative 1 – No Action Mining Plan and Project Area

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2.5 ALTERNATIVE 4 – PROPOSED ACTION (CURRENT FEDERAL MINING PLAN)

Alternative 4 represents full development of Area F: it incorporates the conditions of the approved Federal mining plan for Area F and would be consistent with the approved DEQ operating permit C2011003F. Under Alternative 4, Westmoreland Rosebud would continue mining Area F as described in **Section 2.2.2.2, Area F Operations and Development**, until 2039.

2.5.1 Area F Mine Operations and Reclamation

Under Alternative 4, it is assumed that approximately 71.3 million tons of coal from Federal and private coal leases and approximately 4,288 acres would be disturbed in Area F over a 20-year mine life that began in 2019 and would end in 2039 (see **Table 2.3-1**, **Table 2.3-2**, and **Figure 2.5-1**). Mining (including disturbance, coal recovery, and production rates),[23] fugitive dust control, protection of the hydrologic balance, monitoring, and mitigation would proceed as described in the 2018 Final EIS **Section 2.4, Alternative 2 – Proposed Action** and in this SEIS in **Section 2.2.2.2, Area F Operations and Development**, until 2030. It is assumed that mining would occur in the project area as shown on **Figure 2.5-1**. Under Alternative 4, Westmoreland Rosebud would diligently develop and maximize economic recovery of coal in the Federal coal lease MTM 082186 (**Table 2.2-7**). Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and postmining topography (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**; modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Selection of Alternative 4 would end the project operational life of Area F in 2039, according to the timetable in Westmoreland Rosebud's approved operating permit (**Table 2.2-9**).

2.5.2 State Operating Permit C2011003F

Selection of Alternative 4 is not anticipated to require any revision of Westmoreland Rosebud's state operating permit for the project area (C2011003F) as the alternative is intended to be consistent with that permit. Any revisions needed would be determined by DEQ after review of the MPDD.

2.5.3 Power Plants

Under Alternative 4, Area F coal would be available for combustion in the Colstrip Power Plant and the Rosebud Power Plant for a total of 20 years (2019 to 2039); current operations for both power plants are described in **Section 1.2.2, Coal Combustion**. Once Area F coal is no longer available, the power plants, if they continue to operate, could burn coal from other Rosebud Mine permit areas (thereby potentially changing the rate at which those areas are mined as described in **Section 2.2.6, Life of Operations**). The power plants could also use coal from sources other than the Rosebud Mine. The indirect effects of the combustion of Area F coal at the power plants are considered in the indirect effects analyses and described in **Chapter 4** of this SEIS; combustion of other coal (whether from the Rosebud Mine or other sources) are considered in the cumulative impacts analysis in **Chapter 5** of this SEIS.

23. As with all alternatives, mining would be prohibited in 74 acres of Federal coal in T2N, R38E, Section 12 (see details in **Section 2.3.1, Elements Common to All Alternatives**).

2.5.4 Other Rosebud Mine Permit Areas

Under Alternative 4, mining of other Rosebud Mine permit areas, such as Area B, that are currently permitted and being mined and/or reclaimed by Westmoreland Rosebud would continue as described in **Section 2.2, Description of Past and Existing Mine and Reclamation Operations**. Existing permit areas are considered in the cumulative effects analyses and described in **Chapter 5** of this SEIS.

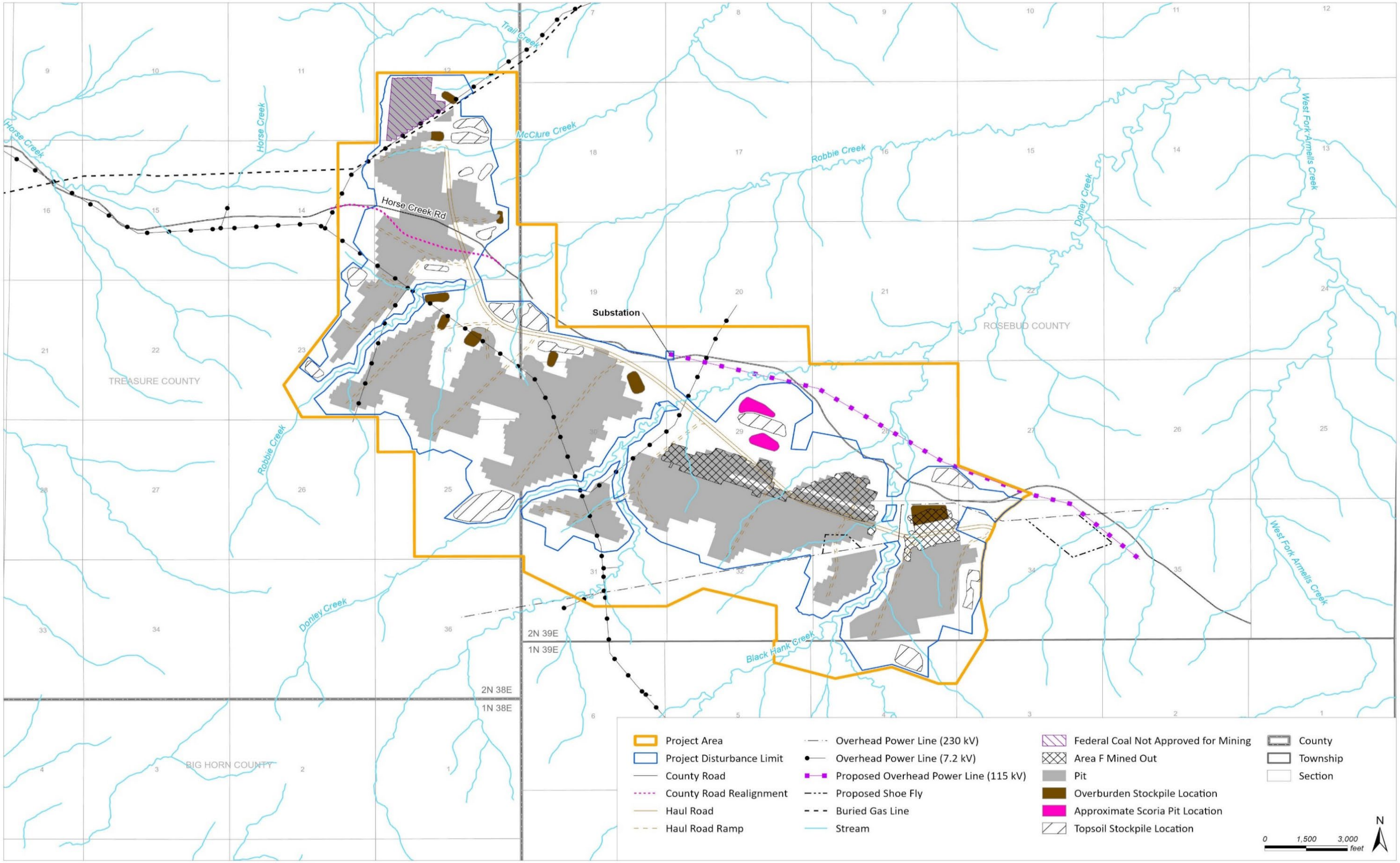

Figure 2.5-1. Alternative 4 – Proposed Action (Current Federal Mining Plan) and Project Area

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2.6 ALTERNATIVE 5 – PARTIAL MINING ALTERNATIVE

Alternative 5 – Partial Mining Alternative was developed to further explore a reasonable range of possible alternatives to allow for meaningful public input and informed agency decision making. It would limit approved mining to approximately a 5-year term (assumed to end in 2030).

2.6.1 Area F Mine Operations and Reclamation

Under Alternative 5, mining in the project area would end after a 5-year term, beginning with the issuance of a new MPDD and ending in 2030 (see **Table 2.3-1** and **Table 2.3-2**).[24] Any mining of Federal coal beyond this 2030 would require several steps, including a reevaluation of the mining operations by OSMRE, a new or supplemental NEPA analysis, and any other environmental review processes (by OSMRE or other agencies) that may be needed (see examples in **Table 1.4-1** and **Table 1.4-2**). Westmoreland would need to propose that the mining term be extended and provide monitoring data or other supporting information to support the proposal, including any factors that could lead to less intense or fewer impacts than those previously disclosed for full mine development (Alternative 4 in this SEIS). OSMRE would need to consider if new alternatives (and/or mitigation measures) would need to be developed and if a new or supplemental NEPA analysis would be needed: it is anticipated that potential effects of continuing mining beyond the 5-year term would be compared to the predicted impacts for full mine development (Alternative 4 in this SEIS). A new OSMRE NEPA compliance document and a new ASLM-approved mining plan would be needed.

For analysis of Alternative 5 effects in this SEIS, it is assumed that mining in Area F would not continue beyond 2030.[25] As noted above under Alternative 1, OSMRE can only regulate mining of the Federal coal lease (Lease MTM 082186). Westmoreland Rosebud could theoretically continue to mine private coal under its state operating permit. However, without access to the Federal coal resource beyond the 5-year term, Westmoreland Rosebud would need to determine whether it is physically possible and economically feasible to only mine private coal (leases 1001 and 1001-A), which is in a checkerboard ownership pattern with the Federal coal (**Figure 1.1-3**); see also discussion of this issue for Alternative 1 (**Section 2.4**).

It is assumed that under Alternative 5, approximately 37.1 million tons of coal would be mined from Federal and private coal leases and approximately 2,495 acres would be disturbed in Area F over an approximately 11-year mine life that began in 2019 and would end in 2030 (see **Table 2.3-1** and **Table 2.3-2**). It is assumed that mining would occur between Donley and Black Hank creeks and between Black Hank Creek and the eastern edge of the permit area; mining is not expected to proceed west of Donley Creek (**Figure 2.6-1**). Mining (including disturbance, coal recovery, and production rates),[26] fugitive dust control, protection of the hydrologic balance, monitoring, and mitigation would proceed as described in the 2018 Final EIS **Section 2.4, Alternative 2 – Proposed Action** and in this SEIS in **Section 2.2.2.2, Area F Operations and Development** until 2030. It is assumed that mining would occur in the southern

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24. Under Alternative 5, mining would occur for approximately 5 years more after issuance of a new MPDD (assumed to be before December 31, 2025). Therefore, December 31, 2030, is the end-of-mining date used for this alternative, although as noted in note 25, the actual date that mining of Federal coal would end in this area may be before that date if the mining plan is vacated before that date. As noted previously, Westmoreland began development of Area F in 2019, and mining began in 2020.

25. Effects of continued mining of private coal beyond 2030, if Westmoreland Rosebud decided to do so, would be similar to or less than the effects of Alternative 4 (full mine development).

26. As with all alternatives, mining would be prohibited in 74 acres of Federal coal in T2N, R38E, Section 12 (see details in **Section 2.3.1, Elements Common to All Alternatives**).

portion of the permit area as shown on **Figure 2.6-1**.[27] Under Alternative 5, Westmoreland Rosebud would not fully develop or maximize economic recovery of coal from Federal coal lease MTM 082186. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 2,495 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and postmining topography (**Figure 2.2-6**), which are similar to those described for Alternative 2 in the 2018 Final EIS **Section 2.4.4, Reclamation Plan**; modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

Selection of Alternative 5 would end the project operational life of Area F 9 years earlier than the timetable in Westmoreland Rosebud's approved operating permit (**Table 2.2-9**) and may lead to closure of the Rosebud Mine as a whole prior to 2045 (see **Section 2.2.6, Life of Operations**).

2.6.2 State Operating Permit C2011003F

Selection of Alternative 5 may require revision of Westmoreland Rosebud's state operating permit for the project area (C2011003F). Any revisions needed would be determined by DEQ after review of the MPDD.

2.6.3 Power Plants

Under Alternative 5, Area F coal (Federal and state) would be available for combustion in the Colstrip Power Plant and the Rosebud Power Plant for a total of 11 years (2019 to 2030); current operations for both power plants are described in **Section 1.2.2, Coal Combustion**. Once Area F coal is no longer available, the power plants, if they continue to operate, could burn coal from other Rosebud Mine permit areas (thereby potentially changing the rate at which those areas are mined as described in **Section 2.2.6, Life of Operations**). The power plants could also use coal from sources other than the Rosebud Mine. The indirect effects of the combustion of Area F coal at the power plants are considered in the indirect effects analyses and described in **Chapter 4** of this SEIS; combustion of other coal (whether from the Rosebud Mine or other sources) is considered in the cumulative impacts analysis in **Chapter 5** of this SEIS.

2.6.4 Other Rosebud Mine Permit Areas

Selection of Alternative 5 may impact the rate of mining of other permit areas of the Rosebud Mine, such as Area B, that are currently permitted and being mined and/or reclaimed by Westmoreland Rosebud (see **Section 2.2, Description of Past and Existing Mine and Reclamation Operations**). As described in **Section 2.2.2.2, Area F Operations and Development**, Westmoreland Rosebud makes adjustments to the production rates for its various permit areas from time to time for a number of operational reasons, including demand from the power plants, coal quality targets, and on-the-ground conditions. Existing permit areas are considered in the cumulative effects analyses and described in **Chapter 5** of this SEIS.

[27]. Please note **Figure 2.6-1** shows an estimate of mining and associated disturbance under Alternative 5. The mine pit footprint is based on the mining schedule provided in MR 16. The extent of disturbance boundary shown is the current extent (as of December 23, 2023) and does not encompass the full 2,495 acres (gray shaded area) that may be disturbed under Alternative 5. Finally, not all scoria pits, topsoil stockpiles, and overburden stockpiles shown on **Figure 2.6-1** would be needed under Alternative 5. Likely, only the ones closest to the mine pit footprint would be used under this alternative; any northwest of Donley Creek would not likely be needed.

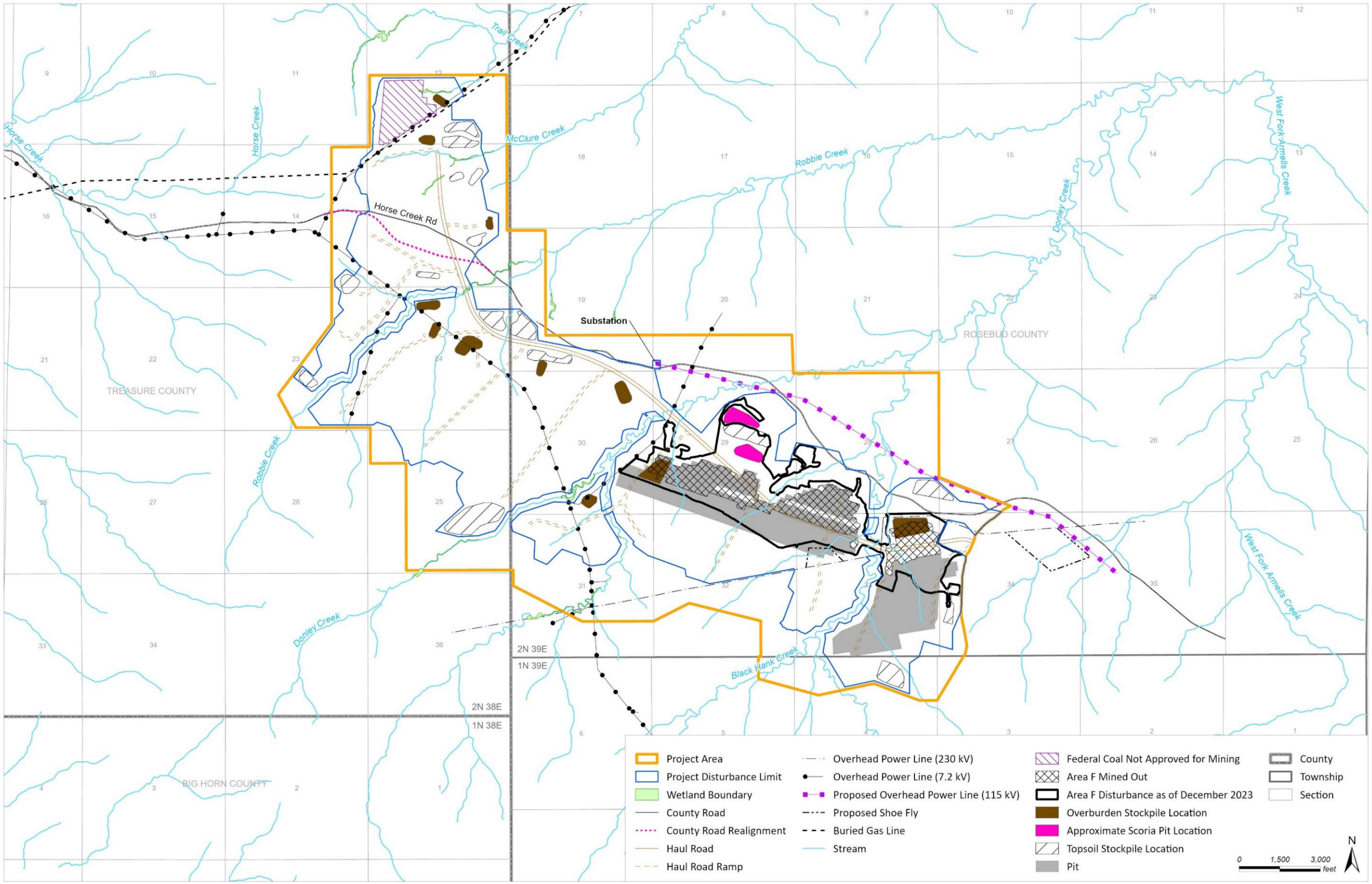

Figure 2.6-1. Alternative 5 – Partial Mining Alternative Mining Plan and Project Area

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2.7 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Alternatives considered but eliminated from further analysis by DEQ and OSMRE while preparing the 2018 Final EIS are described in **Section 2.6** of the 2018 Final EIS along with the rationale for their dismissal. Eliminated alternatives included the following: Coal Conservation Alternative; Private Coal Alternative; Underground Mining Alternative; Mining within a Smaller Disturbance Area, for a Shorter Duration, and/or within a Different Time Frame; Transport Coal by Rail to Western and International Ports; Alternative Land Uses; Alternative Energy Generation; and Mine High Quality Coal Only. For this SEIS, OSMRE reviewed all of the dismissed alternatives again and agreed with the dismissal rationale from the 2018 Final EIS for all alternatives except “Mining within a Smaller Disturbance Area, for a Shorter Duration, and/or within a Different Time Frame.” In the 2018 Final EIS (p. 110), the agencies contemplated an alternative mining plan, including “mining within a smaller permit area or disturbance area, for a period shorter than 21 years (duration of disturbance; see Table 7), and/or using a sequence that would result in different periods of disturbance.” An alternative with a smaller disturbance area and a shorter mining duration has been carried forward for analysis in this SEIS as Alternative 5 – Partial Mining Alternative and is described above in **Section 2.6**.

For this SEIS, OSMRE also reviewed all alternatives that were analyzed in the 2018 Final EIS to determine if additional analysis was warranted. Two alternatives (Alternatives 2 and 3) did not receive additional analysis in this SEIS and are described briefly in the following sections along with the rationale for not including them in the SEIS.

2.7.1 Alternative 2 – 2018 Final EIS Proposed Action

Alternative 2 was described and analyzed in the 2018 Final EIS. The alternative was based on the eighth-round PAP submitted by Western Energy (now Westmoreland Rosebud) to DEQ and certified as complete (August 8, 2012) and acceptable (October 5, 2018) by DEQ. As described above in **Section 2.2.2.2, Area F Operations and Development**, on-the-ground conditions and operational needs have necessitated several minor permit revisions since Westmoreland began development of Area F in 2019; as such, Alternative 2 cannot be selected and implemented as described in the 2018 Final EIS. Alternative 2 is included in this SEIS as a basis of comparison for other alternatives, but it is not analyzed or described in this SEIS. For a complete description of Alternative 2, including figures, please refer to the 2018 Final EIS, **Section 2.4, Alternative 2 – Proposed Action**; key elements of the alternative as they relate to current conditions are described above in **Section 2.2.2.2, Area F Operations and Development**.

2.7.2 Alternative 3 – Proposed Action Plus Environmental Protection Measures from the 2018 EIS

Alternative 3 – Proposed Action Plus Environmental Protection Measures was previously described in the 2018 Final EIS, and impacts of the alternative were analyzed. See **Section 2.5** in the 2018 Final EIS for the full description of the alternative. The Alternative 3 environmental protection measures were conceptual in nature and were designed to minimize environmental effects of the proposed action (Alternative 2) and to address key issues identified during the scoping process (see **Section 1.5.2.1, Key Issues Identified During Scoping for Detailed Analysis** of the 2018 Final EIS). The analysis in the 2018 Final EIS indicated that the benefits of the environmental protection measures were marginal. In its 2019 ROD, OSMRE documented the rationale for not selecting Alternative 3, noting that the agency had determined that “the requirements of MSUMRA, which are met by the Proposed Action as described in

Alternative 2 in the FEIS, are sufficiently protective of resources within the project area and the general vicinity of the project area." OSMRE chose not to select Alternative 3 as a whole or any of the individual protection measures analyzed in the EIS due to the negligible benefit they would provide to affected resources. Based on OSMRE's 2019 ROD determination, Alternative 3 was not carried forward for additional analysis in this SEIS. The Alternative 3 analysis in the 2018 ROD is still valid, and any of the environmental protection measures outlined in the alternative could be included as required mitigation in any of the SEIS alternatives, if agency decision makers determine that mitigation is warranted.

2.8 SUMMARY OF IMPACTS AND IDENTIFICATION OF PREFERRED AND ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Table 2.8-1 below summarizes impacts of the alternatives described in the preceding sections. Detailed discussions of impacts are provided in **Chapters 4** and **5**. Impacts of the alternatives considered in the 2018 Final EIS are summarized in that document in **Section 2.7, Summary of Impacts and Identification of Preferred Alternative**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

2.8.1 Preferred Alternative

Pursuant to 40 CFR § 1502.14(d), an agency is required to identify the "preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference." OSMRE does not have a preferred alternative at this time and will identify its preferred alternative in the Final SEIS after reviewing public comments on the Draft SEIS.

2.8.2 Environmentally Preferable Alternative

Pursuant to 40 CFR § 1502.14(f), an agency is required to identify the "the environmentally preferable alternative or alternatives amongst the alternatives considered in the environmental impact statement." An environmentally preferable alternative is defined as one that would "best promote the national environmental policy expressed in section 101 of NEPA" (40 CFR § 1508.1(n)). The 2024 NEPA regulations at 40 CFR § 1502.14(f) clarify that an environmentally preferable alternative is one that maximizes "environmental benefits, such as addressing climate change-related effects or disproportionate and adverse effects on communities with environmental justice concerns; protecting, preserving, or enhancing historic, cultural, Tribal, and natural resources, including rights of Tribal Nations that have been reserved through treaties, statutes, or Executive Orders; or causing the least damage to the biological and physical environment."

Based on the analyses in this SEIS (summarized in **Table 2.8-1**), OSMRE has determined that the No Action alternative is the environmentally preferable alternative that will best promote the national environmental policy expressed in section 101 of NEPA. As outlined in **Section 2.4**, under the No Action alternative, Westmoreland Rosebud would no longer be able to mine Federal coal lease MTM 082186 after 2025 and it is assumed would cease to mine private coal leases 1001 and 1001a. Westmoreland would be required to apply for and receive all appropriate approvals to fully reclaim any disturbed areas according to its current approved mining and reclamation permit, but no additional coal removal would be allowed from Federal coal lease MTM 082186. Aside from impacts related to reclaiming areas within

Federal coal lease MTM 082186 that have already been disturbed by mining, the No Action alternative would not cause additional adverse environmental effects from ground disturbances or coal removal, including effects on topography, geology, mineral resources, paleontology, air quality, hydrology, soil, vegetation, wildlife, cultural resources, visual resources, or noise. Similarly, because additional mining would not be allowed in the Federal coal lease MTM 082186 tracts, the No Action alternative would also be the only alternative that would not contribute to additional global greenhouse gas (GHG) emissions from the removal or combustion of additional Federal coal lease MTM 082186 coal. Alternatives 4 and 5 would both authorize further mining with the related environmental consequences outlined in **Chapters 4** and **5**. For these reasons, OSMRE has determined that the No Action alternative is the environmentally preferable alternative.

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Table 2.8-1. Summary of Direct and Indirect Environmental Impacts.

Resource	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Topography	Under Alternative 1, impacts on pre-mine topography in the project area would be similar to, but less than, Alternatives 4 and 5. Approximately 3,267 fewer acres would be disturbed, and postmining topography would be achieved 14 years earlier than under Alternative 4.	Changes in topography during mining would be noticeable and would be short-term, major, and adverse. In the years immediately following reclamation, impacts from erosion would be negligible. Over time, differential erosion of the spoil would create a hummocky terrain with fragments of more resistant stone scattered throughout the analysis area; these impacts would be long-term, minor, and adverse. Differential erosion of backfilled areas and unmined drainage basins over an unknown geologic time would result in topographic inversion of the analysis area; these impacts would be long-term, major, and adverse.	Impacts would be the same as Alternative 1 except under Alternative 5, the increased disturbance of 1,474 acres would result in a greater impact on topography than Alternative 1. Compared to Alternative 4, Alternative 5 would result in the decreased disturbance of 1,793 acres. Postmining topography would be achieved 9 years earlier than Alternative 4 and 5 years later than Alternative 1.
Air Quality	Air quality impacts would be similar to, but less than, those for Alternatives 4 and 5 due to a shorter mine life for Area F (6 years). Direct criteria air pollutants (CAPs) and hazardous air pollutants (HAPs) emissions, as well as impacts on air-quality related values, such as visibility, would occur over a 6-year Area F mine life (as compared to longer mine life under Alternative 4 or 5). Indirect effects due to combustion of Area F coal would continue as described for Alternative 4, but over a shorter time period (6 years).	Direct CAPs and HAPs emissions, as well as impacts on air-quality related values, such as visibility, would occur over a 20-year Area F mine life. The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes CAPs and HAPs emissions to the analysis area air, contributing to indirect impacts, including degraded air quality, visibility impairment (haze), and deposition of trace metals, SO2, and NO2 in analysis area soils and waterways. Air emissions would not result in exceedances of any National Ambient Air Quality Standards. Direct and indirect impacts on air quality would be short-term, negligible to minor, and adverse. Deposition impacts would be long-term, negligible to minor, and adverse.	Air quality impacts would be similar to, but less than, those for Alternative 4 but greater than those under Alternative 1. Direct CAPs and HAPs emissions, as well as impacts on air-quality related values, such as visibility, would occur over an 11-year Area F mine life (as compared to longer mine life under Alternative 4 and a shorter mine life under Alternative 1).
Climate and Climate Change	Climate impacts would be similar to, but less than, those for Alternatives 4 and 5. GHG emissions from the project area (direct effects) would be 1,508,291 CO_2e less as compared to Alternative 4. Indirect effects of annual GHG emissions from the power plants as described would be 14 years fewer as compared to Alternative 4.	Direct and indirect GHG emissions would contribute incrementally to climate change. Direct impacts on climate change would be negligible relative to other GHG emission sources. Project area coal would be burned at Colstrip Units 3 and 4 and at the Rosebud Power Plant and, thus, would indirectly contribute to GHG emissions from these facilities. Indirect effects of annual GHG emissions from the power plants would persist for the 20-year operational life of the project area.	Climate impacts would be similar to, but less than, those for Alternative 4 but greater than those under Alternative 1. GHG emissions from the project area (direct effects) would be 945,496 CO_2e less as compared to Alternative 4. Indirect effects of annual GHG emissions from the power plants as described would be 9 years fewer as compared to Alternative 4.
Social Cost of GHGs	The social costs of GHGs under Alternative 1 would be less than those under either Alternative 4 or 5. Depending on the discount rate, the total direct (mining) social costs of GHGs would range from $37 to $76 million for Alternative 1 (**Table 4.4-6**). The indirect (combustion) social costs of GHGs would range from $8 to $18 billion for Alternative 1 (**Table 4.4-8**). The indirect (worker commutes) social costs of GHGs would range from $3.6 million to $7.8 million for Alternative 1 – No Action (**Table 4.4-10**).	Depending on the discount rate, the total direct (mining) social costs of GHGs would range from $187 to $392 million for Alternative 4 (**Table 4.4-6**). The total indirect (combustion) social costs of GHGs would range from $32 to $79 billion for Alternative 4 (**Table 4.4-8**). The indirect (worker commutes) social costs of GHGs would range from $13.4 million to $33.5 million for Alternative 4 – Proposed Action (Current Federal Mining Plan) (**Table 4.4-10**).	The social costs of GHGs under Alternative 5 would be less than those under Alternative 4 but greater than those under Alternative 1. Depending on the discount rate, the total direct (mining) social costs of GHGs would range from $87 to $182 million for Alternative 5 (**Table 4.4-6**). The total indirect (combustion) social costs of GHGs would range from $16 to $38 billion for Alternative 5 (**Table 4.4-8**). The indirect (worker commutes) social costs of GHGs would range from $6.8 million to $16.2 million (**Table 4.4-10**).
Public Health	The public's exposure to diesel particulate matter (DPM) and fugitive dust, including coal dust, would be similar across all alternatives. However, under Alternative 1, the effects would be less significant than Alternatives 4 and 5 due to the shorter mine life (6 years). Exposure would be low because of the limited time and extent. While airborne contaminants may deposit on soils and surface waters, public exposure to these would only be incidental. Project impacts on air concentrations of particulate matter (PM) would result in a short-term minor adverse impact on public health within the project area and public access roads. Members of the public would not be permitted within the project area where PM and other hazardous substances would be present at higher concentrations. Any potential exposure of sensitive receptors to PM would be incidental and limited in duration. Therefore, the direct impacts on public health from PM2.5 and PM10, including from DPM and coal dust, would be short-term, negligible to minor, and adverse. There is a low likelihood that human consumption of or contact with contaminated surface or groundwater would occur from Alternative 1. With monitoring and mitigation activities, increased risk to public health from exposure to contaminated water resulting from Alternative 1 is not likely. Alternative 1 would have a short-term moderate beneficial impact on public health as it relates to economics and social services, a short-term negligible impact on community health, and a short-term minor adverse effect on land use as it relates to public health. Effects on public safety from noise and from solid and hazardous waste would be none to negligible.	The public health and safety effects for Alternatives 4 and 5 would generally be the same as for Alternative 1. However, due to a longer mining duration of 20 years, overall emissions would occur over a longer duration.	The public health and safety effects for Alternative 5 would generally be the same as for Alternative 4. However, due to a shorter mining duration (11 years) and earlier reclamation (9 years sooner), overall emissions would be lower.

Table 2.8-1. Summary of Direct and Indirect Environmental Impacts.

Resource	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Geology	Under Alternative 1, Westmoreland Rosebud would not fully use Federal coal lease MTM 082186. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. Impacts on geology in the project area would be similar to, but less than, Alternatives 4 and 5. Approximately 3,267 fewer acres (and underlying geology) would be disturbed as compared to Alternative 4.	Under Alternative 4, Westmoreland Rosebud would maximize economic recovery and diligent development of coal in the Federal coal lease MTM 082186. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. Horizontal continuity of the geology in the analysis area would be lost during mining, and the overburden would be vertically altered. Rock-outcrop features of historical significance would also be lost. Impacts would be short- and long-term, major, and adverse. Impacts would last until the spoil used to replace the geologically distinct layers was eroded away.	Under Alternative 5, Westmoreland Rosebud would not fully use Federal coal lease MTM 082186, although utilization would be greater compared to Alternative 1. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. As with Alternative 1, impacts on geology in the project area would be similar to, but less than, Alternatives 4. Under Alternative 5, 1,793 fewer acres (and underlying geology) would be disturbed as compared to Alternative 4 and 1,474 acres more acres would be disturbed as compared to Alternative 1.
Water Resources – Surface Water	Direct impacts of Alternative 1 would be similar to impacts for Alternative 4, but because 3,267 fewer acres would be disturbed under Alternative 1 and because the location of mine pits would be limited to the Donley Creek and Black Hank Creek watersheds, the remaining three watersheds (Trail Creek, McClure Creek, and Robbie Creek) would not be impacted from mine pit activity under Alternative 1. Indirect impacts for Alternative 1 would be similar to impacts for Alternative 4, but since the life of operations for Area F and the time period for combustion of project area coal in the Colstrip and Rosebud Power Plants would be 14 fewer years under Alternative 1, the duration of potential impacts related to water withdrawal from the Yellowstone River to supply the Colstrip Power Plant and trace metal deposition onto surface water bodies due to coal combustion at the two power plants would be shortened by 14 years.	Direct impacts to spring flows, stream flows, pond levels, and the hydrologic balance would be long-term, minor to moderate, and adverse. Direct impacts to floodplains would be short-term, minor, and adverse. Direct impacts to spring water quality would be short-term, minor, and adverse. Direct impacts on stream and pond water quality would be long-term, minor to moderate, and adverse. Some surface water resources would be permanently lost or changed. There would be no indirect impacts to stream flow due to Colstrip Power Plant surface water diversions. There would be no indirect impacts to stream water quality due to atmospheric deposition from the Colstrip Power Plant, except in East Fork Armells Creek where indirect impacts would be long-term, negligible to moderate, and adverse.	Same as Alternative 1 except under Alternative 5, there would be an increased disturbance of 1,474 acres and a mine life increase of 5 years as compared to Alternative 1.
Water Resources – Groundwater	Under Alternative 1, impacts on groundwater in the project area would be similar to, but less than, Alternatives 4 and 5. Similar to Alternative 5, mining under Alternative 1 would be limited to lands east of Donley Creek with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Within these drainages, direct impacts under Alternative 1 would be limited to water quantity impacts from drawdown related to mining occurring to the east, and groundwater quality impacts would not be anticipated. Water quantity impacts would progressively decrease further northwest of Donley Creek. The maximum drawdown at the end of mining would not be as deep as that predicted for Alternative 4 since mining would not extend as far south as the mining pits under Alternative 4 and the predicted 5-foot drawdown for the Rosebud and McKay Coals hydrostratigraphic units would not extend as far upgradient to the south as predicted for Alternative 4. In contrast to Alternative 4, Springs 3, 10, 11, 13, and 14 would not be impacted under Alternative 1.	Mining of the project area would permanently remove the Rosebud Coal aquifer and result in long-term reduction or elimination of the bedrock groundwater contribution to baseflow in the perennial and intermittent reaches of the major tributaries. Long-term groundwater drawdown due to mining would extend upgradient to the south beyond the mine area. Drawdown may affect existing water users of the Rosebud Coal aquifer. Mining would permanently remove springs in the project area whose groundwater source is either the Rosebud Coal or overburden since this would be removed during mining. Replacement of the Rosebud Coal with spoil would have long-term moderate adverse impacts on groundwater quality in the analysis area. When the spoil is sufficiently resaturated to discharge to alluvium in the major tributaries, impacts on alluvial groundwater quality would likely be long-term, minor to moderate, and adverse.	Alternative 5 impacts would be the same as Alternative 1 except the predicted maximum and 5-foot drawdown would be greater than under Alternative 1 due to the increased disturbance of 1,474 acres, mine life increase of 5 years, and coal production of 20 million tons more than Alternative 1.
Water Resources – Water Rights	Direct impacts to surface water rights for Alternative 1 would be similar to impacts for Alternative 4, but because the location of mine pits would be limited to the Donley Creek and Black Hank Creek watersheds, the remaining three watersheds (Trail Creek, McClure Creek, and Robbie Creek) would not be impacted from mine pit activity under Alternative 1. As compared to Alternative 4, this would result in four less surface water rights potentially impacted from mining. Indirect impacts to surface water rights for Alternative 1 would be similar to impacts for Alternative 4. Under Alternative 1, impacts on groundwater in the project area would be similar to, but less than, Alternatives 4 and 5. Similar to Alternative 5, mining under Alternative 1 would be limited to lands east of Donley Creek with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages so groundwater rights located within these drainages would not be anticipated to be impacted under Alternative 1. As compared to Alternative 4, this would result in three less groundwater rights destroyed from mining, four less groundwater rights potentially impacted due to drawdown, and five less springs physically disturbed.	Direct surface water diversions downstream of the project area include seven stock water rights associated with either direct stream flow or pond inundation from Trail Creek, McClure Creek, Robbie Creek, Donley Creek, and Black Hank Creek. Under Alternative 4, 11 spring water rights would be impacted (physically disturbed due to mining, their water source would be removed, or their flow rate would be reduced until after mining) and six groundwater rights are likely to be destroyed. If a surface or groundwater right became unusable for its specified purpose due to flow or water quality changes, the impact would be short-term, moderate, and adverse; SMCRA requires that a suitable replacement source be provided by Westmoreland Rosebud. If a water right were impacted by mining but still contained sufficient water of adequate quality to meet beneficial use needs, the impact would be short-term, negligible to minor, and adverse. There would be no indirect impacts from the Colstrip Power Plant (surface water diversion or atmospheric deposition) or from the Rosebud Power Plant (atmospheric deposition) on surface water hydrology or water quality that would affect any surface water rights.	For surface water, groundwater, and spring water rights, Alternative 5 impacts would be the same as Alternative 1. For groundwater and spring rights, Alternative 5 impacts would be the same as Alternative 1.

Table 2.8-1. Summary of Direct and Indirect Environmental Impacts.

Resource	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Vegetation	Under Alternative 1, the types of impacts on vegetation would be the same as described for Alternative 4. About 1,021 acres would be disturbed in the project area over a 6-year mine life. Direct and indirect vegetation impacts would be less than under Alternative 4: about 3,267 fewer acres (and associated vegetation) would be disturbed under Alternative 1 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 14 years shorter in duration under Alternative 1, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.	The removal of 4,288 acres of vegetation for mining activities would result in direct impacts that are short-term, moderate, and adverse. Decreased vegetation vigor and diversity, and the potential for changes to vegetation communities from a reduced amount of surface water and groundwater in the area, would result in impacts that are long-term, minor, and adverse. The indirect impacts on vegetation from power-plant emissions would be long-term, minor, and adverse.	Under Alternative 5, the types of impacts on vegetation would be the same as described for Alternative 4. About 2,495 acres would be disturbed in the project area over an 11-year mine life. Direct and indirect vegetation impacts would be less than under Alternative 4. About 1,793 fewer acres (and associated vegetation) would be disturbed under Alternative 5 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 9 years shorter in duration under Alternative 5, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.
Wetlands and Riparian Zones	No direct wetland impacts are anticipated to occur under Alternative 1 because mining and disturbance would be limited to the southeastern portion of the project area. Mining would be limited to lands east of Donley Creek with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. No wetlands are within the project limits of disturbance.	Approximately 46 acres of riparian habitat occur along drainages that would have reduced flow due to mining activities. Under Alternative 4, 7.19 acres of palustrine persistent emergent saturated wetlands would be directly impacted by mining activities in the analysis area Disturbance and changes to surface water and groundwater during mining activities would result in impacts that are short- and long-term, moderate, and adverse. A wetland mitigation plan would reduce the loss of wetland function and values. Indirect impacts on wetlands from power-plant emissions would be negligible.	No direct wetland impacts are anticipated to occur under Alternative 5 because mining and disturbance would be limited to the southern portion of the project area. Mining would be limited to lands east of Donley Creek with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. No wetlands are within the project limits of disturbance.
Fish and Wildlife Resources	Under Alternative 1, the types of impacts on fish and wildlife would be the same as described for Alternative 4. About 1,021 acres of wildlife habitat would be disturbed in the project area over a 6-year mine life. Direct and indirect wildlife impacts would be less than under Alternative 4: about 3,267 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 1 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 14 years shorter in duration under Alternative 1, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.	Under Alternative 4, 4,288 acres would be of habitat would be disturbed. Mining activities would result in loss of habitat due to surface disturbances that remove vegetation, direct mortality or injury due to vehicle or construction equipment collisions, and behavioral shifts such as a change in movement or displacement to other areas due to increased human activity and noise from blasting and mining operations. Direct impacts on small mammals, carnivores, big game, migratory birds, shorebirds, raptors, reptiles and amphibians, and aquatic species would be short- and long-term, negligible to minor, and adverse. Impacts on bats would be short- and long-term, moderate, and adverse. Indirect impacts from power-plant emissions would be negligible.	The types of direct and indirect fish and wildlife impacts under Alternative 5 would be similar to those described above for Alternative 4. Direct and indirect fish and wildlife impacts would be less than under Alternative 4. About 1,793 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 5 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 9 years shorter in duration under Alternative 5, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.
Special Status Species	Under Alternative 1, the types of impacts on special status species would be the same as described for Alternative 4. Direct and indirect special status species impacts would be less than under Alternative 4: about 3,267 fewer acres (and associated special status species habitat) would be disturbed under Alternative 1 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 14 years shorter in duration under Alternative 1, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.	Under Alternative 4, 4,288 acres would be of habitat would be disturbed. Mining activities would result in loss of habitat due to surface disturbances that remove vegetation, direct mortality or injury due to vehicle or construction equipment collisions, and behavioral shifts such as a change in movement or displacement to other areas due to increased human activity and noise from blasting and mining operations. There would be no impacts on federally listed threatened and endangered species. Direct impacts on state species of concern would be short- and long-term, moderate, and adverse. Indirect impacts from power-plant emissions on state species of concern would be negligible.	The types of direct and indirect impacts on special status species would be the same as described for Alternative 4. About 1,793 fewer acres (and associated special status species habitat) would be disturbed under Alternative 5 as compared to Alternative 4. The life of operations for Area F (and the corresponding impacts) would be 9 years shorter in duration under Alternative 5, as compared to Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.
Cultural and Historic Resources	Long-term major adverse impacts on eight potential historic properties is likely under Alternative 1. As compared to Alternative 4, this would result in 19 fewer potential historic properties being adversely affected by proposed mining activities. Adverse impacts would be resolved through both a property-specific Memorandum of Agreement and a long-term Programmatic Agreement stipulating measures for continued Section 106 compliance.	Surface disturbance from mining and wetland mitigation activity may result in disturbance or destruction of at least 25 historic properties located within the analysis area, and these impacts would be long-term, major, and adverse. Adverse impacts would be resolved through both a property-specific Memorandum of Agreement and a long-term Programmatic Agreement stipulating measures for continued Section 106 compliance.	Long-term major adverse impacts on 10 potential historic properties is likely under Alternative 5. As compared to Alternative 4, this would result in 17 fewer potential historic properties being adversely affected by proposed mining activities. Adverse impacts would be resolved through both a property-specific Memorandum of Agreement and a long-term Programmatic Agreement stipulating measures for continued Section 106 compliance.
Socioeconomic Conditions	Under Alternative 1, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2025. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity in and near the project area during the life of the mine through 2025.	Under Alternative 4, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2039. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity in and near the project area during the life of the mine through 2039.	Under Alternative 5, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2030. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity in and near the project area during the life of the mine through 2030.

Table 2.8-1. Summary of Direct and Indirect Environmental Impacts.

Resource	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Environmental Justice	Under Alternative 1, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2025. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity and therefore any environmental justice population in and near the project area during the life of the mine through 2025.	Under Alternative 4, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2039. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity and therefore any environmental justice population in and near the project area during the life of the mine through 2039.	Under Alternative 5, mining operations in Area F would continue to support the current economic conditions described in **Appendix 4** through 2030. Continued operations would delay the onset of adverse economic impacts due to the eventual closure of the Rosebud Mine, possibly allowing time for other sectors to develop. Impacts would be short-term and minor because the mine would continue to support local economic activity and therefore any environmental justice population in and near the project area during the life of the mine through 2030.
Visual Resources	Mining activities would change the visual landscape for drivers traveling along Horse Creek Road through the project area through changes to geology and topography and the removal of vegetation; the impact would be short-term, moderate, and adverse. For seven residences adjacent to the Rosebud Mine, active mining adjacent to existing mining areas may be visible in a small portion of the viewshed from a few locations. Depending on location, visual impacts would range from none to long-term, moderate, and adverse. over a 6-year mine life. Direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Visibility impairment is expected to be negligible for all Class I areas.	Mining activities would change the visual landscape for drivers traveling along Horse Creek Road through the project area through changes to geology and topography and the removal of vegetation; the impact would be short-term, moderate, and adverse. For seven residences adjacent to the Rosebud Mine, active mining adjacent to existing mining areas may be visible in a small portion of the viewshed from a few locations. Depending on location, visual impacts would range from none to long-term, moderate, and adverse. The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes particulate and gaseous air pollutants that contribute to regional haze in the surrounding viewshed. Visibility impairment is expected to be negligible for all Class I areas.	Under Alternative 5, visual impacts would be similar to those described above for Alternative 4 but would occur over an 11-year mine life. Direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. There would be short-term, moderate, adverse impacts during the life of the mine on drivers traveling along Horse Creek Road through the project area. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years. Similar to Alternative 4, visibility impairment is expected to be negligible for all Class I areas under Alternative 5.
Recreation	All current use of the land for recreation (primarily hunting) would be unavailable during mine operations. Hunting opportunities within the analysis area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. Impacts would be long-term, moderate, and adverse. However, under Alternative 1, recreation impacts would be less than those under Alternative 4 because disturbance and mine operations would be limited to the southeastern portion of the project area, and the life of mine operations in Area F would be 14 years shorter in duration. Reclamation (including revegetation) and postmining topography (PMT) would be achieved 14 years earlier than under Alternative 4, allowing pre-mine recreational use of the analysis area to resume 14 years earlier. Additionally, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4, reducing the duration of air pollutants contributing to regional haze in the surrounding viewshed.	All current use of the land for recreation (primarily hunting) would be unavailable during mine operations. Hunting opportunities on mine-related disturbance areas would be lost until revegetation and forage production were comparable to pre-mining levels associated with adjacent land. Impacts would be long-term, moderate, and adverse.	All current use of the land for recreation (primarily hunting) would be unavailable during mine operations. Hunting opportunities within the analysis area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. Impacts would be long-term, moderate, and adverse. However, under Alternative 5, recreation impacts would be less than those under Alternative 4 because disturbance and mine operations would be limited to the southern portion of the project area, and the life of mine operations in Area F would be 9 years shorter. Reclamation (including revegetation) and PMT would be achieved 9 years earlier than under Alternative 4, allowing pre-mine recreational use of the analysis area to resume 9 years earlier. Additionally, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4, reducing the duration of air pollutants contributing to regional haze in the surrounding viewshed.
Paleontology	Under Alternative 1, impacts on paleontological resources in the project area would be similar to, but less than, Alternatives 4 and 5. Approximately 3,267 fewer acres (and any underlying paleontological resources) would be disturbed as compared to Alternative 4.	Paleontological resources not identified or salvaged prior to mining would be permanently lost, resulting in impacts that are short- and long-term, major, and adverse. However, previously unknown paleontological resources may also be identified during mining activities and potentially salvaged, resulting in a beneficial impact.	Alternative 5 impacts would be the same as Alternative 1 except the increased disturbance of 1,474 acres would result in a greater impact on paleontological resources than under Alternative 1. Compared to Alternative 4, Alternative 5 would result in the decreased disturbance of 1,793 acres.
Access and Transportation	The types of access and transportation impacts under Alternative 1 would be similar to Alternative 4. Under Alternative 1, though, road construction (and associated impacts) would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Reclamation (including road removal) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.	Two segments of Horse Creek Road would be relocated (one has already been completed; see **Section 2.2.2.2, Area F Operations and Development**). Impacts from the relocation/reroute of Horse Creek Road would be short-term, minor, and adverse. The impacts due to haul, ramp, and service roads would be short-term, negligible, and adverse because the overall transportation system would not be disrupted.	The types of direct and indirect access and transportation impacts under Alternative 5 would be similar to those described above for Alternative 4. Under Alternative 5, though, road construction (and associated impacts) would be limited to the southern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Reclamation (including road removal) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.
Solid and Hazardous Waste	Under Alternative 1, impacts in the project area would be similar to, but less than, Alternatives 4 and 5. Potential for leaks or releases of solid or hazardous wastes would end 14 years earlier than under Alternative 4 and 5 years earlier than Alternative 5.	Potential leaks or releases of solid or hazardous wastes would result in impacts that are short-term, negligible, and adverse. Impacts from boron toxicity related to the receipt and use of bottom ash at other permit areas of the mine would be short-term, negligible, and adverse.	The potential for leaks or releases of solid or hazardous wastes under Alternative 5 would end 9 years earlier than under Alternative 4 and would have the potential to occur 5 years later than Alternative 1.

Table 2.8-1. Summary of Direct and Indirect Environmental Impacts.

Resource	Alternative 1 – No Action	Alternative 4 – Proposed Action (Current Federal Mining Plan)	Alternative 5 – Partial Mining Alternative
Noise	Noise impacts under Alternative 1 would be similar to Alternative 4 but would be 14 years shorter under Alternative 4. Mining would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4.	Direct impacts due to noise from mining and reclamation in the project area would be short- and long-term, negligible to minor, and adverse for the nearest rural residences. Indirect impacts due to noise from operation of the Rosebud and Colstrip Power Plants would continue to be moderate to minor for the residences in Colstrip and for those adjacent to the Rosebud Power Plant.	Noise impacts under Alternative 5 would be similar to Alternative 4 but would be 9 years shorter under Alternative 5. Mining would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.
Land Use	Under Alternative 1, Westmoreland Rosebud would not fully use Federal coal lease MTM 082186. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. Impacts on pre-mine land uses in the project area would be similar to, but less than, Alternatives 4 and 5. Approximately 3,267 fewer acres (and associated vegetation) would be disturbed, and reclamation (including revegetation) would be achieved 14 years earlier than under Alternative 4, allowing post-mine land uses to commence earlier in the project area.	Under Alternative 4, Westmoreland Rosebud would maximize economic recovery and diligent development of coal in the Federal coal lease MTM 082186. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. All current land uses within the analysis area would be temporarily disturbed during mine operations based on the timing of the approved mining plan. Impacts on grazing land would be long-term, moderate, and beneficial. Impacts on cropland would be long-term, moderate, and adverse.	Under Alternative 5, Westmoreland Rosebud would not fully use Federal coal lease MTM 082186, although utilization would be greater as compared to Alternative 1. BLM regulations (43 CFR § 3480) require maximum economic recovery and diligent development of leased Federal coal. Impacts on pre-mine land uses in the project area would be similar to, but less than, Alternative 4 and greater than under Alternative 1. Approximately 1,793 fewer acres (and associated vegetation) would be disturbed, and reclamation (including revegetation) would be achieved 14 years earlier than under Alternative 4, allowing post-mine land uses to commence earlier in the project area.
Soil	Soil impacts would be similar to, but less than, those for Alternatives 4 and 5. Approximately 3,267 fewer acres (and associated vegetation) would be disturbed, and reclamation (including application of stockpiled soils and revegetation) would be achieved 14 years earlier than under Alternative 4. With fewer acres disturbed, the potential for erosion and sediment transport would be less than under Alternatives 4 and 5. With shorter stockpile times, the potential for changes to the chemical, physical, and biological properties of stockpiled soils would be less likely as compared to Alternatives 4 and 5. Indirect effects of coal combustion, including deposition of trace metals, SO2, and NO2 into analysis air soils, would be less as compared to Alternatives 4 and 5 due to the shorter duration of mining and fewer tons of coal combusted.	Soil salvage, storage, and respreading would result in soil erosion and changes to physical, chemical, and biological soil characteristics. During mining, soil erosion impacts would be short-term, minor, and adverse. Erosion rates in reclaimed areas would return to pre-mine rates within 2 years once vegetation stabilizes the surface. It would be many years before physical, chemical, and biological soil characteristics return to pre-mine conditions; impacts in reclaimed areas would be long-term, minor, and adverse. The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes trace metals, SO2, and NO2 to the air that are then deposited into analysis area soils.	Soil impacts under Alternative 5 would be similar to, but less than, those for Alternative 4 but greater than those under Alternative 1. Approximately 1,793 fewer acres (and associated vegetation) would be disturbed, and reclamation (including application of stockpiled soils and revegetation) would be achieved 9 years earlier than under Alternative 4. With fewer acres disturbed, the potential for erosion and sediment transport would be less than under Alternative 4. With shorter stockpile times, the potential for changes to the chemical, physical, and biological properties of stockpiled soils would be less likely as compared to Alternative 4. Indirect effects of coal combustion, including deposition of trace metals, SO2, and NO2 into analysis air soils would be less as compared to Alternative 4 due to the shorter duration of mining and fewer tons of coal combusted.

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CHAPTER 3. AFFECTED ENVIRONMENT

This chapter summarizes the condition of the affected environment (including its human elements), the resource-specific analysis areas for direct and indirect effects, and the regulatory framework (state and Federal laws and regulations) applicable to each resource. It also provides the scientific and analytic basis for the comparison of the Proposed Action and alternatives as presented in **Chapter 2** of this Supplemental Environmental Impact Statement (SEIS).

The general setting for the project area, which is the Area F permit boundary,[28] is briefly described in **Section 3.1.2, General Setting**, to provide context for the resource-specific discussions in this chapter. The environmental baseline and current conditions information summarized in this chapter was obtained from the review of published sources, unpublished data, communication with government agencies, and review of field studies of the area. In general, the resource-specific discussions supplement the 2018 Final Environmental Impact Statement (2018 Final EIS); new or updated data that were reviewed and considered in this SEIS are listed in **Chapter 7, References**.

3.1 RESOURCES ANALYZED AND GENERAL SETTING

3.1.1 Resources Analyzed

The 23 resources listed below in **Table 3.1-1** were analyzed in the 2018 Final EIS based on public scoping comments and internal agency scoping. Resources for which there are substantial new circumstances or information relevant to environmental concerns and bearing on the SEIS alternatives are described in detail in this chapter. For other resources, brief resource summaries and relevant changes are provided along with references to relevant sections of the 2018 Final EIS.

[28]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

Table 3.1-1. Resources Analyzed.

Resource	Final EIS and SEIS Chapter and Section		
	Affected Environment	Direct and Indirect Effects	Cumulative Effects
Topography	3.2	4.2	5.3.1
Air Quality	3.3	4.3	5.3.2
Climate and Climate Change	**3.4**	**4.4**	**5.3.3**
Public Health and Safety	3.5	4.5	5.3.4
Geology	3.6	4.6	5.3.5
Water Resources – Surface Water	**3.7**	**4.7**	**5.3.6**
Water Resources – Groundwater	3.8	4.8	5.3.7
Water Resources – Water Rights	**3.9**	**4.9**	**5.3.8**
Vegetation	3.10	4.10	5.3.9
Wetlands and Riparian Zones	3.11	4.11	5.3.10
Fish and Wildlife Resources	3.12	4.12	5.3.11
Special Status Species	**3.13**	**4.13**	**5.3.12**
Cultural and Historic Resources	3.14	4.14	5.3.13
Socioeconomic Conditions	**3.15**	**4.15**	**5.3.14**
Environmental Justice	3.16	4.16	5.3.15
Visual Resources	3.17	4.17	5.3.16
Recreation	3.18	4.18	5.3.17
Paleontology	3.19	4.19	5.3.18
Access and Transportation	3.20	4.20	5.3.19
Solid and Hazardous Waste	3.21	4.21	5.3.20
Noise	3.22	4.22	5.3.21
Land Use	3.23	4.23	5.3.22
Soil	3.24	4.24	5.3.23

Note: Sections shown in **bold** font were substantially updated in the SEIS.

3.1.2 General Setting

The project area is located in Treasure and Rosebud Counties (Township 2 North, Range 38 and 39 East, and Township 1 North, Range 39 East) about 12 miles west of Colstrip, Montana (**Figure 1.1-1** and **Figure 1.1-2**). The Northern Cheyenne Indian Reservation is 13 miles south of the project area in Big Horn and Rosebud Counties. The northeast corner of the Crow Reservation is about 9 miles southwest of the project area in Big Horn County.

Situated in the northern Powder River Basin, the project area is generally east and north of the Little Wolf Mountains. The region has a semiarid climate and flat to rolling topography of shale and sandstone punctuated by occasional buttes. Tributaries of Horse Creek and West Fork Armells Creek, including Black Hank Creek, Donley Creek, Robbie Creek, McClure Creek, and Trail Creek (all of which lie within the drainage of the Yellowstone River), drain the project area. A ridge in the western portion of the project area divides the Horse Creek and West Fork Armells Creek drainages.

The project area is in the Northwest Great Plains Ecoregion, which encompasses the Missouri Plateau section of the Great Plains. Precipitation is variable, ranging from 5 to nearly 24 inches per year (over the past 40 years) and averaging 15 inches. The wettest months are May and June, and the driest are November through February. Large precipitation events of 1 to 3 inches in a day occur fairly frequently, and monthly precipitation totals of 4 to 10 inches have been recorded in April through September. Average annual snowfall is about 35 inches, and the snowiest month is January, averaging 6.9 inches. December, February, and March are nearly as snowy, averaging about 6 inches of snow.

The project area consists primarily of native grasslands, conifer/sumac woodlands, and upland shrublands, which together encompass about 80 percent (about 5,385 acres). Agricultural lands and pasture comprise about 15 percent (about 1,048 acres), and interspersed patches of lowlands, sandstone piles and cliffs, and disturbed or developed lands comprise the remaining 5 percent (about 313 acres).

3.2 TOPOGRAPHY

3.2.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to topography, other than active mining in Area F. Mining in the project area began in 2020, and as of 2023, 582 acres have been disturbed; 494 acres of that disturbance was due to active mining (Westmoreland Rosebud 2024b). See **Tables 2.2-3** and **2.2-4** in **Chapter 2** for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds. Minor Revision 15 to state operating permit C2011003F slightly adjusted the postmining topography and was approved by the Montana Department of Environmental Quality (DEQ) (see **Figure 2.2-6** in **Section 2.2.2.2, Area F Operations and Development**). Information on project area topography is available in **Section 3.2** of the 2018 Final EIS beginning on page 123.

3.2.1.1 Regulatory Framework

The regulatory framework for topography is unchanged since the Final EIS and is described in **Section 3.2.1.1** of the 2018 Final EIS beginning on page 123.

3.2.1.2 Analysis Area

The analysis area for topography, the proposed disturbance area,[29] is described in detail in **Section 3.2.1.2** of the 2018 Final EIS beginning on page 123 and shown on **Figure 13** in that document.

3.2.2 Pre-mine Topography

Information on the affected environment (pre-mine topography) is available in the 2018 Final EIS in **Section 3.2.2** beginning on page 124.

[29]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.3 AIR QUALITY

3.3.1 Introduction

Since the issuance of the 2018 Final EIS, there have been some changed conditions relevant to air quality (**Table 3.3-1**) in the analysis area, but these do not substantially change the analysis presented in the EIS. As applicable, key sections have been updated below. All other information on air quality is available in **Section 3.3** of the 2018 Final EIS beginning on page 123.

Table 3.3-1. Air Quality: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Montana Air Quality Permit (MAQP) #1570-09 was issued to include Area F and limits the emissions from the permit area and Area C. In 2023, Westmoreland Rosebud exceeded the annual 4-million-ton Area F production cap in MAQP #1570-09. Westmoreland Rosebud is working with DEQ to prevent future exceedances. Overall production was still below the combined annual 8-million-ton limit for Areas C and F, and emissions were not inconsistent with levels from prior years. Current emissions for the Rosebud Mine are presented below in **Table 3.3-2** and discussed in **Section 3.3.4.1, Existing Emissions from the Rosebud Mine**.
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for air quality: • Amendment 5 (AM5) to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative air quality impacts of Area F. The project area approved in Montana Department of Environmental Quality (DEQ) Record of Decision (ROD) for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). Westmoreland demonstrated to DEQ that Area B AM5 would comply with MAQP #1483-09. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2021	A statutory amendment to the Major Facility Siting Act (MFSA) allowed operators, such as Talen Montana, the operator of the Colstrip Power Plant, to change their fuel source without amending the MFSA Certificate (75-20-228, Montana Code Annotated [MCA]).
2022	Units 1 and 2 of the Colstrip Power Plant shut down in January 2020, earlier than the date (July 1, 2022) disclosed in the 2018 Final EIS; impacts of combustion of coal in Units 1 and 2 (and the eventual end) were previously considered in the 2018 Final EIS cumulative effects analysis (see **Chapter 5** and **Appendix D** in the 2018 Final EIS).
2022	On August 10, 2022, Montana submitted its Regional Haze State Implementation Plan (SIP) for the Second Planning Period to the Environmental Protection Agency (EPA). This plan was submitted to meet the requirements of the Regional Haze Rule (40 Code of Federal Regulations [CFR] Part 51, Subpart P) by establishing long-term strategies to achieve the 2028 reasonable progress goals. These goals are to improve existing visibility in mandatory Class I areas, prevent future impairment of visibility by manmade sources, and meet the national goal of natural visibility conditions in all mandatory Class I areas by 2064. The SIP must demonstrate Montana is on track to meet the national goal of natural visibility conditions in all mandatory Class I areas by 2064.
2019-2023	The Clean Power Plan (CPP), which was described in the 2018 Final EIS, established emission guidelines for states to follow in limiting carbon dioxide (CO_2) emissions from existing power plants. The EPA repealed the CPP in June 2019 and replaced it with the Affordable Clean Energy (ACE) rule. The ACE rule establishes emission guidelines for states to use when developing plans to limit CO_2 at their coal-fired Electric Utility Steam Generating Units (EGUs). On January 19, 2021, the D.C. Circuit Court vacated the ACE rule and remanded to the EPA for further proceedings consistent with its opinion. In March 2023, the EPA extended the due date for state plans under the ACE rule until April 15, 2024.

Table 3.3-1. Air Quality: Changed Conditions Since the 2018 Final EIS.

Year	Change
2023-2024	In May 2023, the EPA proposed new greenhouse gas (GHG) standards and guidelines for fossil-fuel-fired power plants under Section 111 of the Clean Air Act (CAA) and a repeal of the ACE rule (EPA 2024a). The intent of the new rule is to significantly reduce GHG emissions from existing coal-fired power plants and from new natural gas turbines. The EPA issued the final rule on May 9, 2024, and it became effective on July 8, 2024 (89 Federal Register [FR] 39798). The final rule (1) repeals the ACE rule; (2) finalizes emission guidelines for GHG emissions from existing fossil-fuel-fired (coal and oil/gas) steam-generating EGUs; (3) finalizes revisions to the new source performance standards for GHG emissions from new and reconstructed fossil-fuel-fired stationary combustion turbine EGUs; and (4) finalizes revisions to the New Source Performance Standards for GHG emissions from fossil-fuel-fired steam-generating units that undertake a large modification, based on the 8-year review required by the CAA. With the final rule, the EPA did not finalize emission guidelines for GHG emissions from existing fossil-fuel-fired combustion turbines.
2024	The EPA conducted a review of air quality criteria and National Ambient Air Quality Standards for oxides of nitrogen (NO_x), oxides of sulfur, and particulate matter (PM) and has proposed to revise the existing secondary sulfur dioxide (SO_2) standard to an annual average, averaged over three consecutive years, with a level within the range from 10 to 15 parts per billion (ppb). The EPA proposes to retain the existing secondary standards for NO_x and PM, without revision. The EPA accepted comments through June 14, 2024.
2024	The EPA issued its final rule with National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-Fired EGUs, also known as the Mercury and Air Toxics Standards (MATS). With the new rule, the EPA set technology-based emissions standards for mercury and other hazardous air pollutants (HAPs), including lead, arsenic, chromium, nickel, and cadmium – and hydrogen chloride, emitted by units with a capacity of more than 25 megawatts. These new emission standards will apply to the Colstrip Power Plant, but not the Rosebud Power Plant, which produces only 24 megawatts. Federal MATS and Montana's mercury emission standards, which are more stringent than the old Federal MATS, are discussed in the 2018 Final EIS in **Section 3.3, Air Quality**. Historic mercury emissions for both the Colstrip and Rosebud Power Plants were provided in the 2018 Final EIS and are replicated below in **Section 3.3.4.2**.
2024	The Bureau of Land Management (BLM) prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the Miles City Field Office (MCFO) planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing Federal leases with sufficient coal reserves to maintain existing mine production levels until 2035 for the Spring Creek Mine and 2060 for the Rosebud Mine (BLM 2024a); see **Table 5.2-1**.

3.3.1.1 Regulatory Framework

The regulatory framework applicable to air quality is described in **Section 3.3.1.1** of the 2018 Final EIS beginning on page 127. The regulatory updates since 2018 (see list in **Table 3.3-1**) include a statutory amendment to MFSA, updated air quality permits, and new emissions standards for mercury and other HAPs. Most updates discussed above would not substantially change the 2018 Final EIS air quality analysis. At this point in time, it is unclear how the Colstrip Power Plant will comply with the new MATS, but upgrades to the power plants would likely be needed. For analyses in this SEIS, it has been assumed that the Colstrip Power Plant will either upgrade its technology to meet the new MATS or close the remaining two units (Units 3 and 4). Therefore, the air quality modeling conducted for the 2018 Final EIS has not been updated to reflect new MATS.

3.3.1.2 Analysis Area

The analysis area for air quality, a rectangle with a 300-km extent from the Colstrip and Rosebud Power Plants, is the same as described in **Section 3.3.1.2** and shown on **Figure 14** of the 2018 Final EIS beginning on page 132.

3.3.2 Local and Regional Meteorological Patterns

Information on local and regional meteorological patterns is available in the 2018 Final EIS in **Section 3.3.2** beginning on page 133.

3.3.3 Air Quality Monitoring at Rosebud Mine

Western Energy operated seven PM_{10} air-quality monitoring sites throughout the Rosebud Mine complex from 1992 through 2000. In 2001, Western Energy was permitted by DEQ to terminate their ambient monitoring network based on a review of the monitoring data from the mine (MAQP #1570-06). In 2012, Western Energy deployed two modern, real-time Met One Beta Attenuation Monitors to monitor PM_{10}. All of the monitored values as of the 2018 Final EIS fall well below the level of the NAAQS (and MAAQS) for PM_{10}. Additional information on air quality monitoring at Rosebud Mine is available in the 2018 Final EIS in **Section 3.3.3** beginning on page 134.

3.3.4 Existing Regional Air Pollutant Sources and Emissions

Information on regional air pollutant sources and emissions is available in the 2018 Final EIS in Section **3.3.4** beginning on page 135 and in **Appendix D**. Within the immediate surroundings of the project area, the primary sources of air pollution continue to be the existing permit areas of the Rosebud Mine and the Colstrip and Rosebud Power Plants. The following subsections include updated data (since the 2018 Final EIS) for the Rosebud Mine and the power plants. Air quality and emissions sources in the region were also recently evaluated by the BLM in support of the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). Appendix C Air Resources Technical Support Document to BLM 2024a provides updated emissions inventories for coal mining, oil and gas production, and other BLM-authorized actions in the MCFO Resource Management Plan planning area, which overlaps with the indirect and cumulative effects analysis areas used in this SEIS and the 2018 Final EIS. Data presented in that document are generally consistent with what was presented in the 2018 Final EIS.

3.3.4.1 Existing Emissions from the Rosebud Mine

Criteria Air Pollutant Emissions

A detailed discussion of criteria air pollutant (CAP) emissions from the Rosebud Mine is provided in **Section 3.3.4.1** of the 2018 Final EIS; estimated future emissions are provided in **Appendix D** of the 2018 Final EIS. The following section describes key updates since the 2018 Final EIS. The existing Rosebud Mine includes Areas A, B, and D (MAQP #1483-09); Areas C and F (MAQP #1570-09); and a portable crusher used throughout the mine (MAQP #4436-01). These versions of the permits are available on the DEQ website (https://deq.mt.gov/air/assistance) and are in the project record. Production and associated emissions from the Rosebud Mine are regulated by these MAQPs; actual production rarely reaches the MAQP limit levels. MAQP #1483-09 limits annual combined coal production from Areas A, B, and D to 13 million tons per year. Combined coal production from Areas C and F is limited to 8 million tons per year per MAQP #1570-09, with an Area F–specific production cap of 4 million tons per year.[30]

As shown in **Table 2.2-2**, coal was only produced from Area B and Area F in 2023. Active mining began in Area F in August 2020. Mining and reclamation operations include a number of sources of CAP and HAP emissions. The majority of CAP emissions are from low-level, fugitive dust emission sources. Sources of fugitive dust include:

- Removal, handling, and storage of topsoil
- Drilling, blasting, removal, handling, and storage of overburden
- Drilling, blasting, removal, and loading (Area F); dumping and crushing (Area A or Area C); and conveying of coal to the Colstrip Power Plant
- Vehicle traffic on haul and access roads, including covered trucks hauling coal to the Rosebud Power Plant and employee vehicles
- Wind erosion of disturbed areas

Westmoreland Rosebud is required to develop and employ a Fugitive Dust Control Plan to minimize fugitive dust emissions from all permit areas of the mine. The control measures include but are not limited to the application of water and chemical dust suppressant on haul and access roads, use of a foam dust-suppression system in coal processing and conveying facilities, prompt revegetation of disturbed areas, and use of an enclosure when drilling coal and overburden before blasting. Other major emission sources at the mine include diesel exhaust emissions from mobile and stationary diesel engines and blasting emissions from the explosives used in coal and overburden blasting.

Annual emissions of CAPs and volatile organic compounds (VOCs) from the existing areas of the Rosebud Mine are shown as reported by DEQ for the period 2010 through 2023 in **Table 3.3-2**; the 2018 Final EIS only included data through 2015. In general, reported CAP and VOC emissions from the Rosebud Mine have been the same as or less than the emissions disclosed in the 2018 Final EIS and used in the air quality modeling that supported the analysis. One exception is 2021, which had higher emissions for NO_x, SO_2, and CO; in 2021, NO_x emissions (320.4 tons) were about 48 percent higher than the average (216.9 tons) over 2020 through 2023, SO_2 emissions (35.2 tons) were about 51 percent higher than the average (23.3 tons) over 2020 through 2023, and CO emissions (1,182.9 tons) were about 51 percent higher than the average (782.8 tons) over 2020 through 2023. According to Westmoreland Rosebud's annual mining reports for January 1, 2021, through December 31, 2021, total production for the Rosebud Mine in 2021 was about 6.5 million tons, including about 0.97 tons from Area F. Emissions for NO_x, SO_2, and CO returned to lower values in 2022 and 2023. As shown in **Table 2.2-2**, current (2023) production from Area F (about 4.6 million tons) accounted for about 65 percent of total production for the Rosebud Mine (about 7.1 million tons).

[30]. Note that 2023 production in Area F (about 4.6 million tons) was greater than the production limit (4 million tons) in MAQP #1570-09. Westmoreland Rosebud is working with DEQ to prevent future exceedances. Overall production was still below the combined limit for Areas C and F. Areas C and F emissions were not inconsistent with levels from prior years. Current emissions for the Rosebud Mine are presented below in **Table 3.3-2**.

Table 3.3-2. Historic CAP Emissions Reported from Rosebud Mine (All Permit Areas).

Year	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs
	(tons/year)					
2010	1557.7	345.9	200.8	21.5	724.1	1.5
2011	1312.3	263.6	162.2	16.9	569.4	1.5
2012	1307.2	271.9	212.7	22.2	747.1	2.0
2013	1267.1	301.4	200.6	21.1	709.7	1.8
2014	1545.1	361.3	238.9	26.6	894.1	1.0
2015	1514.7	350.4	302.1	33.1	1111.7	1.7
2016	1449.6	331.5	293.4	31.8	1069.8	1.9
2017	1336.0	306.3	288.9	31.1	1047.5	2.0
2018	NA	NA	NA	NA	NA	NA
2019	1321.0	301.0	286.8	30.9	1039.2	2.0
2020	1103.6	221.3	179.2	18.4	622.0	1.8
2021	1259.0	256.5	*320.4	*35.2	*1182.9	1.8
2022	1261.9	251.6	204.3	21.5	724.0	1.8
2023	1388.0	279.6	145.7	15.4	518.0	1.2

Notes: Lead (Pb) is included under HAPs.
* These cells have higher values than what were disclosed in the 2018 Final EIS.
Source: DEQ 2024.

Hazardous Air Pollutant Emissions

Operations associated with the mining, processing, and handling of coal result in the emission of HAPs from the Rosebud Mine with the primary sources being fugitive coal dust sources and diesel engines. Coal dust contains a number of hazardous metals (e.g., antimony, arsenic, chromium, lead, mercury, and selenium), and emission of coal dust suspends these compounds in the air. Suspended fugitive coal dust can impact human health and ecosystems through inhalation or deposition to soil and waterbodies. The use of diesel engines throughout the mine results in the emission of toxic gases and particulates known as diesel particulate matter (DPM). DPM is not currently regulated by the EPA but is considered a carcinogen (EPA 2002). Further information on HAP emissions from the mine is provided in **Project Area Hazardous Air Pollutant Emissions** under **Section 4.3.3.1, Direct Impacts**.

3.3.4.2 Existing Emissions from the Colstrip and Rosebud Power Plants

Detailed discussions of CAP and HAP emissions from regional sources and Colstrip mobile sources are provided in **Section 3.3.4.2** (Colstrip and Rosebud Power Plants) and **Section 3.3.4.3** (other regional sources) in the 2018 Final EIS; estimated future emissions are provided in **Appendix D** of the 2018 Final EIS. The Colstrip Power Plant and Rosebud Power Plant continue to be the major sources of air emissions within the analysis area.

The Colstrip Power Plant, which is described in detail in **Section 1.2.2.1**, is surrounded by the Rosebud Mine (**Figure 1.1-2**) and receives coal directly from the mine via enclosed conveyors. The facility comprises two coal-fired boilers (Units 3 and 4) with an approximate total generating capacity of 1,480 megawatts; Units 1 and 2, which were considered in the 2018 Final EIS, were retired in January 2020 (earlier than anticipated). Each operating unit employs wet Venturi scrubbers for SO_2 and PM control, advanced low NO_x firing and digital controls for NO_x control, and mercury oxidizer/sorbent systems for mercury control. The operators are also required to maintain Continuous Emissions Monitoring Systems for SO_2, NO_x, CO_2, and opacity along with Mercury Emissions Monitoring Systems for mercury compliance monitoring.

The Rosebud Power Plant, which is described in detail in **Section 1.2.2.2**, is located approximately 6 miles north of the Rosebud Mine along State Highway 39 and is an approximately 38-megawatt electric generating facility designed to burn low–British thermal unit (Btu) waste coal using a low-temperature circulating fluidized bed boiler (see **Section 1.2.2.2**). Limestone is injected with the waste coal prior to combustion to control SO_2, and a baghouse is employed to control PM.

The existing sources of air pollution at the power plants include the boilers (which primarily burn coal but also utilize distillate fuel oil or liquid propane gas for start-up), fugitive dust sources (on-road and non-road vehicles, coal/ash handling and storage, and the limestone handling systems), emergency diesel generators, and mobile exhaust.

Criteria Air Pollutant Emissions

The most recent CAP emissions (2019-2023) for the power plants are presented below in **Table 3.3-3** and compared to the CAP emissions (2011-2015) data provided in **Table 19** of the 2018 Final EIS. In general, CAP emissions from Units 3 and 4 of the Colstrip Power Plant[31] and the Rosebud Power Plant have remained consistent with or less than the emissions data presented in the 2018 Final EIS; the cells with the asterisks notate values that are higher than what was considered in 2018. CAP emissions were higher than the highest reported emissions value in the 2018 Final EIS only for the Rosebud Power Plant and only in one year: in 2023, Rosebud Power Plant PM_{10} emissions (27 tons) were about 44 percent higher than the average (18.7 tons) over 2010 through 2023, SO_2 emissions (1,258.4 tons) were 11 percent higher than the average (1,138.9 tons) over 2010 through 2023, and CO emissions (5.32 tons) were 213 percent higher than the average (1.7 tons) over 2010 through 2023.

As described in 2018 Final EIS **Section 3.3.4.2**, mobile exhaust emissions from on-road and non-road mobile sources from the Colstrip Power Plant were estimated from the 2012-2013 emission inventory in the modeling study done for the Bureau of Land Management Montana Dakotas State Office (BLM-MT/DK). On-road and non-road exhaust emissions are expected to be very small at the Colstrip Power Plant because of limited use of mobile source equipment at the facility. Estimated mobile emissions from the Colstrip Power Plant are listed in **Table 20** in the 2018 Final EIS. Those estimates have not been updated in this SEIS but are assumed to still be valid.

[31]. Units 1 and 2 of the Colstrip Power Plant were no longer emission sources after their retirement in January 2020.

Table 3.3-3. CAP Emissions from the Colstrip and Rosebud Power Plants (2010–2023).

Facility/Year	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs
Colstrip Power Plant Units 1 and 2	(tons/year)					
2010	643.8	540.2	8080.3	10541.8	734.8	102.8
2011	502.9	421.2	6312.6	7460.8	574.5	80.4
2012	367.8	308.7	4650.5	4571.9	420.2	58.8
2013	636.1	532.9	8453.2	8402.0	718.6	100.6
2014	584.0	488.5	7622.4	5823.8	658.1	92.1
2015	512.3	428.7	5807.5	3757.9	574.9	80.5
Colstrip Power Plant All Units (1-4)	(tons/year)					
2019	505.1	131.4	NA	8325.1	2157.6	301.9
Colstrip Power Plant Units 3 and 4	(tons/year)					
2010	1625.0	1329.6	10054.5	4766.8	1818.5	254.4
2011	1323.5	1086.6	8067.1	3832.9	1486.3	207.8
2012	1362.8	1120.2	8242.7	4193.6	1523.4	213.2
2013	1138.9	932.2	6542.8	3441.9	1270.9	177.9
2014	1393.3	1120.1	7965.2	4286.1	1530.7	214.2
2015	1613.2	1295.2	9336.7	5166.1	1759.1	246.2
2020	285.2	76.4	NA	3207.5	1280.0	179.0
2021	339.9	90.1	NA	4111.8	1560.3	218.2
2022	353.5	94.2	NA	4751.9	1686.4	202.2
2023	349.8	93.6	NA	4976.1	1694.01	203.1
Rosebud Power Plant	(tons/year)					
2010	14.5	5.6	875.4	1181.4	0.2	7.0
2011	25.2	25.2	843.1	1032.9	0.3	5.4
2012	13.7	4.7	951.0	1168.9	0.2	6.2
2013	17.2	5.3	938.6	1198.4	0.4	7.0
2014	16.4	5.0	849.4	1165.3	2.6	6.7
2015	16.5	5.0	856.4	1195.3	3.4	6.7
2019	17.5	3.9	NA	1086.7	.7	6.2
2020	17.5	3.8	NA	970.6	2.4	5.8
2021	20.2	4.4	NA	1112.7	2.7	6.6
2022	20.2	4.4	NA	1157.1	0.3	6.4
2023	*27.0	4.1	NA	*1258.4	*5.32	6.7

Note: Values have been rounded to the nearest tenth decimal place.
* These cells have higher values than what were disclosed in the 2018 Final EIS.
Source: Montana DEQ Annual Emission Inventory Reporting Records (2010-2015) and DEQ 2024 (2019-2023).

Hazardous Air Pollutant Emissions

The combustion of coal in power plant boilers releases a large number of hazardous trace metals and organic and inorganic compounds contained within the coal. Mercury is the only HAP whose emission rates are continuously monitored at the Colstrip and Rosebud Power Plants. The historic mercury emissions (2010-2015) were provided in **Table 21** in the 2018 Final EIS; these emissions data are compared to more recent (2016-2022) mercury below in **Table 3.3-4**. The 2018 Final EIS also disclosed estimated emission rates of selected metal HAPs for the Colstrip Power Plant (based on 2010 and 2011 stack testing). Those estimated metal HAP emissions data from the 2018 Final EIS (**Table 22**) are compared to more recent (2016-2022) emissions data below in **Table 3.3-5**. As with CAP emissions, metal HAP emissions from the Colstrip Power Plant[32] have generally remained consistent with or less than the emissions data in the 2018 Final EIS. For the Rosebud Power Plant, the 2018 Final EIS also provided estimated metal HAPs emissions based on emission limits described in the MATS in **Table 23**. Those estimates have not been updated in this SEIS but are assumed to still be valid. In the 2018 Final

32. Units 1 and 2 of the Colstrip Power Plant were no longer emission sources after their retirement in January 2020.

EIS, non-metal HAP emissions data disclosed in **Table 24** for the Colstrip Power Plant were from the 2014 National Emissions Inventory (NEI) (EPA 2016b). Facility-level is not as comprehensive in the 2020 NEI (EPA 2023a); available 2020 data are provided below in **Table 3.3-6** in comparison to the 2014 data.

Table 3.3-4. Historic Mercury Emissions from the Colstrip and Rosebud Power Plants.

Year	Total Mercury Emissions (lb/year)			
	Colstrip Power Plant			Rosebud Power Plant
	Units 1 and 2	Units 3 and 4	Total All Units (1-4)	
2010	32.6	117.9	150.5	2.5
2011	26.4	86.2	112.6	1.2
2012	18.4	81.6	100.0	2.6
2013	36.0	81.6	117.6	1.4
2014	28.7	103.2	131.9	1.4
2015	23.6	121.0	144.6	0.9
2016	NA	NA	120.0	1.91
2017	NA	NA	120	1.09
2018	NA	NA	110	1.14
2019	NA	NA	110	1.56
2020	-	60	60	0.61
2021	-	70	70	0.94
2022	-	80	80	1.29

NA = Not Available.
Source: 2010-2015 data are from DEQ Mercury Emissions Monitoring System; 2016-2022 Toxic Inventory Data for the Colstrip Power and Rosebud Power Plants are from the EPA's Envirofacts site (EPA 2024b and EPA 2024c).

Table 3.3-5. Historic Metal HAP Emissions from the Colstrip Power Plant.[1]

Year	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Selenium
Colstrip Units 1 and 2	(lb/year)						
2010	50.2	116.2	31.5	166.7	693.7	271.6	493.2
2011	39.3	91.0	24.7	130.5	543.2	212.7	386.2
2012	29.8	69.0	18.7	99.0	411.9	161.2	292.8
2013	50.0	115.6	31.4	166.0	690.7	270.4	491.0
2014	45.4	104.9	28.5	150.5	626.4	245.2	445.3
2015	40.6	93.9	25.5	134.8	560.9	219.6	398.7
Colstrip Units 3 and 4	(lb/year)						
2010	116.6	269.6	73.2	387.0	1610.4	630.4	1144.8
2011	98.0	226.7	61.5	325.3	1353.7	529.9	962.3
2012	101.7	235.2	63.8	337.5	1404.5	549.8	998.4
2013	83.3	192.6	52.3	276.4	1150.3	450.3	817.7
2014	99.9	231.0	62.7	331.6	1379.9	540.2	980.9
2015	115.0	266.0	72.2	381.8	1588.8	622.0	1129.4
Total for All Colstrip Units (just Units 3 and 4 after 2019)	(lb/year)						
2016	140	310	NA	450	1870	800	1330
2017	140	310	NA	450	1860	730	1330
2018	130	300	NA	430	1780	730	1270
2019	140	310	NA	450	1880	730	1340
2020	NR	190	NA	270	1130	440	810
2021	NR	230	NA	330	1390	530	990
2022	NR	300	NA	430	1390	510	990

lb/year = pounds per year; NA = Not Available; NR = Not Reported.
Source: 2010-2015 Metal HAP emissions are based on 2010/2011 stack test data from Colstrip Unit 3 and annual heat input from EPA's Clean Air Markets Data (https://ampd.epa.gov/ampd/); 2016-2022 Toxic Inventory Data are from the EPA's Envirofacts site (EPA 2024b).

Table 3.3-6. 2014 Existing Non-Metal HAP Emissions from the Colstrip Power Plant.

Hazardous Air Pollutant	2014 NEI Emission Rate (tons/year)	2020 NEI Emission Rate (tons/year)
2,4-Dinitrotoluene	1.28E-03	
2-Chloroacetophenone	3.20E-02	
5-Methylchrysene	1.00E-04	
Acenaphthene	2.33E-03	
Acenaphthylene	1.14E-03	
Acetaldehyde	2.60E+00	
Acetophenone	6.86E-02	
Acrolein	1.33E+00	
Anthracene	9.64E-04	
Benz[a]Anthracene	3.66E-04	
Benzene	5.95E+00	
Benzo[a]Pyrene	1.74E-04	
Benzo[g,h,i,]Perylene	1.24E-04	
Benzyl Chloride	3.20E+00	
Beryllium	8.82E-03	5.00E-03
Biphenyl	7.78E-03	
Bis(2-Ethylhexyl)Phthalate	3.34E-01	
Bromoform	1.78E-01	
Carbon Disulfide	5.95E-01	
Chlorobenzene	1.00E-01	
Chloroform	2.70E-01	
Chrysene	4.57E-04	
Cobalt	2.48E-02	1.50E-02
Cumene	2.43E-02	
Cyanide	1.14E+01	
Dimethyl Sulfate	2.19E-01	
Ethyl Benzene	4.30E-01	
Ethyl Chloride	1.92E-01	
Ethylene Dibromide	5.49E-03	
Ethylene Dichloride	1.83E-01	
Fluoranthene	3.25E-03	
Fluorene	4.16E-03	
Formaldehyde	1.10E+00	
Hexachlorobenzene	5.00E-03	
Hexane	3.06E-01	
Hydrochloric Acid	4.83E+00	7.50E+00
Hydrogen Fluoride	1.10E+01	
Indeno[1,2,3-c,d]Pyrene	2.79E-04	
Isophorone	2.65E+00	
Methyl Bromide	7.32E-01	
Methyl Chloride	2.43E+00	4.06E+01
Methyl Methacrylate	9.18E-02	
Methyl Tert-Butyl Ether	1.60E-01	
Methylene Chloride	1.33E+00	
Methylhydrazine	7.78E-01	
Naphthalene	5.95E-02	8.00E-02
Phenanthrene	1.24E-02	
Phenol	7.32E-02	
Propionaldehyde	1.74E+00	
Pyrene	1.51E-03	
Styrene	1.14E-01	
Tetrachloroethylene	1.97E-01	
Toluene	1.10E+00	
Vinyl Acetate	3.48E-02	
Xylenes (Mixed Isomers)	1.70E-01	

lb/year = pounds per year.
Source: 2014 NEI (EPA 2016) and 2016 NEI (EPA 2023a).

3.3.4.3 Existing Emissions from Other Regional Sources

There are several other regional sources of air pollution (e.g., coal and hard rock mines, oil and gas refineries, gravel pits, cities, etc.) within the cumulative and indirect impacts analysis area for air quality that contribute to cumulative effects. **Table 25** (regional sources) in the 2018 Final EIS provides emissions for these sources based on the emissions inventory from the Bureau of Land Management Montana/Dakotas (BLM-MT/DK) air quality modeling (BLM 2016a), and **Appendix D** in the 2018 Final EIS provides estimated future emissions from these sources and effects on regional air quality. Those estimates have not been updated in this SEIS but are assumed to still be valid.[33]

3.3.5 Regional Air Quality

Information on regional air quality is available in the 2018 Final EIS in **Section 3.3.5** beginning on page 142.

33. Note that some regional sources identified in **Table 25** in the 2018 Final EIS are no longer sources. For example, the Decker Mine closed in January 2021 due to a decline in demand for thermal coal (AP News 2021).

3.4 CLIMATE AND CLIMATE CHANGE

3.4.1 Introduction

Since the issuance of the 2018 Final EIS, there have been some changed conditions relevant to air quality (**Table 3.3-1**), and therefore GHG emissions, as well as those listed below that are specific to climate change (**Table 3.4-1**).

Table 3.4-1. Climate Change: Changed Conditions Since 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed GHG emissions: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative impacts of Area F. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2021	Two recent executive orders issued by President Biden address climate change: • EO 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, requires the use of best available science in Federal decision making, including capturing the full costs of GHG emissions as accurately as possible. • EO 14008, Tackling the Climate Crisis at Home and Abroad, requires a government-wide approach to the climate crisis and encourages broad participation in the goal of conserving 30 percent of U.S. land and waters by 2030.
2019-2023	The CPP, which was described in the 2018 Final EIS, established emission guidelines for states to follow in limiting CO_2 emissions from existing power plants. The EPA repealed the CPP in June 2019 and replaced it with the ACE rule. The ACE rule establishes emission guidelines for states to use when developing plans to limit CO_2 at their coal-fired EGUs. On January 19, 2021, the D.C. Circuit vacated the ACE rule and remanded to the EPA for further proceedings consistent with its opinion. In March 2023, the EPA extended the due date for state plans under the ACE rule until April 15, 2024.
2023-2024	In May 2023, the EPA proposed new GHG standards and guidelines for fossil-fuel-fired power plants under Section 111 of the CAA and a repeal of the ACE rule (EPA 2024a). The intent of the new rule is to significantly reduce GHG emissions from existing coal-fired power plants and from new natural gas turbines. The EPA issued the final rule on May 9, 2024, and it became effective on July 8, 2024 (89 FR 39798). The final rule (1) repeals the ACE rule; (2) finalizes emission guidelines for GHG emissions from existing fossil-fuel-fired (coal and oil/gas) steam generating EGUs; (3) finalizes revisions to the new source performance standards for GHG emissions from new and reconstructed fossil-fuel-fired stationary combustion turbine EGUs; and (4) finalizes revisions to the New Source Performance Standards for GHG emissions from fossil-fuel-fired steam generating units that undertake a large modification, based on the 8-year review required by the CAA. With the final rule, the EPA did not finalize emission guidelines for GHG emissions from existing fossil-fuel-fired combustion turbines.
2024	The BLM prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the MCFO planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing Federal leases with sufficient coal reserves to maintain existing mine production levels until 2035 for the Spring Creek Mine and 2060 for the Rosebud Mine (BLM 2024a); see **Table 5.2-1**.
2024	Recent Council on Environmental Quality (CEQ) updates to National Environmental Policy Act (NEPA) Regulations (40 CFR §§ 1500 to 1508) place new emphasis on consideration of environmental justice concerns and climate change in NEPA analyses.

3.4.1.1 Regulatory Framework

The regulatory framework applicable to climate change is described in **Section 3.4.1.1** of the 2018 Final EIS beginning on page 155. Climate-change-specific regulatory updates since 2018 (see list in **Table 3.4-1**) include updates to the NEPA regulations, new GHG standards and guidelines for fossil-fuel-fired power plants, and two climate-related executive orders. In general, most updates discussed above would not substantially change the 2018 Final EIS climate change analysis. Any specific changes to the analysis are described in **Section 4.4, Climate and Climate Change**.

3.4.1.2 Direct and Indirect Effects Analysis Area

The analysis area for climate change is the same as described in **Section 3.4.1.2** of the 2018 Final EIS beginning on page 132. In general, the analysis area for climate and climate change is the world with focus on the United States and Montana. In particular, the analysis area for air quality was used for identifying major regional sources of GHGs.

3.4.2 Climate Conditions

In general, climate conditions, including atmospheric composition and primary GHGs, remain consistent with those described in **Section 3.4.2** of the 2018 Final EIS beginning on page 157. The most common GHG produced from human activity (fuel combustion) is carbon dioxide (CO_2), followed by methane (CH_4) and nitrous oxide (N_2O). These are also the primary GHGs that would be emitted from the project area and the Colstrip and Rosebud Power Plants and thus are the focus of the discussion in the 2018 Final EIS and this SEIS. Larger GHG emissions lead to higher concentrations of GHGs in the atmosphere. GHG concentrations are measured in parts per million (ppm), parts per billion (ppb), and parts per trillion (ppt). Emissions are measured in a common unit, which is the metric tons of carbon dioxide equivalent (CO_2e); this unit of measure takes into account the Global Warming Potential (GWP) of each of the emitted GHGs in terms of CO_2e.[34]

3.4.2.1 Climate and Emissions Trends

Detailed climate and emissions trends for global-, national-, and state-level (Montana) scales are provided in the 2018 Final EIS and supplemented or updated as appropriate in the sections below.

Global Emission Trends

Estimates from the Rhodium Group for 2022 show global emissions at 50.6 gigatons of carbon dioxide equivalent (Gt CO_2e), representing a 1.1 percent increase from 2021 levels. Global emissions dropped in 2020 primarily due to the COVID-19 pandemic and global recession and rebounded by a nearly equivalent amount in 2021. In 2022, China accounted for 26 percent of all global emissions, the U.S. accounted for approximately 12 percent of global GHG emissions, and India and the European Union accounted for 7 percent each. In 2021 (the latest year for which there is sufficient data to provide sectoral-level detail) GHGs were emitted across the following primary economic sectors globally: industry (29

[34]. According to the EPA, emissions of GHGs are typically expressed in a common metric so that their impacts can be directly compared, as some gases are more potent (have a higher GWP) than others. Gases with a higher GWP absorb more energy (and thus contribute more to warming the earth) than gases with a lower GWP. The international standard practice is to express GHGs in CO_2 equivalents, or CO_2e. Emissions of gases other than CO_2 are translated into CO_2e using GWPs. A GWP is calculated over a specific time interval, commonly 20, 50, or 100 years. The IPCC recommends using 100-year potentials (EPA 2017d).

percent); electric power generation (29 percent); land use, agriculture, and waste (20 percent); transportation (15 percent); and buildings (7 percent) (Rivera et al. 2023).

National Emissions Trends

GHG emissions in the U.S. are tracked by the EPA through two complementary programs. First is the U.S. annual GHG emissions inventory, the *Inventory of U.S. Greenhouse Gases and Sinks*, which is published annually by the EPA; this inventory report estimates the total national GHG emissions and removals associated with human activities in all 50 states and compares it to emissions from the prior year. The 2018 Final EIS used the 2017 inventory report (EPA 2017), which covered 2015 GHG emissions data; the most recent inventory report was issued in 2024 and covers 2022 GHG emissions data (EPA 2024d). Data from 2022 (EPA 2024d) are compared to 2015 data in this SEIS to show the trends since issuance of the 2018 Final EIS; as applicable to demonstrate trends, the 2022 date is also compared to data older than 2015.[35] The second program is the Greenhouse Gas Reporting Program (GHGRP), which generally applies to facilities that emit more than 25,000 million metric tons (MMT) of CO_2e each year. The facility-level emissions reported under GHGRP are published through the Facility Level Information on Greenhouse Gases Tool (FLIGHT) (EPA 2024m). EPA estimates that the FLIGHT data reported by large emitters reflect 85 to 90 percent of the total U.S. emissions.

GHG emissions include both anthropogenic and natural emissions of GHGs. The gross total 2022 GHG emissions for the U.S. were 6,343.21 MMT CO_2e (EPA 2024e), as compared to gross total national 2015 GHG emissions of 6,736.22 MMT CO_2e cited in the 2018 Final EIS. Compared to 2015 (the latest data year used in the 2018 Final EIS), total gross annual GHG emissions in the U.S. have decreased by 5.8 percent. Net GHG emissions account for removals by sinks (e.g., carbon uptake by forests). Net GHG emissions in 2022 were 5,489.0 MMT CO_2e (EPA 2024d). Overall, net emissions increased by 1.3 percent from 2021 to 2022 and decreased by 16.7 percent from 2005 levels (EPA 2024d).

Important drivers of year-to-year emissions are long-term trends in population and economic growth, energy markets, technological changes (including energy efficiency), the price of fuel, weather, and other factors. For example, from 2019 to 2020, there was a steep decline in emissions, due in part to the impacts of the coronavirus (COVID-19) pandemic on travel and other economic activity (EPA 2024d). In 2020 and 2021, the increase in total GHG emissions was primarily due to an increase in CO_2 emissions from fossil fuel combustion related to the economic rebound after the height of the COVID-19 pandemic (EPA 2024d).

The primary GHG emitted by human activities in the United States is CO_2, representing nearly 80 percent of total GHG emissions in 2022, and the largest source of CO_2 is fossil fuel combustion (e.g., transportation [29 percent] and power generation [25 percent])(EPA 2024e). Overall, CO_2 emissions (5,053.02 MMT CO_2e in 2022) have decreased 1.5 percent since 1990 (EPA 2024d) and decreased 5.9 percent since 2015 (EPA 2024e).

Methane (CH_4) emissions from sources such as domestic livestock, natural gas, and waste decomposition account for about 11 percent of total U.S. GHG emissions (EPA 2024e). Overall, CH_4 emissions (760.75 MMT CO_2e in 2022) in the U.S. have decreased about 19.4 percent since 1990 (EPA 2024d) and about 8.13 percent since 2015 (EPA 2024e).

Nitrous oxide (N_2O) is produced by biological processes that occur in soil and water and by a variety of human activities in the agricultural, energy, industrial, and waste management fields; N_2O emissions

[35]. A supplement to the annual emissions inventory report is the EPA's Greenhouse Gas Inventory Explorer (2024e), a web-based tool that allows comparison of the EPA's GHG emissions inventory for key gases across decades (1990-2022). This internet tool was used to compare data years and describe the resulting trends in this SEIS.

account for about 6 percent of total U.S. GHG emissions (EPA 2024e). Overall, U.S. N_2O emissions (398.84 MMT CO_2e in 2022) have increased about 4.5 percent since 1990 (EPA 2024d) and about 9.22 percent since 2015 (EPA 2024e).

The five main types of fluorinated GHGs are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3), and other fully fluorinated GHGs. HFCs and PFCs (synthetic chemicals emitted from the production of electronics and aluminum), as well as SF_6 (emitted from the manufacturing and use of electrical transmission and distribution equipment) and NF_3 (emitted from electronics production), are potent GHGs with long atmospheric lifetimes. Fluorinated gas emissions account for about 3 percent of total U.S. GHG emissions (EPA 2024e). HFCs account for most fluorinated GHG emissions; HFC emissions (182.8 MMT CO_2e in 2022) have increased 282.9 percent since 1990. PFC emissions (6.7 MMT CO_2e in 2022) have decreased 83.1 percent. SF_6 emissions (7.6 MMT CO_2e in 2022) have decreased more than 80 percent since 1990 due to increasing prices of SF_6 and emission reduction programs. NF_3 emissions (1.1 MMT CO_2e in 2022) have increased 238.3 percent since 1990 (EPA 2024d). In total, fluorinated GHG emissions (198.13 MMT CO_2e in 2022) have increased 12.2 percent since 2015 (EPA 2024e).

In recent years, there has been a general nationwide trend of declining GHG emissions across many sectors (EPA 2024d). In its annual inventory, the EPA considers emissions in five sectors: energy (including electric power and electricity generation), industrial processes, agriculture, waste management, and land use and forestry (sinks). GHG emission sources in the energy sector account for most GHG emissions. Overall, emissions (5,199.8 MMT CO_2e in 2022) from energy production have decreased 3.4 percent since 1990 (EPA 2024d) and decreased 6.8 percent since 2015 (EPA 2024e). Agriculture is the next highest GHG emissions source after energy. Overall, emissions (593.4 MMT CO_2e in 2022) from agriculture have increased by 7 percent since 1990 (EPA 2024d) and have decreased about 3.5 percent since 2015 (EPA 2024e). Industrial processes and product use, which include the chemical or physical transformation of raw materials, account for the third highest gross U.S. GHG emissions. Overall, emissions (383.2 MMT CO_2e in 2022) from industrial processes and product use have increased by about 3.9 percent since 1990 (EPA 2024d) and increased 3.7 percent since 2015 (EPA 2024e). Waste management, particularly from landfills, accounts for the least total gross U.S. GHG emissions. Overall, emissions (166.9 MMT CO_2e in 2022) from waste management have decreased about 29.3 percent since 1990 (EPA 2024d) and have decreased 2.8 percent since 2015 (EPA 2024e). Forests, cropland, and rangeland provide a vast terrestrial carbon sink that helps balance U.S. emissions; in 2021, these uses provided a sink for 854.27 MMT CO_2e (EPA 2024e).

Federal lands are responsible for GHG emissions from activities such as fossil fuel extraction and combustion, as well as carbon sequestration, which is the process of capturing and storing atmospheric carbon dioxide through uptake into soils, vegetation, aquatic environments, and other ecosystems (biologic sequestration) or through injection into porous underground rock formations (geologic sequestration). The U.S. Geological Survey (USGS) has estimated GHG emissions and carbon sequestration on Federal lands for the 10-year period from 2005 to 2014 (Merrill et al. 2018). GHG emissions (when considering just CO_2) associated with the combustion and extraction of fossil fuels from U.S. Federal lands increased from 1,362 MMT CO_2e in 2005 to 1,429 MMT CO_2e in 2010, and then decreased to 1,279 MMT CO_2e in 2014. CH_4 and N_2O emissions from Federal lands also decreased over the same 10-year period. When the Federal lands' fossil fuel extraction and combustion emissions are combined with ecosystem emissions and sequestration estimates, the annual net carbon emissions from Federal lands within the conterminous U.S. (48 contiguous states) ranged from 683 MMT CO_2e to 783.5 MMT CO_2e from 2005 to 2014, indicating a net increase in carbon emission from Federal lands within the conterminous U.S.

Montana Emissions Trends

Emission trends in Montana have been similar to those on the national level: there has been a slight general increase in state GHG emissions since 1990 (based on data through 2021; EPA 2024e). Overall, gross GHG emissions in Montana (52.251 MMT CO_2e in 2021) have increased by about 2.8 percent since 1990 and have decreased 8.5 percent since 2015 (the data year used in the 2018 Final EIS).

The EPA requires reporting of GHG data from large GHG emission sources: pursuant to FLIGHT (EPA 2024m), there are 31 facilities categorized as large emitters in the state of Montana, including the Colstrip Power Plant and the Rosebud Plant. In Montana, these large emitters produced about 17.574 MMT CO_2e in 2022 (EPA 2024m). Therefore, large emitters account for about 34 percent of Montana's total GHG emissions.

As with national data, the EPA's Montana GHG inventory data (EPA 2024e) are broken down into several general categories: energy, industrial processes, agriculture, waste management, and land use and forestry (sinks). Since 1990, the sources of emissions in Montana have been shifting sectors from electric power generation and industry to agriculture and other sources. Overall, energy sector emissions (31.529 MMT CO_2e in 2021) have decreased 26 percent since a high in 2007 (42.784 MMT CO_2e) and about 14 percent since 2015 (EPA 2024e). The overwhelming energy contributor continues to be general fossil fuel combustion, especially coal power plants and oil refineries. Overall, agricultural emissions (19.014 MMT CO_2e in 2021), which are the second highest source of GHG emissions in Montana, have increased 22 percent since 1990 (EPA 2023a) and a little less than 2 percent since 2015. For industrial processes, overall emissions (1.108 MMT CO_2e in 2021) are down about 63 percent since 1990 (EPA 2024e) but have increased about 4 percent since 2015 (EPA 2024e). Waste emissions (0.600 MMT CO_2e in 2021) have increased more than 37 percent since 1990 and have increased a little less than 1 percent since 2015. Montana's forests, cropland, and rangeland provide a vast terrestrial carbon sink that helps balance the state's emissions; in 2021, these uses provided a sink for 10.163 MMT CO_2e (EPA 2024e).

At the state scale (as well as the national scale described above), Federal lands are responsible for GHG emissions from activities such as fossil fuel extraction and combustion, as well as biological and geological carbon sequestration. The annual net carbon emissions from Montana ranged from 15.6 MMT CO_2e to 20.2 MMT CO_2e from 2005 to 2014, indicating a net increase in carbon emission from Montana Federal lands (Merrill et al. 2018). The BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends presents the estimated emissions of GHGs attributable to fossil fuels produced on lands and mineral estate managed by the BLM. More specifically, the report estimates GHG emissions from coal, oil, and gas development that is occurring, and is projected to occur, on the Federal onshore mineral estate. BLM estimated a total of 1,033.21 Mt CO_2e from all coal production on Federal lands in 2022 and 33.5 Mt CO_2e from all coal production on Federal lands in Montana in 2022 (BLM 2022).

Coal Production

The Energy Information Administration (EIA) tracks coal production in the U.S. (EIA 2024). Total U.S. production in 2022 was a little more than 595 million tons as compared to nearly 897 million tons in 2015 (the data year used in the 2018 Final EIS), representing a nearly 34 percent reduction in U.S. production since the issuance of the 2018 Final EIS. In Montana, total coal production in 2022 was about 28.2 million tons, as compared to about 41.9 million tons in 2015 (data year used in the 2018 Final EIS), representing about a 33 percent reduction in Montana production since the issuance of the 2018 Final EIS (**Table 3.4-2**).

Table 3.4-2. Montana Coal Production in 2015 versus 2022.

Mine	Production (tons/year)	
	2015	2022
Absaloka Mine	5,534,969	2,229,591
Bull Mountains Mine	6,419,645	7,431,273
Decker (East and West) Mines	2,980,682	0*
Rosebud Mine	9,671,003	6,970,910
Savage Mine	270,285	36,282
Spring Creek Mine	16,987,420	11,565,298
Total	**41,864,004**	**28,233,354**

*The Decker coal mines closed in 2021.
Source: EIA 2024.

As described in **Section 2.2.1, Past and Existing Production**, Westmoreland Rosebud recovered about 7.1 million tons of coal from the Rosebud Mine (Areas B and F) in 2023. Production in recent years has ranged between a low around 5.4 million tons to a high around 7.1 million tons in 2023 (see discussion in **Chapters 1** and **2**). Future production from the Rosebud Mine will depend on a number of factors, including market conditions (see additional discussion in **Section 2.2.6, Life of Operations** and in **Section 4.3.3.1, Direct Impacts** (Air Quality). The BLM developed reasonably foreseeable development scenarios for the Rosebud Mine in its recent *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). The BLM estimates there are sufficient leased coal reserves within the Federal subsurface mineral estate to meet forecasted production levels (112.5 million tons) at the Rosebud Mine through 2060 (BLM 2024a); however, not all of the Federal coal is currently permitted. The BLM estimates there are sufficient leased coal reserves to meet forecasted production levels (88.2 million tons) at the Spring Creek Mine through 2035 (BLM 2024a); estimates for the other mines are not available.

Three potential sources of fugitive CH_4 are associated with surface coal mining:

- Emissions from the coal excavated and processed during mining activities
- Emissions from the coal and other gas-bearing strata in the overburden or underburden exposed by mining activities
- Emissions from the overburden coal excavated and stored on-site in waste piles

As discussed in the 2018 Final EIS, despite the fact that the majority of U.S. coal comes from surface mines (about 63 percent in 2015), CH_4 emissions from surface mines constitute only 14 percent of total U.S. coal-mine methane emissions from active mines (EPA 2017).

3.4.2.2 Rosebud Mine GHG Emissions

The primary sources of GHG emissions from the Rosebud Mine are fugitive CH_4 emissions from exposed coal, and exhaust from mobile and stationary engines used at the mine, including those that power the conveyor to the Colstrip Power Plant (see discussion of sources in **Section 3.3.4.1, Existing Emissions from the Rosebud Mine**). Mobile sources of GHG include gasoline- and diesel-powered loaders, coal-haul trucks, coal and overburden drills, hydraulic excavators, support vehicles, maintenance equipment, other materials handling equipment (e.g., graders, dozers, dump trucks, and reclamation tractors), and explosive detonation. The dominant fuel used for mobile sources at the Rosebud Mine is diesel.

As described in the 2018 Final EIS **Section 3.4.2.4**, GHG emissions were estimated for the mine (Areas A B, C, D, and E) using activity data for 2010-2015 provided by Westmoreland Rosebud. To estimate emissions from off-road diesel and gasoline mobile sources, CO_2, CH_4, and N_2O emission factors for diesel and gasoline fuel combustion were applied to the annual reported fuel usage rates. Annual stationary diesel equipment emissions were calculated based on the stationary diesel usage rate for the mine (Areas A, B, C, D, and E), along with stationary diesel equipment emission factors. Emissions from the hauling of waste coal to the Rosebud Power Plant were estimated using EPA's Motor Vehicle Emissions Simulator (MOVES) model with data provided by Westmoreland Rosebud and were assumed to be representative of annual emissions. Surface methane emissions were calculated based on an emission rate of 33.1 standard cubic feet per ton (scf/ton) (EPA 2005a). None of the basins with available methane production rates were located in Montana; therefore, the value for Green River Basin (Wyoming) was selected. The resulting annual GHG emission rates for the Rosebud Mine and associated activities (e.g., crushing, hauling, conveying, etc.) are provided in **Table 3.4-3** (**Table 33** from the 2018 Final EIS). Based on recent production and the rationale provided above in **Section 3.3.4.1, Existing Emissions from the Rosebud Mine**, the GHG emissions estimates from the Final 2018 EIS (**Table 3.4-3**) provide a reasonable or even over-estimate of current GHG emissions from the Rosebud Mine; total production from the Rosebud Mine in 2023 was 7,027,880 tons (Area F accounted for about 65 percent of this production).

Table 3.4-3. Historic GHG Emissions Summary from the Rosebud Mine (All Permit Areas).

Year	Coal Production (MT/year)	GHG Emissions (MT/year)			
		CO_2	CH_4	N_2O	CO_2e
2010	11,095,174	47,333	8,211	1.19	277,550
2011	7,969,457	39,554	5,898	1.00	204,959
2012	7,273,891	40,268	5,383	1.01	191,271
2013	7,482,397	42,188	5,538	1.06	197,526
2014	8,181,408	39,085	6,055	0.98	208,877
2015	8,732,547	45,887	6,463	1.16	227,151

MT/year = metric tons per year.

3.4.2.3 Colstrip and Rosebud Power Plants Stationary Source GHG Emissions

The most recent GHG emissions (2016-2022) for the power plants are presented below in **Table 3.4-4** and compared to the GHG emissions (2010-2015) data provided in **Table 34** of the 2018 Final EIS. Since then, two of the four units at the Colstrip Power Plant (Units 1 and 2) have been retired (as of January 2020); see discussion in **Chapter 1, Section 1.2.2, Coal Combustion**. Recent GHG emissions from the Colstrip Power Plant were less than those considered in the 2018 Final EIS (**Table 3.4-4**). Recent GHG emissions for the Rosebud Power Plant generally were similar to those previously considered, except in 2016 and 2021, when emissions were somewhat higher (see the cells with asterisks in **Table 3.4-4**).

Table 3.4-4. Historic GHG Emissions Summary from the Colstrip and Rosebud Power Plants.

Year	GHG Emissions (MT/year)			
	CO_2	CH_4	N_2O	CO_2e
All Colstrip Units (1 to 4)				
2010	16,994,687	1,902	277	17,121,274
2011	13,991,414	1,535	223	14,093,594
2012	13,395,792	1,455	212	13,492,605
2013	13,577,421	1,491	217	13,676,663
2014	14,796,150	1,627	237	14,904,402
2015	15,854,041	1,740	253	15,969,860
2016	14,281,357	1,596	232	14,390,436
2017	13,826,006	1,589	231	13,934,589
2018	13,211,678	1,521	221	13,315,612
2019	14,167,992	1,603	233	14,277,559
Colstrip Units 3 and 4				
2020	8,274,559	964	140	8,340,434
2021	9,954,520	1,183	172	10,035,340
2022	10,653,538	1,275	185	10,740,663
Rosebud Power Plant				
2010	415,871	51	7	419,297
2011	371,211	39	6	373,832
2012	427,247	45	7	430,267
2013	439,555	50	7	442,812
2014	418,448	48	7	421,612
2015	472,857	48	7	476,043
2016	*520,285	48	7	*523,594
2017	310,979	30	4	313,011
2018	411,215	54	8	414,892
2019	376,950	45	7	380,050
2020	370,283	46	7	373,440
2021	*487,752	48	7	*491,021
2022	436,594	45	7	439,647

MT/year = metric tons per year.
* These cells have higher values than what were disclosed in the 2018 Final EIS.
Source: 2011-2015 GHG emissions were acquired from the EPA’s FLIGHT, which uses GWP from the Intergovernmental Panel on Climate Change’s (IPCC’s) AR4. Reported CO2e was revised for CH4 and N2O using the GWP from the IPCC’s AR5. 2016-2022 GHG emissions are from the EPA’s Envirofacts site (EPA 2024f and EPA 2024g) and have been rounded to the nearest whole number.

3.4.2.4 Emissions from Worker Commutes

In addition to GHG emissions related to the operations of the Rosebud Mine, the Colstrip Power Plant, and the Rosebud Power Plant, GHG emissions are generated by workers employed at those facilities during their daily commutes. GHG emissions were calculated using a distance-based method outlined in the *Technical Guidance for Calculating Scope 3 Emissions* (World Resources Institute et al. 2013). Data inputs provided in **Table 3.4-5** below were used in the calculations. Emission factors for light trucks, which was the vehicle assumed to be the most commonly used by commuters, were obtained from Table 10 in *Emission Factors for Greenhouse Gas Inventories* (EPA 2024l). The following emissions factors were used: 0.405 kg/vehicle-mile CO_2, 0.011 g/vehicle-mile CH_4, and 0.010 g/vehicle-mile N_2O. Annual worker commute emissions are provided in **Table 3.4-6**.

Table 3.4-5. Data Used to Calculate Worker Commute GHG Emissions.

Data	Rosebud Mine[1]	Colstrip Power Plant[2]	Rosebud Power Plant
Total employees	320	260	101
Average one-way distance (miles) travelled by employees per day	40.9 miles*	40.9 miles*	40.9 miles*
Commuting days per week (7 days)	35 employees commuting 5 days/week 285 crew members commuting 4 days/week	260 employees commuting 4 days/week	101 employees commuting 4 days/week
Commuting days per year per employee	214	208	208
Total annual distance traveled (mi) for light trucks (number of employees × daily one-way distance between home and work (miles) × 2 × number of commuting days per year)	5,593,484 miles/year	4,423,744 miles/year	1,718,454 miles/year

*All three facilities (Rosebud Mine, Colstrip Power Plant, and Rosebud Power Plant) are within the immediate vicinity of the city of Colstrip. Employees of these facilities live in the tri-county (Rosebud, Treasure, and Big Horn) region that includes the following incorporated municipalities: Colstrip (1.5 miles), Forsyth (47 miles), Hardin (80 miles), Hysham (52 miles), and Lame Deer (24 miles). This analysis used an average commute distance and assumed an even distribution of employees from each of the municipalities.

1. Source: Batie 2024.

2. Source: Criswell 2024 and Olsen 2024.

Table 3.4-6. Worker Commute GHG Emissions.

Employer	Total Annual Distance (miles) for Light Trucks	CO_2 (kg) Annual CO_2e Emissions	CH_4 (g) Annual CO_2e Emissions	N_2O (g) Annual CO_2e Emissions
Colstrip Power Plant	4,423,744	1,791,616	48,661	44,237
Rosebud Power Plant	1,718,454	695,974	18,903	17,185
Rosebud Mine	5,593,484	2,265,361	61528	55,935
Total	11,735,682	4,752,951 (4,753 MT)	129,093 (0.13 MT)	117,357 (0.18 MT)

Note: Values have been rounded to the nearest whole numbers.

3.5 PUBLIC HEALTH AND SAFETY

3.5.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to public health and safety, other than those described above for air quality and climate. Information on public health and safety is available in **Section 3.5** of the 2018 Final EIS beginning on page 170.

3.5.1.1 Regulatory Framework

The regulatory framework applicable to public health and safety is unchanged since the 2018 Final EIS and is described in **Section 3.5.1.1** of the 2018 Final EIS beginning on page 170.

3.5.1.2 Analysis Area

The analysis areas for public health and safety are described in **Section 3.5.1.2** of the 2018 Final EIS beginning on page 172. For direct public health effects, this area includes the project area,[36] nearby residences and waterbodies, and the transportation network (**Figure 1.1-2** in **Chapter 1**). As with socioeconomics and environmental justice, indirect public health effects were analyzed in the tri-county area (Rosebud, Bighorn, and Treasure Counties); see **Figure 3.15-1**. For public safety, the same analysis areas as for noise (**Section 3.22.1.2**) and solid and hazardous waste (**Section 3.21.1.2**) were used.

3.5.2 Environmental Health

Information on environmental health is available in the 2018 Final EIS in **Section 3.5.2** beginning on page 173.

3.5.2.4 Surface Water and Groundwater Quality

Please note that Circular DEQ-7, which provides Montana Numeric Water Quality Standards pursuant to Administrative Rules of Montana (ARM) 17.30.629, was updated in 2019; the 2017 standards were used in the Final EIS analysis. The change in water quality standards in Circular DEQ-7 is not a significant new circumstance for the public health and safety analysis as the new standards would not result in remarkably different outcomes than the impacts described in the 2018 Final EIS. See **Section 3.7, Water Resources – Surface Water**, below for a more detailed discussion of updated water quality standards.

3.5.3 Socioeconomic Environment and Health

Information on socioeconomic environment and health is available in the 2018 Final EIS in **Section 3.5.3** beginning on page 183.

36. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres). These minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.5.4 Public Safety

Information on public safety is available in the 2018 Final EIS in **Section 3.5.4** beginning on page 186.

3.6 GEOLOGY

3.6.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to geology. Information on project area geology is available in **Section 3.6** of the 2018 Final EIS beginning on page 187.

3.6.1.1 Regulatory Framework

The regulatory framework for geology is unchanged since the Final EIS and is described in **Section 3.2.1.1** of the 2018 Final EIS beginning on page 187.

3.6.1.2 Analysis Area

The analysis areas for geology, which are the project area[37] for direct effects and the downstream watersheds for indirect effects, are described in detail in **Section 3.6.1.2** of the 2018 Final EIS beginning on page 187.

3.6.2 Analysis Area Geology

Information on the affected environment (analysis area geology) is available in the 2018 Final EIS in **Section 3.6.2** beginning on page 187.

3.6.3 Regional Geology

Information on the affected environment (regional geology) is available in the 2018 Final EIS in **Section 3.6.3** beginning on page 195.

[37]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres). These minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.7 WATER RESOURCES – SURFACE WATER

3.7.1 Introduction

This section describes surface water resources that occur within the direct and indirect effects analysis areas, including a description of floodplains, stream flow, spring flow, and ponds. This section also describes surface water quality in the direct and indirect effects analysis areas and includes the regulatory requirements to protect surface water (floodplains, quantity, and quality).

This section has been updated from the November 2018 Final EIS, in part, to address the deficiencies identified in the September 30, 2022, court order (see **Section 1.1, Introduction**). An updated description of the indirect analysis area is provided in **Section 3.7.1.2**, updated descriptions and data related to surface water hydrology in the indirect effects analysis area are provided in **Section 3.7.5.4**, and updated descriptions and data related to surface water quality in the indirect effects analysis area are provided in **Section 3.7.6.2**.

The direct effects analysis area remains the same as what was defined in the 2018 Final EIS, but the indirect effects analysis area and the cumulative effects analysis area, defined below in **Section 3.7.1.2, Analysis Area**, and in **Section 5.3.6, Water Resources – Surface Water**, respectively, have been enlarged to include a portion of the Yellowstone River in response to the 2022 court order. As a result, this section has been updated to describe surface water resources in the expanded indirect and cumulative effects analysis areas to support analyses presented in **Chapter 4** (direct and indirect impacts) and **Chapter 5** (cumulative impacts). This section was also updated to describe Montana's surface water quality classifications and standards updated through state regulation and court action since the 2018 Final EIS. This includes (in **Section 3.7.1.1**) updated definitions for state waters, updated classifications for specific type waters, and updated surface water quality standards. Other changed conditions are listed in **Table 3.7-1**.

Table 3.7-1. Surface Water and Groundwater: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	In the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), which is also referred to as the CHIA in this SEIS, DEQ determined that Westmoreland's proposed mining plan put forth in its Permit Application Package (PAP) (Alternative 2 in the 2018 Final EIS), if implemented in T2N, R38E, Section 12, would likely result in a change in water quality in the Rosebud Coal outside the permit boundary, which could result in material damage. To remove the potential for material damage, DEQ did not approve mine passes in that portion of the permit area in its 2019 ROD and Written Findings (DEQ 2019a). OSMRE similarly did not authorize mining in this portion of the permit area in its 2019 ROD (OSMRE 2019a).
2019	DEQ updated the water quality standards in Circular 7.
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in Area F in August 2020 pursuant to the approved state operating permit C2011003F and the 2019-approved Federal mining plan. Both the state operating permit and Federal mining plan prohibit mining in 74 acres of Federal coal in T2N, R38E, Section 12 to prevent material damage outside of the Area F permit area. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for groundwater: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative groundwater impacts of Area F. Area B AM5 was analyzed as a cumulative impact in the 2018 Final EIS, and DEQ prepared a CHIA for Area B AM5. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2023	Westmoreland monitors water resources in the project area and submits Annual Hydrology Reports to Montana DEQ as a condition of its operating permits for the Rosebud Mine. The most recent reporting year available is 2023 (January 1, 2023, through December 31, 2023); this report (WET 2024) was used to update water quality tables in **Appendix 3**.

3.7.1.1 Regulatory Framework

The regulatory framework has been updated (as applicable) to document regulatory changes since the 2018 Final EIS.

Federal Requirements

Federal surface water quantity and quality regulations applicable to the analysis area include the Clean Water Act (CWA) of 1972 and CWA Amendments of 1977, which require Federal agencies to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Surface Mining Control and Reclamation Act (SMCRA), which requires minimization of the disturbance to the hydrologic balance and to the quality and quantity of water in surface water and groundwater systems both during and after surface coal mining operations and during reclamation, is also applicable. Authority to administer SMCRA in the state has been delegated by OSMRE to DEQ (see **Section 1.4.1.1, Office of Surface Mining Reclamation and Enforcement** in the 2018 Final EIS), and DEQ administers several sections of the Federal CWA pursuant to an agreement between the state and EPA. Both the CWA and SMCRA are discussed in more detail below.

Surface Water Quantity

SMCRA requires that surface coal mining and reclamation operations protect surface water and groundwater resources, including the hydrologic balance on-site and off-site, natural watercourses on-site and off-site, watersheds, springs, seeps, aquifers (Sections 510, 515, 516, 517, and 522), water supply, and water rights (Sections 403, 406, 407, 411, and 522). The Environmental Protection Performance Standards (Section 515 of SMCRA) require that surface coal mining and reclamation operations "minimize disturbances to the prevailing hydrologic balance at the mine site and in associated off-site areas and to the quality and quantity of water in surface and groundwater systems both during and after surface coal mining operations and during reclamation."

Surface Water Quality

The CWA utilizes both water quality standards and technology-based effluent limitations to protect water quality. To achieve its objectives, the CWA's National Pollutant Discharge Elimination System program (Section 402 of the Act) requires the discharger to attain technology-based effluent limits and specify the effluent limitations a discharger must meet and the deadline for compliance (Congressional Research Service 2016).

SMCRA requires that surface coal mining and reclamation operations protect surface water and groundwater quality in compliance with all applicable state and Federal water quality laws and regulations and with the effluent limitations for coal mining operations. DEQ is responsible for enforcing compliance with most water quality laws on all lands in the state, excluding tribal lands (see **State Requirements** below).

For industrial sources, national effluent limit guidelines (ELGs) have been developed for specific categories of industrial facilities and represent technology-based effluent limits. The analysis area is in an industrial category that is specifically identified and included in the ELGs at 40 CFR § 434, Coal Mining. The Federal ELGs that apply to discharges from the project area are for alkaline mine drainage (Subpart D), western alkaline coal mining (Subpart H), and precipitation discharge events (Subpart F). ELGs after application of the best practicable control technology currently available are provided in **Table 3.7-2** for new coal facilities. Alkaline mine drainage is defined as having a pH equal to or greater than 6.0, a total iron concentration of less than 10 mg/L, and a net alkalinity greater than zero prior to any treatment.

Table 3.7-2. Effluent Limit Guidelines for New Coal Mine Point Source Discharges.

Parameter	1-Day Maximum	30-Day Average
Iron, total (mg/L)	6.0	3.0
Total suspended sediments (mg/L)	70.0	35.0
pH (s.u.)	6.0–9.0	6.0–9.0
Settleable solids[1] (mL/event)	0.5	NA

mg/L = milligrams per liter; s.u. = standard units; mL = milliliters.
[1.] Settleable solids limits are for discharges caused by precipitation events less than or equal to the 10-year, 24-hour precipitation event.
Source: 40 CFR § 434, Subparts D and F.

Subpart H is applicable to alkaline mine drainage at western coal mining operations from reclamation areas, brushing and grubbing areas, topsoil stockpiling areas, and graded areas. Subpart H requires submittal of a site-specific Sediment Control Plan designed to prevent an increase in the average annual sediment yield from current, undisturbed conditions. The Sediment Control Plan must identify Best Management Practices (BMPs); describe design specifications, construction specifications, maintenance schedules, and criteria for inspection; and specify the expected performance and longevity of the BMPs. BMPs must be designed, implemented, and maintained as specified in the approved Sediment Control Plan.

EPA has delegated authority to the state, through DEQ, for administering non-point-source pollution prevention programs, the National Pollutant Discharge Elimination System program for point sources, and water quality standards. The Montana Water Quality Act provides a regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses.

State Requirements

State surface water quantity and quality regulations applicable to the analysis area include the Montana Surface and Underground Mine Reclamation Act (MSUMRA), which contains reclamation requirements to protect the hydrologic balance and achieve postmining land use performance standards. Hydrologic balance is defined as the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in groundwater and surface water storage per Section 82-4-203(24), MCA. The Montana Water Quality Act, which prevents degradation of surface waters and groundwaters due to discharges of mine wastewater and storm water, is also applicable. Both MSUMRA and the Montana Water Quality Act are discussed in more detail below. State water rights requirements are described in **Section 3.9.1.1**.

MSUMRA conditions approval of an application for a coal mine operating permit on demonstration by the applicant that "the assessment of the probable cumulative impact of all anticipated mining in the area on the hydrologic balance has been made by the department [DEQ] and the proposed operation of the mining operation has been designed to prevent material damage to the hydrologic balance outside the permit area" under Section 82-4-227(3)(a), MCA, and ARM 17.24.405(6)(c). MSUMRA defines "material damage" as follows: "with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage." The permit application must contain a detailed description of the "measures to be taken during and after mining activities to minimize disturbance to the hydrologic balance on and off the mine permit area and prevent material damage to the hydrologic balance outside the permit area" (ARM 17.24.314(1)). Material damage criteria are established for the evaluation of both surface water and groundwater quality and quantity, and are used to determine whether water quality or quantity outside the permit area will be impacted to the extent that land uses or beneficial uses of water are adversely affected, water quality standards outside the permit area will be violated, or water rights outside the permit area will be impacted by the proposed mine operations. An approved application for a coal mine operating permit allows adverse effects on water quality and quantity within the permit boundary as long as the proposed mining includes measures to minimize disturbance on and off the mining plan area and to prevent material damage to the hydrologic balance outside the permit area (ARM 17.24.314(1)).

Surface Water Quantity and Quality

The rules implementing MSUMRA (ARM 17.24.301 through 1309) provide requirements to protect water quality and quantity, including water quality performance standards and the use of best technology currently available to protect water resources. The regulations limit or prevent stream-channel disturbances within 100 feet of a perennial or intermittent stream or a stream reach with a biological community (as defined by ARM 17.24.651(3)) and to the stream itself. Disturbances within 100 feet may be approved provided requirements are met for reclaiming drainage basins to restore the original stream function and prevent, during and after mining, adverse impacts on water quantity and quality and other environmental resources of the stream and lands within 100 feet of the stream. The regulations provide requirements for the design, construction, stabilization, and maintenance of water diversions, sediment ponds, and other treatment facilities (e.g., discharge structures and acid- and toxic-forming spoil impoundments). The regulations also require surface water monitoring and reporting. Section 82-4-203, MCA provides definitions for ephemeral drainages and intermittent and perennial streams:

- "'Ephemeral drainageway' means a drainageway that flows only in response to precipitation in the immediate watershed or in response to the melting of a cover of snow or ice and is always above the local water table."
- "'Intermittent stream' means a stream or reach of a stream that is below the local water table for at least some part of the year and obtains its flow from both groundwater discharge and surface runoff."
- "'Perennial stream' means a stream or part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff."

DEQ is responsible for administering the Montana Water Quality Act through issuance of Montana Pollutant Discharge Elimination System (MPDES) Permits, which regulate discharges of pollutants into state surface waters, and adoption of water quality standards and nondegradation policy (implementing rules: ARM 17.30.101 et seq.). Montana's nondegradation policy and implementing rules apply to any human activity resulting in a new or increased source that may cause degradation of high-quality waters. The analysis area would be considered a new source. High-quality waters include all state surface waters except those "not capable of supporting any one of the designated uses for their classification" or those that "have zero flow or surface expression for more than 270 days during most years" (Section 75-5-103(12), MCA). For all state waters, existing and anticipated uses and the water quality necessary to protect those uses must be maintained. For high-quality waters outside the permit boundary, degradation may be authorized by DEQ following procedures described in ARM 17.30.708, or it may be determined that the changes in existing water quality are nonsignificant as described in ARM 17.30.715 or 17.30.716. The nondegradation rules do not apply to nonpoint sources of pollution to water resources within (or outside) the permit boundary.

DEQ also administers several sections of the CWA pursuant to an agreement between the state and the EPA. DEQ developed water quality classifications and standards, as well as a permit system to control discharges into state waters. Mining operations must comply with state regulations and standards for surface water and groundwater. MPDES Permits are required for point source discharges of wastewater to state surface water. MPDES Permits regulate discharges of wastewater by establishing effluent limitations based on, when applicable, technology-based effluent limits, state surface water quality standards including numeric and narrative requirements, and nondegradation criteria.

Section 303(d) of the CWA requires states to assess the condition of state waters to determine where water quality is impaired (does not fully support uses identified in the stream classification or does not meet all water quality standards) or threatened (is likely to become impaired in the near future). The result of this review is the compilation of a 303(d) list, which states must submit to the EPA biannually. Section 303(d) also requires states to prioritize and target waterbodies on their list for development of water quality improvement strategies, and to develop such strategies for impaired and threatened waters such as Total Maximum Daily Loads (TMDLs). A TMDL, as defined by the EPA, is a pollution budget that includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and allocates the necessary reductions to one or more pollutant sources. A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the ultimate goal of attaining or maintaining water quality standards. The 303(d) list includes probable causes (a chemical or physical condition that could affect uses) and probable sources (an activity that could contribute to that condition). The actual causes and sources of impairment are determined and quantified during the TMDL development process. Causes are listed with high, medium, or low confidence, and sources are listed as either confirmed or unconfirmed.

Streams near the Rosebud Mine that are on the current 303(d) list include one stream associated with the direct effects analysis area (West Fork Armells Creek) and five streams associated with the indirect effects analysis area (East Fork Armells Creek, Armells Creek, and portions of Sarpy Creek, Rosebud Creek, and the Yellowstone River) as shown on **Figure 3.7-1** and Figure **3.7-2**. **Table 3.7-3** summarizes impairments, probable causes of impairment, and probable sources of impairment for those streams as detailed in the current 303(d) list (DEQ 2020).

Table 3.7-3. Impaired Waters in the Analysis Area.

Waterbody Name	Waterbody Location	Impairment	Cause Name	Source Name
West Fork Armells Creek	Headwaters to Mouth (Armells Creek)	Not Fully Supporting Aquatic Life	Aluminum	Natural Sources
			Iron	Source Unknown
East Fork Armells Creek	Headwaters to East Rosebud Mine Outfall 020	Not Fully Supporting Aquatic Life	Alteration in Streamside or Littoral Vegetative Covers	Grazing in Riparian or Shoreline Zones
	East Rosebud Mine Outfall 020 to Mouth (Armells Creek)	Not Fully Supporting Aquatic Life	Alteration in Streamside or Littoral Vegetative Covers	Agriculture
			Aluminum	Coal Mining
			Habitat Alterations	Grazing in Riparian or Shoreline Zones
			Iron	Natural Sources
			Nitrate/Nitrite (Nitrite + Nitrate as N)	Source Unknown
			Nitrogen, Total	Transfer of Water from an Outside Watershed
			Phosphorus, Total	
			Specific Conductivity	
			Total Dissolved Solids (TDS)	
Armells Creek	Confluence of East and West Forks to Mouth (Yellowstone River)	Not Fully Supporting Aquatic Life	Aluminum	Natural Sources
			Iron	Source Unknown
Sarpy Creek	Crow Indian Reservation Boundary to Mouth (Yellowstone River)	Not Fully Supporting Aquatic Life	Nitrate/Nitrite (Nitrite + Nitrate as N)	Crop Production (Non-Irrigated)
			Nitrogen, Total	Grazing in Riparian or Shoreline Zones
			Phosphorus, Total	Grazing in Riparian or Shoreline Zones
Rosebud Creek	Northern Cheyenne Reservation Boundary to Boundary at S28/29 T6N R42E	Not Fully Supporting Aquatic Life	Cause Unknown	Dam Construction (Other than Upstream Flood Control Projects)
	Boundary at S28/29 T6N R42E to Mouth (Yellowstone River)	Not Fully Supporting Aquatic Life	Physical Substrate Habitat Alterations	Loss of Riparian Habitat
Yellowstone River	Cartersville Diversion Dam to Powder River	Not Fully Supporting Aquatic Life	Alteration in Streamside or Littoral Vegetative Covers	Agriculture
			Copper	Crop Production (Irrigated)
			Lead	Municipal Point Source Discharges
			Nitrate/Nitrite (Nitrite + Nitrate as N)	Natural Sources
			Sediment	Post-Development Erosion and Sedimentation
			Total Dissolved Solids (TDS)	Rangeland Grazing
			Zinc	Source Unknown
			pH	Streambank Modifications/ Destabilization

Under MSUMRA, DEQ is required to prepare a CHIA as part of the written findings DEQ must issue when it approves a permit, a major revision to a permit, or an amendment to a permit (Section 82-4-231(8)(f), MCA; ARM 17.24.314(5); 17.24.405(1)). The findings provided in the CHIA (DEQ 2019b) for Area F were incorporated into this SEIS as applicable for the water resources sections (surface water, groundwater, and water rights). MSUMRA conditions approval of an application for a coal mine operating permit on demonstration by the applicant that "the assessment of the probable cumulative impact of all anticipated mining in the area on the hydrologic balance has been made by the department and the proposed operation of the mining operation has been designed to prevent material damage to the hydrologic balance outside the permit area" (Section 82-4-227(3)(a), MCA; see also ARM 17.24.405(6)(c)).

This requirement was adopted to make MSUMRA's requirements equivalent to a requirement in SMCRA. Neither SMCRA nor the applicable Federal rules provide a definition of "material damage" or "designed to prevent material damage." However, MSUMRA was amended in 2003 (Section 82-4-203(32), MCA) to define "material damage" as "with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage."

Section 82-4-203(25), MCA, also provides a definition of "hydrologic balance": "the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in groundwater and surface water storage." As a result, DEQ is charged with assessing material damage at the level of a hydrologic unit, "such as a drainage basin, aquifer, soil zone, lake, or reservoir" (Section 82-4-203(25), MCA).

Classification and Standards

This section has been updated to reflect regulatory changes since the 2018 Final EIS was issued. Circular DEQ-7, Montana Numeric Water Quality Standards (ARM 17.30.629) were updated in 2019 and were used for this SEIS; the 2017 version was used for the 2018 Final EIS. Based on recent developments related to ARM 17.30.615(2) since the 2018 Final EIS was issued, DEQ adopted a different approach to application of specific water quality standards for C-3 waters and ephemeral streams. Details of these regulatory changes are described below.

Montana's surface water quality is regulated through classifications and standards, which Section 75-5-301, MCA states:

> (1) establish the classification of all state waters in accordance with their present and future most beneficial uses, creating an appropriate classification for streams that, due to sporadic flow, do not support an aquatic ecosystem that includes salmonid or nonsalmonid fish;
>
> (2) formulate and adopt standards of water quality, giving consideration to the economics of waste treatment and prevention.

State waters are bodies of water, irrigation systems, or drainage systems, either surface or underground, excluding ponds or lagoons used solely for treating, transporting, or impounding pollutants (75-5-103(32)). Surface waters are any waters on Earth's surface including, but not limited to, streams, lakes, ponds, and reservoirs, as well as irrigation and drainage systems, but not water bodies used solely for treating, transporting, or impounding pollutants (ARM 17.30.602(31)). DEQ classifies surface water in the analysis area as C-3 based on the spatial description provided under ARM 17.30.611. Class C-3 waters "are to be maintained suitable for bathing, swimming, and recreation, and growth and propagation of nonsalmonid fish and associated aquatic life, waterfowl, and furbearers." The quality of C-3 waters is "naturally marginal for drinking, culinary, food-processing purposes, agriculture, and industrial water supply" under ARM 17.30.629(1). Montana surface water quality standards identified at ARM 17.30.629(2) for C-3 waters in the analysis area are provided in **Table 3.7-4** (DEQ 2019c) (updated from the corresponding table presented in the 2018 Final EIS). Narrative water quality standards found at ARM 17.30.637 apply to all state surface waters, including those in the project area.

The specific water quality standards for C-3 waters do not apply to hydrologically ephemeral streams pursuant to ARM 17.30.637(4). The general prohibition at ARM 17.30.637(4) states: "Treatment requirements for discharges to ephemeral streams must be no less than the minimum treatment requirements set forth in ARM 17.30.1203. Ephemeral streams are subject to ARM 17.30.635 through 17.30.637, 17.30.640, 17.30.641, 17.30.645, and 17.30.646 but not to the specific water quality standards of ARM 17.30.6.20 through 17.30.629." State surface waters in the project area including Trail Creek, McClure Creek, Robbie Creek, Donley Creek, and Black Hank Creek are predominantly considered ephemeral, and as such the general prohibition of ARM 17.30.637(4) applies to these ephemeral streams. The C-3 water quality standards for other state surface waters are applicable, excluding waterbodies solely used for treating, transporting, or impounding pollutants, which includes sedimentation ponds and traps associated with the mine's drainage control plan.

The standards listed in **Table 3.7-4** presumably would apply only to perennial and intermittent streams, ponds, and springs in the analysis area. Discharges to ephemeral streams would be subject to general treatment standards (ARM 17.30.635), general operation standards (ARM 16.30.636), and general prohibitions (ARM 17.30.637), but would not be subject to the water quality standards listed in **Table 3.7-4**.

Table 3.7-4. Montana Surface Water Quality Standards for C-3 Waters.

Parameter – Category[1]	Human Health Standard	Aquatic Life Standard[2]	
		Acute	Chronic
Temperature (°F) – H	—	• 3ºF maximum increase for naturally occurring range of 32º to 77ºF • In range of 77° to 79.5°F, no increase to above 80ºF • 0.5ºF maximum increase for naturally occurring 79.5ºF or greater • 2ºF per hour maximum decrease for naturally occurring temperatures above 55ºF; 2ºF maximum decrease for naturally occurring range of 32º to 55ºF	
pH (s.u.)[3]	—	—	—
Dissolved oxygen[4] – T	—	• 5.0 (early life) • 3.0 (other life stages)	• 6.0 (7-day mean, early life) • 4.0 (7-day mean minimum, other life stages) • 5.5 (30-day mean, other life stages)

Table 3.7-4. Montana Surface Water Quality Standards for C-3 Waters.

Parameter – Category[1]	Human Health Standard	Aquatic Life Standard[2]	
		Acute	Chronic
Escherichia coli	**April 1–October 31:** geometric mean may not exceed 126 colony-forming units per 100 milliliters, and 10 percent of the total samples may not exceed 252 colony-forming units per 100 milliliters during any 30-day period **November 1–March 31:** geometric mean may not exceed 630 colony-forming units per 100 milliliters, and 10 percent of the total samples may not exceed 1,260 colony-forming units per 100 milliliters during any 30-day period	—	—
Turbidity (NTU)[8] – H	—	Increase above ambient no more than 10 NTUs	Increase above ambient no more than 10 NTUs
Nitrate+nitrite, as N – T	10	No excessive amounts that would produce undesirable aquatic life	
Ammonia, as N – T	—	Calculated based on stream pH	Calculated based on stream pH and temperature
Total nitrogen	—	—	
Total phosphorus	—	—	
Aluminum[5] – T	—	0.75	0.087
Antimony[5]– T	0.0056	—	—
Arsenic[5] – C	0.01	0.34	0.15
Barium[5] – T	1.0	—	—
Beryllium[5] – C	0.004	—	—
Cadmium[5] – T	0.005	0.0074	0.0024
Chromium[5] – T	0.1	5.61/0.016[6]	0.27/0.011[6]
Copper[5] – T	1.3	0.052	0.031
Fluoride[5] – T	4.0	—	—
Iron[5] – H	—	—	1.0
Lead[5] – T	0.015	0.477	0.019
Mercury[5] – T, BCF>300[7]	0.00005	0.0017	0.0009
Nickel[5] – T	0.1	1.52	0.169
Selenium[5] – T	0.05	0.020	0.005
Silver[5] – T	0.1	0.044	—
Zinc[5] – T	2.0	0.388	0.388

All units are in milligrams per liter (mg/L) unless otherwise indicated.
1. T = toxic; C = carcinogen; H = harmful (aquatic life).
2. Many metals standards are hardness-dependent; for this table, values presented are based on a hardness of 400 mg/L. DEQ-7 states that 400 mg/L is to be used to calculate hardness-dependent metals standards when hardness is greater than or equal to 400 mg/L. Hardness in most surface water samples in the analysis area is greater than 400 mg/L.
3. s.u. = standard units. Under ARM 17.30.629(2)(c), induced variation in pH within a range of 6.5 to 9.0 must be less than 0.5 pH unit; natural pH outside this range must not change; natural pH above 7.0 must be maintained above 7.0.
4. Dissolved oxygen standards are water column concentrations; see DEQ-7 for other notes.
5. All metals standards except aluminum are based on total recoverable concentrations. Aluminum standards are based on dissolved aluminum concentrations and are valid only in a pH range of 6.5 to 9.0.
6. Aquatic life chromium standards are for trivalent/hexavalent forms.
7. Mercury has a bioconcentration factor of greater than 300 (developed by the EPA).
8. NTU = nephelometric turbidity units.
mg/L = milligrams/liter; "—" = no applicable standard.
Source: Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2019c); ARM 17.30.629.

Primary pre-mining land uses in and downslope of the analysis area are grazing/pastureland, cropland, and wildlife habitat. The state and EPA have not established ambient water quality criteria for livestock or wildlife. There is little scientific consensus on recommended water quality limits for livestock, which are assumed to be appropriate for wildlife. The values presented in several studies are shown in **Table 3.7-5** (updated from the corresponding table presented in the 2018 Final EIS).

Table 3.7-5. Recommended Water Quality Concentration Limits for Livestock.

Analyte	NRC 1972	Bagley 1997	Sigler & Bauder 2006	Raisbeck et al. 2008	Olkowski 2009	Pick 2011	Pfost et al. 2012	Meehan et al. 2015
Aluminum	5				5	5	5	5
Arsenic	0.2	0.2	0.2	1	0.025	0.01	0.2	0.2
Barium						10		10
Bicarbonate								
Boron	5				5	5	5	
Cadmium	0.05	0.05	0.05		0.08	0.05	0.05	0.05
Calcium					1,000	500		1,000
Chloride						1,500		
Chromium	1	1	1		0.05	1	1	1
Copper	0.5	0.05	0.5		0.5	0.5	0.5	0.5
Fluoride	2	2	2	2	1	2	2	2
Iron						0.3		
Lead	0.1	0.1	0.1		0.1	0.1	0.05	0.1
Magnesium						125		
Manganese						0.05		
Mercury	0.01	0.01	0.01		0.003	0.01	0.01	
Molybdenum				0.3	0.5			0.5
Nickel			1					1
Nitrate (as N)	23	100	100	114	23	100	23	100
Nitrite (as N)	2.3	33	10	23	3	10	2.3	33
pH		8.3				8.5	7.5	9
Selenium	0.05			0.1	0.05	0.05	0.05	0.05
Sodium				1,000				1,000
Sulfate		1,000	2,500	1,000	1,000	1,000	2,000	500 - 1,000
TDS		10,000	5,000		3,000	10,000	10,000	10,000
Vanadium	0.1	0.1	0.1		0.1	0.1	0.1	0.1
Zinc	25	25	25		50	25	24	25

Note: Metal limits are for both dissolved and total metals.

In southeastern Montana, ambient surface water concentrations of sodium, sulfate, and total dissolved solids (TDS) often naturally exceed recommended concentrations for these parameters, particularly in stock ponds. Cattle will adapt to higher TDS concentrations, and wildlife likely also will adapt to higher TDS concentrations, but sulfate in particular can affect animal weight gain and health (MSU 2014). Aquatic life data collected by DEQ in streams in southeastern Montana, including East Fork Armells Creek (Montana Department of Environmental Quality 2017), indicate that these streams support an assemblage of species that are tolerant of naturally occurring sodium, sulfate, and TDS concentrations that exceed the recommended concentrations, which is similar to the community assemblage identified in a survey from the 1970s. In most situations, the naturally occurring minerals in water do not result in acute toxicosis but lead to chronic conditions of poor animal performance or increased health problems (National Research Council 2005). TDS toxicity in animals depends on the type and combination of ions in solution (Timpano et al. 2010). TDS concentrations exceeding 500 to 1,000 mg/L may be harmful to sensitive crops in southeastern Montana, and 3,150 mg/L is about the maximum TDS concentration tolerated by most plants (Ferreira 1984). However, waters with higher TDS concentrations support wetlands in the analysis area. Plant response to and tolerance of water quality conditions are highly variable and can be influenced by interactions between conditions associated with water (constituents, irrigation method, and drainage), soil (profile, biota, fertility, and drainage), plants (variety, growth stage, and density), and climate (air quality and seasonality) (Maas and Grattan 1999).

Local Requirements

The Federal Emergency Management Agency (FEMA) has mapped the floodplains in the analysis area as Special Flood Hazard Areas (Zone A), which are areas subject to inundation by the 100-year flood. Detailed hydraulic analyses have not been performed for Special Flood Hazard Areas, so no base flood elevations or flood depths have been estimated (FEMA 2015). Anyone planning new development within a designated Special Flood Hazard Area, including excavation, placement of fill, storage of equipment or materials, roads, culverts, bridges, and other activities, must obtain a permit for such development from the local floodplain administrator. This administrator is designated by the city or county government. The following links provide state and local resources and guidance associated with floodplain management including points of contact for Rosebud County, required permitting forms, and the 2024 Model Floodplain Hazard Management Regulations:

- https://dnrc.mt.gov/Water-Resources/Floodplains/
- https://dnrc.mt.gov/Water-Resources/Floodplains/Contacts
- https://dnrc.mt.gov/Water-Resources/Floodplains/Property-Owner-Resources
- https://dnrc.mt.gov/Water-Resources/Floodplains/Permitting-and-Regulations

The purpose of the Floodplain Development Permit is to review and permit appropriate uses within Special Flood Hazard Areas that will not be seriously damaged or present a hazard to life if flooded, thereby limiting the expenditure of public tax dollars for emergency operations and disaster relief.

Anyone planning to do work on or near a waterway in Montana must submit a 310 Joint Application Form 270 for Proposed Work in Montana's Streams, Wetlands, Floodplains, and Other Water Bodies to the conservation district in which the activity will take place (https://dnrc.mt.gov/Conservation/Conservation-Programs/Conservation-Districts/). Projects must be designed and constructed to minimize adverse impacts on the stream and stream banks. The project must be reviewed to determine the impacts of soil erosion and sedimentation; the impacts of stream alteration; the impacts on stream flow, turbidity, and water quality; the impacts on fish and aquatic habitat; whether there are modifications or alternatives that would reduce disturbance to the stream and its environment; and whether the project would create harmful flooding or erosion problems.

3.7.1.2 Analysis Area

Direct Effects Analysis Area

The direct effects analysis area for surface water quantity and quality includes streams that may be impacted by mining in the Area F permit area by changes in flow and/or changes in water quality. **Figure 3.7-1** shows the currently approved Area F permit and disturbance areas, which differ slightly from those presented in 2018 Final EIS (see the discussion in **Section 2.2.2.2, Area F Operations and Development**). The direct effects analysis area includes where mining and/or related disturbances would occur and the watersheds of the streams in and downstream of the Area F permit area that flow through the disturbance area or receive water from the disturbance area. This includes the West Fork Armells Creek, but does not include the East Fork Armells Creek (**Figure 3.7-1**). Tributaries to the West Fork Armells Creek in the analysis area are, from north to south, Trail, McClure, Robbie, Donley, and Black Hank Creeks. A small portion of the analysis area flows to Horse Creek, a tributary to Sarpy Creek. Measurable direct effects are not expected to extend beyond the watersheds of Trail Creek, McClure Creek, Robbie Creek, Donley Creek, and Black Hank Creek.

Indirect Effects Analysis Area

Project area coal would be burned in the nearby Colstrip Power Plant Units 3 and 4, located about 12 miles east of the project area, and in the Rosebud Power Plant, located 6 miles north of Colstrip. Trace metal deposition modeling due to coal combustion at the power plants was conducted to determine the indirect effects analysis area for special status species and is described in **Section 4.3, Air Quality**. Using a conservative analysis, the deposition model identified a 32-km circular analysis area for mercury. The analysis area for selenium was substantially smaller, and for the other five metals modeled was within the plant site area of the Colstrip Power Plant (see **Section 4.3, Air Quality**). The deposition analysis area is based on soil concentrations that are deposition thresholds for plants and animals. As a result of various pathways including wind, precipitation, runoff, and erosion of soil to surface water, as well as direct deposition onto surface water bodies, mercury that is deposited from the atmosphere may reach surface water in and downstream of the 32-km circular area.

The indirect effects analysis area includes all of the Armells Creek watershed and parts of the Sarpy Creek and Rosebud Creek watersheds within and downstream of the 32-km circular area (Figure **3.7-2**). It also includes the Yellowstone River between the Cartersville Dam (located near Forsyth between river miles 238 and 329) and the confluence with the Tongue River to account for indirect effects of water withdrawals by the Colstrip Power Plant. The diversion point for the Colstrip Power Plant's water right (42KJ94423 00) is downstream of the confluence with Armells Creek and upstream of the Carterville dam. The Carterville dam was chosen as the upstream bound on the Yellowstone River because it is a barrier to fish passage and likely precludes pallid sturgeon above the dam (see **Section 3.13, Special Status Species**). The uppermost parts of the Sarpy and Rosebud Creek watersheds are not in the analysis area because they are outside of the 32-km circular analysis area. Because less than 3 percent of the Tongue River watershed (139 square miles of a total 5,400 square miles) is in the 32-km circular area, it is not included in the analysis area for surface water effects. Mercury water quality data for streams in the indirect effects analysis area support the indirect effects analysis area as being adequately large to evaluate the effects of coal combustion from the two power plants.

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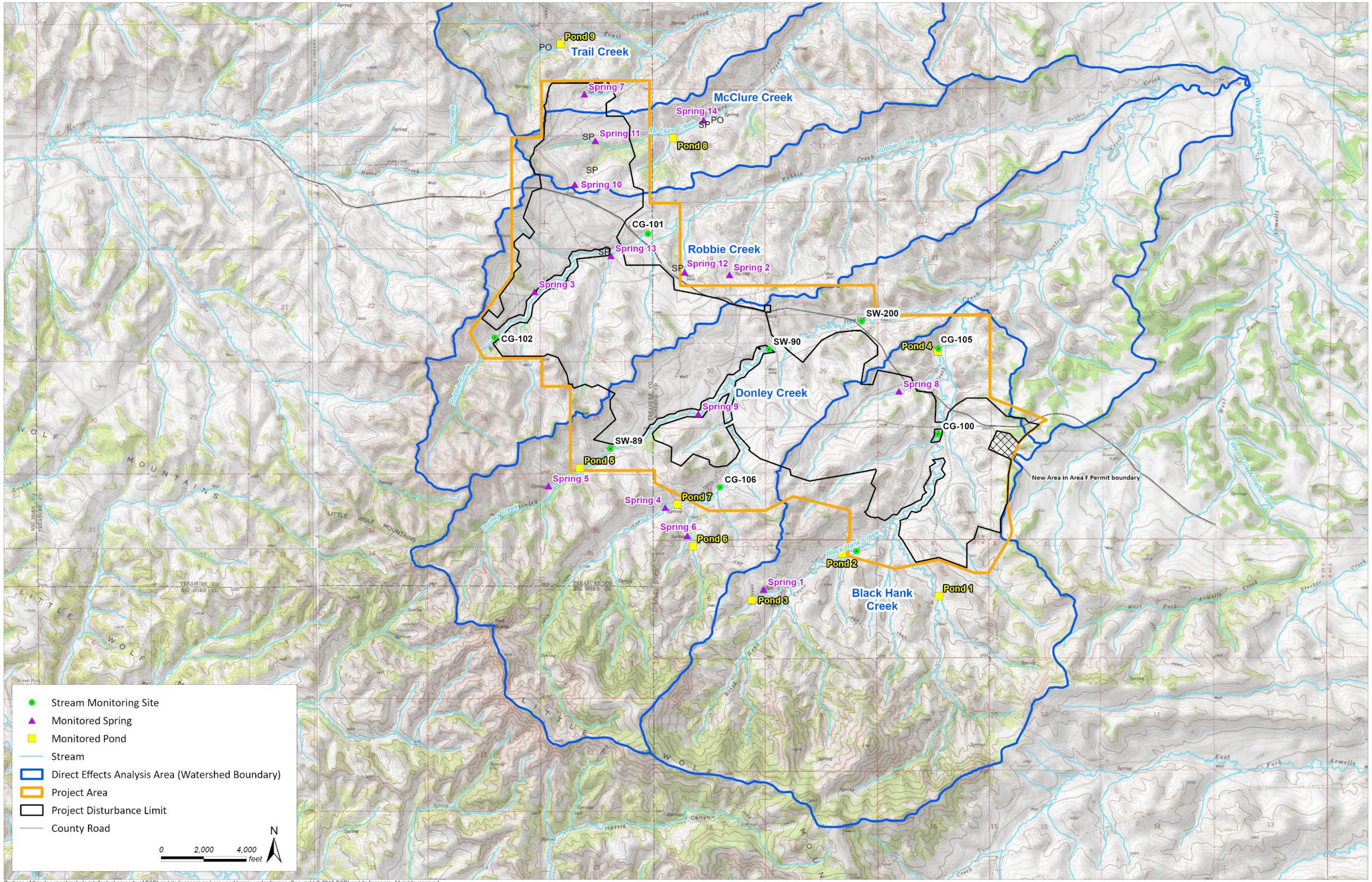

Figure 3.7-1. Surface Water Direct Effects Analysis Area

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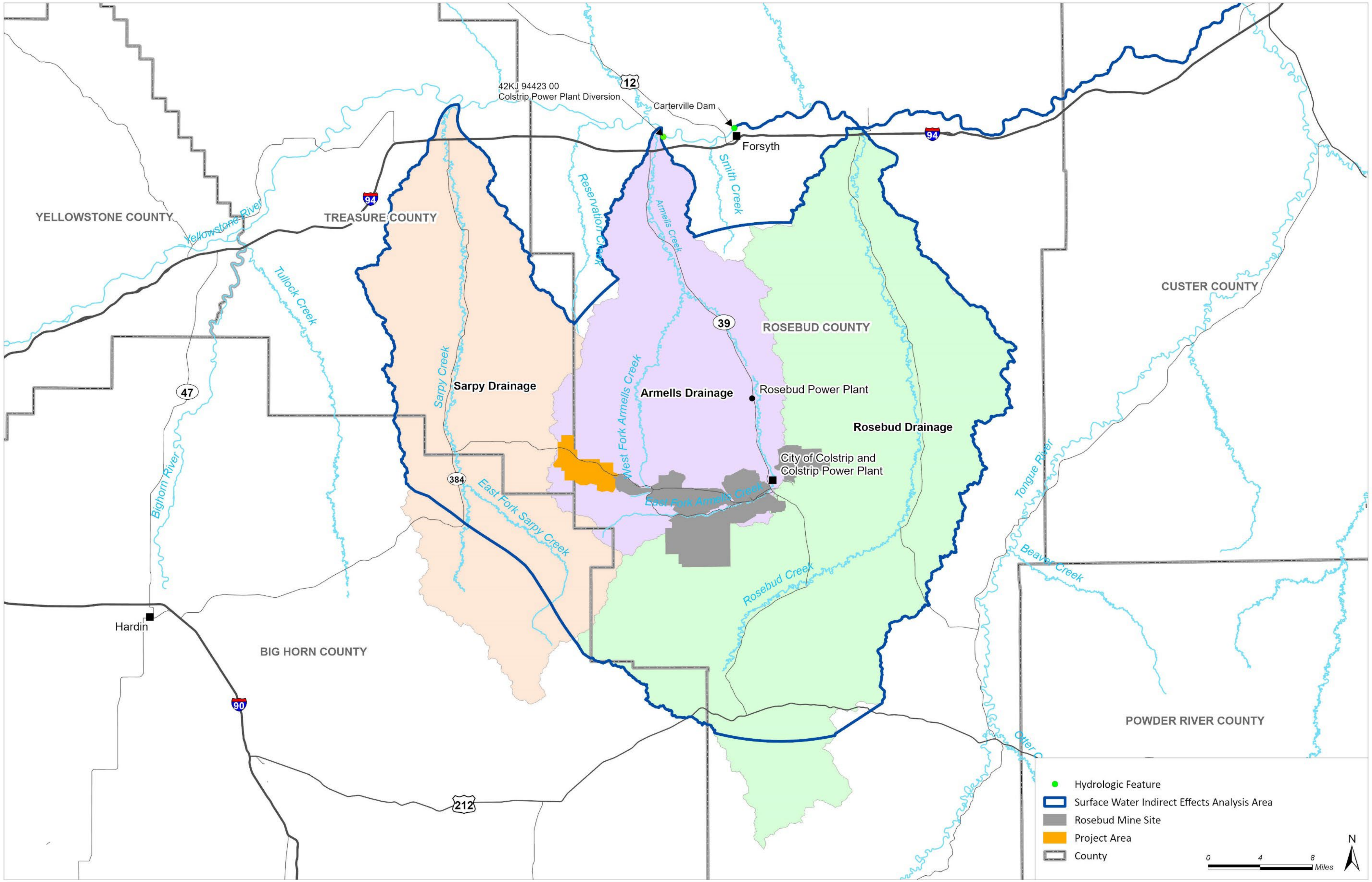

Figure 3.7-2. Surface Water Indirect Effects and Cumulative Effects Analysis Area.

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3.7.2 Climate

The analysis area is in the Northwest Great Plains Ecoregion, which encompasses the Missouri Plateau section of the Great Plains. The region has a semiarid climate and flat to rolling topography of shale and sandstone punctuated by occasional buttes. Native grasslands persist in rangeland areas. Daily precipitation and other climate data are recorded at a weather station in Colstrip (NOAA 2024), summarized below, and at multiple private weather stations within the Rosebud Mine property.

Precipitation is variable, ranging from 7 to 25 inches per year and averaging 15 inches (over the past 40 years). The wettest months are May and June, and the driest are November through February. Large precipitation events of up to 3 inches in a day have been observed, and monthly precipitation totals of 4 to 10 inches have been recorded in April through September. Large multiday events occurred on May 20 to 22, 2011, when 4.8 inches of precipitation fell, and on May 19 to 31, 2013, when 7.6 inches of precipitation fell (with 5.5 inches falling on the last 2 days). The two wettest years during the past 40 years occurred in 2016 (25.0 inches) and 2011 (23.9 inches). The two driest years during the past 40 years occurred in 2012 (7.4 inches) and 1988 (8.1 inches). Precipitation over the past 5 years ranged from drier than average (2020 and 2021) to near average (2022 and 2023) to wetter than average (2019).

Snowfall is variable, ranging from 7 to 87 inches per year and averaging 41 inches (over the past 40 years). The highest annual snow accumulation over the past 40 years was in 2018 with 87.2 inches. The highest average monthly accumulation of snow occurs in February (8.3 inches), and December, January, and March accumulations average 6.4 to 7.5 inches. From 2018 through 2023, months with the highest snow accumulation included February 2018 (34.5 inches) and February 2019 (16.0 inches), and annual accumulations ranged from above average (49 to 87 inches) in 2018, 2019, and 2020 to nearly average (40 inches) in 2022 to below average (19 to 32 inches) in 2021 and 2023.

3.7.3 Floodplains

FEMA has mapped the floodplains in the analysis area as Special Flood Hazard Areas (Zone A), which are areas subject to inundation by the 1 percent annual chance flood event (a 100-year flood). Detailed hydraulic analyses have not been performed for Special Flood Hazard Areas, so no base flood elevations or flood depths have been estimated. In general, the floodplains mapped along the creeks in the analysis area are about 300 feet wide (FEMA 2015).

3.7.4 Hydrologic Balance

Precipitation as rain and snow, described in **Section 3.7.2**, is the source of water to the hydrologic system in the project area. A majority of the precipitation is returned to the atmosphere by evaporation from water bodies, plants, and the ground surface, as well as transpiration from plants. Evapotranspiration was calculated using the Blaney Criddle formula to average nearly 28 inches at Colstrip (PAP, Appendix B, Table B-2), and using measured pan evaporation at the Rosebud Mine to average 59 inches per year (PAP, Appendix B, Table B-3). In either case, average evapotranspiration exceeds the average annual precipitation of 15 inches per year, but on a monthly basis is less on average than precipitation during November through April. The loss of moisture by evapotranspiration is a major factor in the water balance for this semiarid area. Sublimation, the direct conversion of ice or snow to water vapor, occurs during the winter months, and in the Colstrip area has been estimated to transfer about half of the winter precipitation, or about 2.5 inches, back into the atmosphere. Interception loss of precipitation occurs as a result of vegetative cover absorbing the water or evaporation from the vegetation and is estimated to range from about 0.5 to 1.8 inches per year (PAP, Appendix B, Table B-1). Infiltration is the movement of water into and through the soil. Based on soil type, the average infiltration rate in the project area is 2.3 inches per hour (PAP, Appendix B, Table B-4). This substantially reduces runoff because most precipitation events in the area have intensities of less than 2 inches per hour. When the rainfall or snowmelt rate exceeds the infiltration rate, water flows overland to drainage channels. Soil can absorb significant quantities of water infiltrating in the subsurface. Soil in the project area has the capacity to hold water that averages 0.1 inch per inch (PAP, Appendix B, Table B-4). Soil moisture content is typically highest in the spring and early summer, and driest in late summer. Soil can be a major factor in water storage, where it can be evaporated to the atmosphere or taken up by plants. Groundwater recharge, discharge, and storage are also parts of the hydrologic balance in the project area and are discussed in **Section 3.8, Water Resources – Groundwater**. When a land surface is disturbed by human activities, there may be changes in vegetative cover, soil cover, and topography, resulting in changes to the hydrologic balance.

3.7.5 Surface Water Hydrology

3.7.5.1 Springs in the Direct Effects Analysis Area

Numerous springs occur in the analysis area. Western Energy (now Westmoreland Rosebud) inventoried springs in the analysis area and documented the locations of 53 springs (PAP, Appendix B, Table B-31). Until 2015, Springs 1 through 9 were monitored by Western Energy adjacent to tributaries or the mainstem of Trail, McClure, Robbie, Donley, and Black Hank Creeks (**Figure 3.7-1**). Beginning in 2015, five additional springs were monitored by Western Energy in the McClure and Robbie Creek watersheds. Some of the 14 monitored springs are used for livestock watering and have permitted diversion volumes of 30 gallons per day per animal. Only one (Spring 3 on a tributary of Robbie Creek) is developed and has a decreed maximum diversion rate, which is 8 gallons per minute. The springs, except for Spring 1 and Spring 8 on Black Hank Creek, are water sources for wetlands. Springs or seeps in the analysis area that support wetlands flow all or nearly all the time. The majority of the wetlands in the project area are typical of the Great Plains region, with most occurring in drainage bottoms and a few along upland seeps. The wetlands extend several to hundreds of feet from the groundwater surface discharge point before percolating into the soil or evaporating.

The monitored springs in the analysis area, which are listed in **Section 3.8.2.1, Springs**, are typically located along or near drainages, and some of them maintain perennial or intermittent reaches of streams. The sources of these springs are described in **Section 3.8.2.1**. Data presented in the 2018 Final EIS (2011 through 2016 monitoring events) indicated that most of the springs were nearly always flowing, with quantifiable flow observed at Springs 1 through 5, 7, 10, and 11 and with the highest flow of 9 gallons per minute (gpm) occurring in Spring 4. Data compiled from 2017 through 2023 monitoring events indicate the following results for each of the 14 springs:

- Spring 1: No flow recorded as the site was not visited
- Spring 2: Nearly always flowing with quantifiable flow up to 2 gpm
- Spring 3: Nearly always flowing with quantifiable flow up to 2.3 gpm
- Spring 4: Nearly always flowing with quantifiable flow up to 28.1 gpm
- Spring 5: Nearly always flowing with quantifiable flow up to 2 gpm
- Spring 6: No flow recorded as the site was not visited or was ponded
- Spring 7: Nearly always flowing with quantifiable flow up to 11.4 gpm
- Spring 8: Combination of dry or flowing conditions with no quantifiable flow
- Spring 9: Nearly always flowing with quantifiable flow up to 9.7 gpm

- Spring 10: Nearly always flowing with quantifiable flow up to 9.7 gpm
- Spring 11: Combination of dry or flowing conditions with quantifiable flow up to 4.4 gpm
- Spring 12: Combination of dry or flowing conditions with no quantifiable flow
- Spring 13: Combination of dry or flowing conditions with quantifiable flow up to 2 gpm
- Spring 14: Nearly always flowing with no quantifiable flow

3.7.5.2 Streams in the Direct Effects Analysis Area

The direct effects analysis area contains portions of the headwaters of Trail, McClure, Robbie, Donley, and Black Hank Creeks (**Figure 3.7-1**), all of which flow in an easterly or northeasterly direction to West Fork Armells Creek, then to Armells Creek, a tributary to the Yellowstone River (**Figure 3.7-2**). A small portion of the analysis area contains the headwaters for Horse Creek, which flows west into Sarpy Creek, a tributary to the Yellowstone River.

Surveyed pre-mine channel cross-sections and geomorphic characteristics of the five watersheds in the analysis area have been measured and were provided by Western Energy in the PAP (PAP, Appendix J). Exhibit J-1 contains the channel cross-sections, and Table J-2 in Appendix J to the PAP provides drainage area, slope, length, relief, stream length, channel sinuosity, and other information for Trail, McClure, Robbie, Donley, and Black Hank Creeks and their minor tributaries within the project area.

The sections below describe flow conditions in analysis area streams. When the groundwater table is always below the channel bottom, groundwater discharge is not a source of water to a creek, and ephemeral flow occurs only during and after snowmelt runoff or rainfall events. When the groundwater table is above the channel during part of the year, a stream is intermittent and flows not only when surface runoff enters the channel but also when groundwater discharges to the stream surface as baseflow (Section 82-4-203, MCA). Baseflow is the contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. A perennial stream flows continuously, either because it has a constant source of surface runoff (such as from springs) or because the groundwater table is above the channel bottom for much or all of the year, providing baseflow.

As noted in DEQ’s 2019 Cumulative Hydrologic Impact Assessment (DEQ 2019b): “There are no perennial streams within the permit boundary area. Baseline data and the EIS indicate that tributary streams within the project area exhibit ephemeral flow with localized spring/seep contributions. Lower reaches of West Fork Armells Creek tributaries (Robbie Creek and Trail Creek) are likely intermittent to perennial several miles beyond the permit boundary.”

Trail Creek

Stream flows and alluvial groundwater levels have not been monitored in the project area in Trail Creek. Spring 7 is located on upper Trail Creek above Wetland B, which is described in the Rosebud Mine Wetland Delineation, Area F Report (Wetland Delineation Report; PAP, Appendix E). When measured in the summer of 2013, the wetland in the swale bottom was about 1,200 feet long. Spring 7 was flowing in every month of the year when measured from 2011 to 2016, indicating that flow within Trail Creek is perennial. Data compiled from 2017 through 2023 monitoring events indicate that Spring 7 is nearly always flowing with quantifiable flow up to 11.4 gpm. Water flows above the ground surface in the channel for up to about 1,200 feet downstream of Spring 7. Below the wetland, Trail Creek may flow intermittently or ephemerally.

McClure Creek

Stream flows and alluvial groundwater levels have not been monitored in the project area in McClure Creek. The Wetland Delineation Report found two wetlands on McClure Creek that were both supported by springs or seeps. At Wetland C (see **Figure 47** in the 2018 Final EIS), the wetland was observed to occur within the drainage bottom below a spring and extended 1,000 feet downstream. Observed "hydrology characteristics included soil saturation to the surface or flowing water in most locations along the thalweg [creek bottom]" (PAP, Appendix E). In August 2015, the measured wetted area of Wetland C was nearly 3,600 square feet (PAP, Appendix B, Attachment B-P). At Wetland F028 (see **Figure 47** in the 2018 Final EIS), the wetland was measured to be about 1,350 feet long in the main channel and 280 feet long in a side channel. The report states that "hydrology characteristics included apparent perennial seepage, ponded surface water, and soil saturation to the surface in most locations along the drainage" (PAP, Appendix E). In August 2015, the measured wetted area of Wetland F028 was slightly more than 12,000 square feet (PAP, Appendix B). The 2015 aquatic life survey identified more than two dozen aquatic species at both wetlands (PAP, Appendix B, Attachment B-P).

Springs located within the McClure Creek watershed include Spring 10 (within the Area F permit boundary and one-third of a mile south of the McClure Creek mainstem), Spring 11 (within the Area F permit boundary along the McClure Creek mainstem), and Spring 14 (one-half mile downstream from the Area F permit boundary along the McClure Creek mainstem). Data compiled from 2017 through 2023 monitoring events indicate that Spring 10 is nearly always flowing with quantifiable flow up to 9.7 gpm, Spring 11 exhibits a combination of dry or flowing conditions with quantifiable flow up to 4.4 gpm, and Spring 14 is nearly always flowing with no quantifiable flow. In the areas of the springs and wetlands, flow in McClure Creek is perennial, but downstream of the wetlands McClure Creek may flow intermittently or ephemerally.

Robbie Creek

In Robbie Creek, surface water depth has generally been monitored monthly, and flow was calculated since 2013 at CG-101, located near the eastern proposed Area F permit boundary. During the monitoring period associated with the 2018 Final EIS (2013 through 2016), the creek was flowing at CG-101 nearly always in 2013 to mid-2015 with the highest flow estimated at 36 cubic feet per second (cfs) in May 2015, and then was nearly always dry from mid-2015 through 2016. During the monitoring period associated with this SEIS (2017 through 2023), the creek was nearly always dry from 2017 through February 2019 and from August 2020 through September 2023, with nearly constant flowing conditions from March 2019 through July 2020 and the highest flow estimated at 49 cfs in March 2020. Western Energy (now Westmoreland Rosebud) began monitoring Robbie Creek at CG-102 at the upper end of Robbie Creek within the project area in March 2016 where there was no flow in March through June 2016 (the monitoring period associated with the 2018 Final EIS). During the monitoring period associated with this SEIS (2017 through 2023), the creek was nearly always dry with no measurable flows.

Upstream of CG-101, Wetland D (see **Figure 47** in the 2018 Final EIS) is located where "it appears that a subterranean rock formation may be responsible for forcing alluvial water to the surface and causing the seeps" (PAP, Appendix E). Open water and small fish were observed in 2013 up to 2,000 feet downstream from the seeps. Observed "hydrology characteristics included ponded and flowing surface water and soil saturation to the surface in most locations along the drainage" (PAP, Appendix E). In August 2015, the measured wetted area of Wetland D was 27,640 square feet, and the aquatic life survey identified 30 species at Wetland D (PAP, Appendix B). Upstream of Wetland D, Spring 3 flows perennially into a tank, and there are several other springs and seeps. At alluvial well WA-222 located at the downstream end of Robbie Creek in the project area, the depth to water ranged from above ground surface to about 6 feet below ground surface in 2012 to 2016, indicating intermittent flow at this location.

In the areas of the springs and wetlands, and in the stream adjacent to WA-222, flow in Robbie Creek is perennial or intermittent, but the creek may be ephemeral at other locations in the analysis area.

Donley Creek

Stream flow has been measured in the Donley Creek watershed at four monitoring locations within the Area F permit boundary: since May 2013 at the upstream-most monitoring point (SW-89) located on the creek's mainstem near the west edge of the project area; since August 2011 at the next downstream monitoring point (SW-90) located on the creek's mainstem; since January 2020 at the downstream-most monitoring point (SW-200) located on the creek's mainstem near the east edge of the project area; and since May 2020 at a monitoring point (CG-106) located on an unnamed tributary to the creek's mainstem near the south edge of the project area (**Figure 3.7-1**).

At SW-89, during the monitoring events associated with the 2018 Final EIS (2013 through 2016), mostly dry conditions were observed with one relatively continuous period of flowing conditions between May and October 2014, during which the highest flow of 16.6 cfs was measured in June 2014. At SW-89, during the monitoring events associated with this SEIS (2017 through 2023), mostly dry conditions were observed with one relatively continuous period of flowing conditions between October 2019 and July 2020, during which the highest flow of 3.7 cfs was measured in October 2019. Many of the flows at SW-89 do not appear to be directly related to large precipitation events (recorded in Colstrip and at weather station RL-5 in the project area) (PAP, Appendix C). SW-89 is located within Wetland F049 and downstream of Pond 5, a large stock pond. Leakage from the dam may be the source of smaller, longer-term flow at SW-89, and Pond 5 also reduces flows from the upper watershed at SW-89. Wetland F049 is located downstream of Pond 5, and water was observed in 2013 to flow 2,400 feet downstream. In August 2015, the measured wetted area of Wetland F049 was 7,790 square feet, and the aquatic life survey identified 21 species at Wetland F049 (PAP, Appendix B).

At SW-90, during the monitoring events associated with the 2018 Final EIS (2011 through 2016), mostly dry conditions were observed with one relatively continuous period of flowing conditions between August and September 2011 and with three periodic flow events occurring in February 2012, June 2013, and February 2014, during which the highest flow of 265 cfs was measured in February 2014. At SW-90, during the monitoring events associated with this SEIS (2017 through 2023), mostly dry conditions were observed with five periodic flow events in February 2017, January 2018, March 2019, February 2021, and March 2023, during which the highest flow of 2,032 cfs was measured in March 2023. Wetland F is located between SW-89 and SW-90 where groundwater seeps from a sandstone outcrop along the drainage (see **Figure 47** in the 2018 Final EIS). The seeps appear to be perennial or nearly perennial (PAP, Appendix E). In 2013, water was observed for a distance of 2,500 feet downstream of the seeps. Observed "hydrology characteristics included apparent perennial seepage, ponded surface water, and soil saturation to the surface in most locations along the drainage" (PAP, Appendix E). In August 2015, the measured wetted area of Wetland F was nearly 20,000 square feet, and the aquatic life survey identified 26 species at Wetland F (PAP, Appendix B). At alluvial wells WA-224 and WA-225 on Donley Creek, measured in 2012 to 2015, and in alluvial well WA-220 on Donley Creek, measured from 2005 to 2015, groundwater levels ranged from 8 to more than 30 feet below ground surface, indicating that stream flow at these locations is ephemeral. In the main southern tributary to Donley Creek, there are two wetlands (see **Figure 47** in the 2018 Final EIS). At Wetland F058, there is a spring that supports the wetland, which in 2013 was observed for 1,100 feet in the creek channel. Observed "hydrologic characteristics included ponded surface water and soil saturation to the surface in most locations along the drainage" (PAP, Appendix E). In August 2015, the measured wetted area of Wetland F058 was more than 32,290 square feet, and the aquatic life survey identified 26 species at Wetland F058 (PAP, Appendix B). At Wetland F061, a high groundwater table and ponded surface water were observed in 2013. The depth to the groundwater table at alluvial well WA-226 located upstream of Wetland F061 was about 13.5 feet in

2012 to 2016, indicating that the stream is ephemeral at that location. It appears that much of Donley Creek in the project area is ephemeral except at the wetland locations, where flow is perennial.

At SW-200, during the monitoring events associated with this SEIS (2020 through 2023), mostly dry conditions were observed with two periodic flow events in February 2021 and March 2023, during which the highest flow of 109 cfs was measured in March 2023.

At CG-106, during the monitoring events associated with this SEIS (2020 through 2023), mostly dry conditions were observed with one periodic flow event in March 2021 (24.7 cfs).

Black Hank Creek

Stream flow has been measured in the Black Hank Creek watershed at four monitoring locations within the Area F permit boundary: since March 2016 at the upstream-most monitoring points (CG-103 and CG-104) located on the creek's mainstem near the south edge of the project area; since May 2013 at the next downstream monitoring point (CG-100) located on the creek's mainstem; and since January 2020 at the downstream-most monitoring point (CG-105) located on the creek's mainstem near the east edge of the project area (**Figure 3.7-1**).

At CG-103 and CG-104, during the monitoring events associated with this SEIS (2016 through 2023), mostly dry conditions were observed with two periods of frozen conditions in February 2017 and February 2018 and no measurable flow results.

At CG-100, during the monitoring events associated with the 2018 Final EIS (2013 through 2016), mostly dry conditions were observed with 13 events exhibiting flowing, ponded, or frozen conditions (no estimated flow measurements) occurring in 2013, 2014, and 2015, during which the highest water depth of 0.5 feet was measured in June 2013. At CG-100, during the monitoring events associated with this SEIS (2017 through 2023), mostly dry conditions were observed with three periodic flow events in February 2017, March 2019, and February 2021, during which the highest flow of 96.3 cfs was measured in February 2021.

At CG-105, during the monitoring events associated with this SEIS (2020 through 2023), dry conditions were observed continually through the monitoring period.

No springs or wetlands have been mapped along the main channel of Black Hank Creek, but Spring 8 is located on a tributary to Black Hank Creek. At alluvial wells WA-219 and WA-227 on Black Hank Creek, the first measured from 2005 to 2016, and the second measured in 2012 to 2016, groundwater levels ranged from 7 to 22 feet below ground surface, indicating that stream flow at these locations is ephemeral. Based on the very infrequent flow events described above, it appears that much or all of Black Hank Creek in the analysis area is ephemeral.

Horse Creek

Horse Creek, located within the analysis area, has not been monitored. The USGS McClure Creek and Minnehaha Creek 7.5-minute topographic maps show several springs on Horse Creek, so some sections of the creek may have intermittent or perennial flows.

3.7.5.3 Ponds in the Direct Effects Analysis Area

Nine monitored dam diversions, shown as man-made livestock ponds (Pond 1 to Pond 9), are located within or close to the direct effects analysis area adjacent to or on Trail Creek, McClure Creek, Donley

Creek, or Black Hank Creek (**Figure 3.7-1**). There are more than two dozen ponds located within or near the project area, but water level and water quality data are not available for the other ponds. Some are in-stream ponds, and some are spring fed ponds. Ponds 1 to 9 have year-round water rights diversion volumes of 30 gallons per day per animal. Following are comparisons of monitoring results for each pond between the monitoring period associated with the 2018 Final EIS (2011 through 2016) and the more recent monitoring period associated with the SEIS (2017 through 2023).

Black Hank Creek Watershed

- Pond 1: Combination of dry and ponded conditions with no recorded water depths (2017-2023); combination of dry and ponded conditions with 32 recorded water depths up to 1.5 feet (2011-2016).
- Pond 2: Mostly dry conditions with one recorded water depth of 0.5 feet (2017-2023); mostly dry conditions with 10 recorded water depths up to 15 feet (2011-2016).
- Pond 3: No recorded water depths as the site was not visited (2017-2023); combination of dry and ponded conditions with 31 recorded water depths up to 3 feet (2011-2016).
- Pond 4: Mostly dry conditions with one recorded water depth of 1.5 feet (2017-2023); mostly dry conditions with 7 recorded water depths up to 3 feet (2011-2016).

Donley Creek Watershed

- Pond 5: Mostly ponded conditions with no recorded water depths (2017-2023); mostly ponded conditions with 31 recorded water depths up to 9.4 feet (2011-2016).
- Pond 6: No recorded water depths as the site was visited only once (2017-2023); combination of dry and ponded conditions with 25 recorded water depths up to 5 feet (2011-2016).
- Pond 7: No recorded water depths as the site was not visited (2017-2023); mostly ponded conditions with 44 recorded water depths up to 1 foot (2011-2016).

McClure Creek Watershed

- Pond 8: Mostly ponded conditions with no recorded water depths (2017-2023); mostly ponded conditions with one recorded water depth of 3 feet (2011-2016).

Trail Creek Watershed

- Pond 9: Mostly ponded conditions with no recorded water depths (2017-2023); mostly ponded conditions with two recorded water depths up to 5 feet (2011-2016).

3.7.5.4 Surface Waters in the Indirect Effects Analysis Area

The indirect effects analysis area (**Figure 3.7-2**) includes all of the Armells Creek watershed, parts of the Sarpy Creek and Rosebud Creek watersheds, and the Yellowstone River from the confluence with the Tongue River upstream to the Cartersville Dam (location chosen to account for indirect effects of water withdrawals by the Colstrip Power Plant and because it is a barrier to fish passage and likely precludes pallid sturgeon above the dam). The diversion point for the Colstrip Power Plant's water right is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam.

In Armells Creek, located east of the Area F permit boundary, and into which nearly all streams in the project area flow, stream flow was measured daily by the USGS near its confluence with the Yellowstone River (USGS 06294995) from 1974 to 1995, during which time flow was measured 93 percent of monitored days (USGS 2024). Mean annual flow in the stream ranged from 0.4 cfs in 1981 to 17.4 cfs in 1994; mean monthly flow in the stream ranged from 0.5 cfs in December to 27 cfs in March; and mean daily flow in the stream ranged from zero cfs to 2,390 cfs on March 3, 1994.

In Sarpy Creek, located west of the Area F permit boundary, stream flow was measured daily by the USGS near its confluence with the Yellowstone River (USGS 06294940) from 1973 to 1984, during which time flow was measured 71 percent of monitored days (USGS 2024). Mean annual flow in the stream ranged from 1.5 cfs in 1981 to 20.1 cfs in 1975; mean monthly flow in the stream ranged from 0.2 cfs in August to 29 cfs in March; and mean daily flow in the stream ranged from zero cfs to 390 cfs on January 20, 1975.

In Rosebud Creek, located east of the Area F permit boundary, stream flow was measured daily by the USGS near Colstrip (USGS 06295250) from 1974 to 2006, during which time flow was measured 90 percent of monitored days (USGS 2024). Mean annual flow in the stream ranged from 3 cfs in 2002 to 95.9 cfs in 1975; mean monthly flow in the stream ranged from 6.1 cfs in September to 47 cfs in May; and mean daily flow in the stream ranged from zero cfs to 668 cfs on March 3, 1994.

In the Yellowstone River, located north of the Area F permit boundary, stream flow was measured daily by the USGS at Forsyth Montana (USGS 06295000) from 1977 to 2024, during which time flow was measured 100 percent of monitored days (USGS 2024). Mean annual flow in the stream ranged from 6,026 cfs in 2001 to 18,260 cfs in 2018; mean monthly flow in the stream ranged from 5,540 cfs in January to 31,500 cfs in June; and mean daily flow in the stream ranged from 1,400 cfs on November 23, 1977, to 97,000 cfs on May 21, 1978.

Table 3.7-6 and the narrative that follows were reported by OSMRE (2024) as part of the *Area F Biological Assessment* to evaluate the potential for and the magnitude of any effects of Yellowstone River water withdrawals on pallid sturgeon. Flow metrics were calculated using data from the USGS gage approximately 6 miles downstream of the diversion and immediately upstream of the Cartersville Dam at Forsythe (#06295000). A gage is also in Billings, Montana (USGS #06214500), upstream of the diversion. Data from this gage were not used in the analysis, as the Billings gage is approximately 100 miles upstream of the diversion and upstream of the confluence with the Bighorn River. Multiple other smaller tributaries also contribute flow to the Yellowstone River between Billings and the analysis area, and irrigation withdrawals and returns also occur throughout these reaches. No major tributaries are present between the diversion point and the Forsythe gage, although irrigation return flows and pumps are within the reach (U.S. Army Corps of Engineers [USACE] and Yellowstone River Conservation District Council 2016). Based on this, data from the Forsythe gage was determined to be representative of streamflow downstream of the diversion; the amount of water withdrawn to supply the Colstrip Power Plant was then added to the gage data to provide a reasonably accurate approximation of the magnitude of flows upstream of the diversion.

Average daily, monthly, and annual flow data were available and finalized for the Yellowstone River gage at Forsyth from October 1977 through April 2024; data from 2000 through 2023 were used in **Table 3.7-6** to represent current conditions. Data were summarized in the flow metrics to provide a comprehensive analysis of changes to the flow regime on the daily, monthly, and annual time scales. The monthly flow metrics focused on February and June, to represent monthly data when flows were typically at their lowest and highest values, respectively. For most of the flow metrics, a subset of data representing the five years with the highest and lowest values for each metric were also used to represent any effects in a typically wet (above average) or dry (below average) flow year.

Table 3.7-6. Yellowstone River Flow Data.

Flow Metric	Year Type	Flow at Forsythe (cfs)	Estimated Flow Upstream of the Diversion (cfs)	Proportion Diverted (%)
Mean Annual Flow	Average	10,354	10,423	0.7
	Dry	6,761	6,830	1.0
	Wet	15,838	15,907	0.4
Mean Peak Flow	Average	49,396	49,465	0.1
	Dry	32,080	32,149	0.2
	Wet	66,560	66,629	0.1
Mean February Flow	Average	5,210	5,279	1.3
	Dry	3,875	3,944	1.8
	Wet	7,058	7,127	1.0
Mean June Flow	Average	32,000	32,069	0.2
	Dry	18,128	18,197	0.3
	Wet	48,408	48,477	0.1

Source: OSMRE 2024.

3.7.6 Surface Water Quality

The sections below describe the water quality of surface water resources in the direct and indirect effects analysis areas. The water quality of surface water resources in the direct effects analysis area, specifically within the project area, represents largely natural conditions that have been minimally affected by man-made disturbances within or upstream of the project area. Water quality is variable in the project area primarily due to the dominance of either direct runoff from snowmelt or rainfall or groundwater discharge to surface water during various times of the year. Differences between drainages are more subtle than the effect of seasonal flow variability and are due to the presence or absence of baseflow from groundwater discharges, lithology, soil types, and land use practices (Slagle et al. 1983). Other factors affecting surface water quality are evaporation and transpiration, reactions of water with sediment, aquatic biota, and impoundments and diversions for agricultural purposes.

3.7.6.1 Water Quality in the Direct Effects Analysis Area

Streams in the Project Area

Baseline water quality results (through 2015) for streams in the project area (Robbie Creek, Donley Creek, and Black Hank Creek) were documented in the November 2018 Final EIS. Post-baseline (SEIS) water quality results (2016 through 2023) were compiled for two stream monitoring sites located on Robbie Creek (CG-101 and CG-102), four stream monitoring sites located on Donley Creek (CG-106, SW-89, SW-90, and SW-200), and three stream monitoring sites located on Black Hank Creek (CG-100, CG-103, and CG-105). Monitoring locations are shown on **Figure 3.7-1**. Post-baseline (SEIS) stream water quality data are summarized in **Appendix 3 – Water Quality Tables**: Table 1 (Robbie Creek), Table 2 (Donley Creek), and Table 3 (Black Hank Creek). Monitoring periods for the post-baseline (SEIS) stream monitoring sites are listed below.

- Robbie Creek: Six primary monitoring events:
    - CG-101 (March 2019 through July 2020)
    - CG-102 (March 2019)
- Donley Creek: 12 primary monitoring events:
    - CG-106 (March 2021)
    - SW-89 (June 2018 through June 2023)
    - SW-90 (May 2016 through June 2023)
    - SW-200 (February 2021 through March 2023)
- Black Hank Creek: Three primary monitoring events:
    - CG-100 (February 2017 through September 2023)
    - CG-103 (March 2019)
    - CG-105 (February 2017 through March 2023)

The quality of surface water was highly variable during the post-baseline (SEIS) monitoring periods. Measured pH was generally basic with values ranging from 8.7 down to 7.2. Parameters with exceedances of Montana Numeric Water Quality Standards (Circular DEQ-7) during the post-baseline (SEIS) stream monitoring periods include (see **Appendix 3** for a detailed list of exceedances):

- Robbie Creek:
    - Dissolved Aluminum (Aquatic Life Standard)
    - Total Copper (Aquatic Life Standard that is hardness dependent)
- Donley Creek:
    - Dissolved Aluminum (Aquatic Life Standard)
    - Ammonia (Aquatic Life Standard that is temperature and pH dependent)
    - Total Copper (Aquatic Life Standard that is hardness dependent)
    - Total Iron (Aquatic Life Standard)
    - Total Lead (Human Health Standard and Aquatic Life Standard that is hardness dependent)
- Black Hank Creek:
    - Dissolved Aluminum (Aquatic Life Standard)
    - Total Copper (Aquatic Life Standard that is hardness dependent)
    - Total Iron (Aquatic Life Standard)
    - Total Lead (Aquatic Life Standard that is hardness dependent)

Following is a comparison of baseline (2018 Final EIS) and post-baseline (SEIS) stream water quality results that exceeded DEQ-7 Aquatic Life or Human Health Standards. The stream monitoring locations that included both 2018 Final EIS and SEIS water quality results (that can be compared) include Robbie Creek (CG-101), Donley Creek (SW-89 and SW-90), and Black Hank Creek (CG-100). Bold text reflects parameters with DEQ-7 exceedances for post-baseline (SEIS) monitoring events where there were no DEQ-7 exceedances for baseline (2018 Final EIS) monitoring events.

- Robbie Creek (CG-101): Ten baseline (2018 Final EIS) monitoring events and six post-baseline (SEIS) monitoring events resulted in:
  - Dissolved Aluminum: One 2018 Final EIS exceedance and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.
  - **Total Copper: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.**
  - Total Iron: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
- Donley Creek (SW-89): Six baseline (2018 Final EIS) monitoring events and four post-baseline (SEIS) monitoring events resulted in:
  - No 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Standards.
- Donley Creek (SW-90): Six baseline (2018 Final EIS) monitoring events and five post-baseline (SEIS) monitoring events resulted in:
  - Dissolved Aluminum: Two 2018 Final EIS exceedances of the DEQ-7 Aquatic Life Standard, one 2018 Final EIS exceedance of the DEQ-7 Human Health Standard, and five SEIS exceedances of the DEQ-7 Aquatic Life Standard.
  - Fluoride: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Human Health Standard.
  - Total Iron: Four 2018 Final EIS exceedances and five SEIS exceedances of the DEQ-7 Aquatic Life Standard.
  - Total Lead: One 2018 Final EIS exceedance and one SEIS exceedance of the DEQ-7 Aquatic Life and Human Health Standards.
  - Total Mercury: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Human Health Standard.
  - Total Selenium: Two 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
- Black Hank Creek (CG-100): Three baseline (2018 Final EIS) monitoring events and three post-baseline (SEIS) monitoring events resulted in:
  - Dissolved Aluminum: One 2018 Final EIS exceedance and two SEIS exceedances of the DEQ-7 Aquatic Life Standard.
  - Total Iron: Three 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.

Ponds in the Project Area

Baseline water quality results (through April 2016) for ponds in the project area (Ponds 1 through 9) were documented in the November 2018 Final EIS. Post-baseline (SEIS) water quality results (June 2014 through November 2023) were compiled for seven of the nine pond monitoring sites (not including Ponds 3 and 6). Monitoring locations are shown on **Figure 3.7-1**. Post-baseline (SEIS) pond water quality data are summarized in **Appendix 3 – Water Quality Tables**: Tables 4 through 10. Monitoring periods for the post-baseline (SEIS) spring monitoring sites are listed below.

- Pond 1: Seven primary monitoring events from April 2018 through May 2020
- Pond 2: One primary monitoring event in June 2014
- Pond 4: One primary monitoring event in March 2023
- Pond 5: 26 primary monitoring events from May 2015 through November 2023
- Pond 7: One primary monitoring event in October 2016
- Pond 8: 21 primary monitoring events from July 2016 through November 2023
- Pond 9: 21 primary monitoring events from July 2016 through November 2023

The quality of pond water was highly variable during the post-baseline (SEIS) monitoring periods. Measured pH was generally basic with values ranging from 9.55 down to 7.4. Parameters with exceedances of Montana Numeric Water Quality Standards (Circular DEQ-7) during the post-baseline (SEIS) pond monitoring periods include (see **Appendix 3** for a detailed list of exceedances):

- Pond 1:
    - Dissolved Aluminum (Aquatic Life Standard)
    - Total Iron (Aquatic Life Standard)
    - Total Selenium (Aquatic Life Standard)
- Pond 5:
    - Dissolved Aluminum (Aquatic Life Standard)
    - Ammonia (Aquatic Life Standard that is temperature and pH dependent)
    - Total Arsenic (Human Health Standard)
    - Total Cadmium (Aquatic Life Standard that is hardness dependent)
    - Total Iron (Aquatic Life Standard)
    - Total Selenium (Aquatic Life Standard)
- Pond 8:
    - Ammonia (Aquatic Life Standard that is temperature and pH dependent)
    - Total Arsenic (Human Health Standard)
    - Total Copper (Aquatic Life Standard that is hardness dependent)
    - Total Iron (Aquatic Life Standard)
- Pond 9:
    - Total Arsenic (Human Health Standard)

Following is a comparison of baseline (2018 Final EIS) and post-baseline (SEIS) pond water quality results that exceeded DEQ-7 Aquatic Life or Human Health Standards. The monitored ponds that included both 2018 Final EIS and SEIS water quality results (that can be compared) include Ponds 1, 2, 4, 5, 7, 8, and 9. Bold text reflects parameters with DEQ-7 exceedances for post-baseline (SEIS) monitoring events where there were no DEQ-7 exceedances for baseline (2018 Final EIS) monitoring events.

- Pond 1: 14 baseline (2018 Final EIS) monitoring events and seven post-baseline (SEIS) monitoring events resulted in:
    - **Dissolved Aluminum: No 2018 Final EIS exceedances and two SEIS exceedances of the DEQ-7 Aquatic Life Standard.**
    - Fluoride: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Human Health Standard.
    - Total Iron: Three 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.
    - Total Selenium: Five 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.
- Pond 2: Three baseline (2018 Final EIS) monitoring events and one post-baseline (SEIS) monitoring event resulted in:
    - Total Iron: Two 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
- Pond 4: One baseline (2018 Final EIS) monitoring event and one post-baseline (SEIS) monitoring event resulted in:
    - Total Selenium: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
- Pond 5: 17 baseline (2018 Final EIS) monitoring events and 26 post-baseline (SEIS) monitoring events resulted in:
    - Dissolved Aluminum: One 2018 Final EIS exceedance of the DEQ-7 Human Health and Aquatic Life Standards and two SEIS exceedances of the DEQ-7 Aquatic Life Standard.
    - **Ammonia: No 2018 Final EIS exceedances and three SEIS exceedances of the DEQ-7 Aquatic Life Standard.**
    - **Total Arsenic: No 2018 Final EIS exceedances and two SEIS exceedances of the DEQ-7 Human Health Standard.**
    - **Total Cadmium: No 2018 Final EIS exceedances and two SEIS exceedances of the DEQ-7 Aquatic Life Standard.**
    - Total Iron: Four 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.
    - **Total Selenium: No 2018 Final EIS exceedances and six SEIS exceedances of the DEQ-7 Aquatic Life Standard.**
- Pond 7: 20 baseline (2018 Final EIS) monitoring events and one post-baseline (SEIS) monitoring event resulted in:
    - Dissolved Aluminum: Three 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
    - Total Arsenic: One 2018 Final EIS exceedance and no SEIS exceedances of the DEQ-7 Human Health Standard.
    - Total Iron: Nine 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.
    - Total Lead: One 2018 Final EIS exceedance of the DEQ-7 Human Health and Aquatic Life Standards and no SEIS exceedances of the DEQ-7 Human Health or Aquatic Life Standards.
    - Total Selenium: Six 2018 Final EIS exceedances and no SEIS exceedances of the DEQ-7 Aquatic Life Standard.

- Pond 8: Three baseline (2018 Final EIS) monitoring events and 21 post-baseline (SEIS) monitoring events resulted in:
    - **Ammonia: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.**
    - **Total Arsenic: No 2018 Final EIS exceedances and two SEIS exceedances of the DEQ-7 Human Health Standard.**
    - **Total Copper: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.**
    - **Total Iron: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Aquatic Life Standard.**
    - Pond 9: Three baseline (2018 Final EIS) monitoring events and 21 post-baseline (SEIS) monitoring events resulted in:
    - **Total Arsenic: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Human Health Standard.**

Springs in the Project Area

Baseline water quality results (through April 2016) for springs in the project area (Springs 1 through 14) were documented in the November 2018 Final EIS. Post-baseline (SEIS) water quality results (July 2016 through November 2023) were compiled for the same 14 spring monitoring sites. Monitoring locations are shown on **Figure 3.7-1**. The likely source of water to these springs is listed in **Section 3.8.2.1, Springs**. Post-baseline (SEIS) spring water quality data are summarized in **Appendix 3 – Water Quality Tables**: Tables 11 through 24. Monitoring periods for the post-baseline (SEIS) spring monitoring sites are listed below.

- Spring 1: Two primary monitoring events from July 2016 through October 2016
- Spring 2: 20 primary monitoring events from July 2016 through November 2023
- Spring 3: 21 primary monitoring events from July 2016 through November 2023
- Spring 4: 21 primary monitoring events from July 2016 through November 2023
- Spring 5: 19 primary monitoring events from July 2016 through November 2023
- Spring 6: Three primary monitoring events from July 2016 through March 2017
- Spring 7: 21 primary monitoring events from July 2016 through November 2023
- Spring 8: Nine primary monitoring events from October 2018 through March 2022
- Spring 9: 20 primary monitoring events from July 2016 through November 2023
- Spring 10: 21 primary monitoring events from July 2016 through November 2023
- Spring 11: 14 primary monitoring events from March 2017 through May 2023
- Spring 12: 16 primary monitoring events from October 2016 through November 2023
- Spring 13: Eight primary monitoring events from June 2018 through November 2023
- Spring 14: 21 primary monitoring events from July 2016 through November 2023

The quality of spring water was highly variable during the post-baseline (SEIS) monitoring periods. Measured pH was generally basic with values ranging from 9.22 down to 7.9. Parameters with exceedances of Montana Numeric Water Quality Standards (Circular DEQ-7) during the post-baseline (SEIS) spring monitoring periods include (see **Appendix 3** for a detailed list of exceedances):

- Spring 5:
  - Nitrate+Nitrite (Human Health Standard)
  - Dissolved Selenium (Human Health Standard)
- Spring 6:
  - Dissolved Nickel (Human Health Standard)
  - Dissolved Zinc (Human Health Standard)
- Spring 7:
  - Dissolved Selenium (Human Health Standard)
- Spring 8:
  - Dissolved Selenium (Human Health Standard)
- Spring 9:
  - Dissolved Arsenic (Human Health Standard)
- Spring 12:
  - Nitrate+Nitrite (Human Health Standard)
  - Dissolved Selenium (Human Health Standard)

Following is a comparison of baseline (2018 Final EIS) and post-baseline (SEIS) spring water quality results that exceeded DEQ-7 Aquatic Life or Human Health Standards. The monitored springs that included both 2018 Final EIS and SEIS water quality results (that can be compared) include Springs 5, 6, 7, 8, 9, and 12. Bold text reflects parameters with DEQ-7 exceedances for post-baseline (SEIS) monitoring events where there were no DEQ-7 exceedances for baseline (2018 Final EIS) monitoring events.

- Spring 5: 18 baseline (2018 Final EIS) monitoring events and 19 post-baseline (SEIS) monitoring events resulted in:
  - Nitrate+Nitrite: 17 2018 Final EIS exceedances and 16 SEIS exceedances of the DEQ-7 Human Health Standard.
  - Dissolved Selenium: 13 2018 Final EIS exceedances and 13 SEIS exceedances of the DEQ-7 Human Health Standard.
- Spring 6: 21 baseline (2018 Final EIS) monitoring events and three post-baseline (SEIS) monitoring events resulted in:
  - **Dissolved Nickel: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Human Health Standard.**
  - **Dissolved Zinc: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Human Health Standard.**
- Spring 7: 21 baseline (2018 Final EIS) monitoring events and 21 post-baseline (SEIS) monitoring events resulted in:
  - Dissolved Selenium: Two 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Human Health Standard.
- Spring 8: 19 baseline (2018 Final EIS) monitoring events and nine post-baseline (SEIS) monitoring events resulted in:
  - **Dissolved Selenium: No 2018 Final EIS exceedances and one SEIS exceedance of the DEQ-7 Human Health Standard.**

- Spring 9: 20 baseline (2018 Final EIS) monitoring events and 20 post-baseline (SEIS) monitoring events resulted in:
  - Dissolved Arsenic: One 2018 Final EIS exceedance and three SEIS exceedances of the DEQ-7 Human Health Standard.
- Spring 12: Four baseline (2018 Final EIS) monitoring events and 16 post-baseline (SEIS) monitoring events resulted in:
  - **Nitrate+Nitrite: No 2018 Final EIS exceedances and three SEIS exceedances of the DEQ-7 Human Health Standard.**
  - **Dissolved Selenium: No 2018 Final EIS exceedances and three SEIS exceedances of the DEQ-7 Human Health Standard.**

Effluent from MPDES Outfalls in the Project Area

Baseline water quality results for effluent from MPDES outfalls in the project area were not documented in the November 2018 Final EIS. Post-baseline (SEIS) water quality results (June 2023 through September 2023) were compiled for effluent from two MPDES (Permit MT-0031828) outfall monitoring sites (Outfalls 005 and 009). Monitoring locations are shown on **Figure 3.7-1**. Post-baseline (SEIS) MPDES outfall effluent water quality data are summarized in **Appendix 3 – Water Quality Tables**: Tables 25 and 26. Monitoring periods for the post-baseline (SEIS) MPDES outfall effluent monitoring sites are listed below.

- Outfall 005: Two monitoring events from June 2023 through September 2023
- Outfall 009: One monitoring event in June 2023

The quality of MPDES outfall effluent was variable during the post-baseline (SEIS) monitoring periods. Measured pH was basic with a value of 7.7. Parameters with exceedances of MPDES Permit MT-0031828 effluent limitations and Montana Numeric Water Quality Standards (Circular DEQ-7) during the post-baseline (SEIS) MPDES outfall effluent monitoring periods include (see **Appendix 3** for a detailed list of exceedances):

- Outfall 005:
  - Total Arsenic (Human Health Standard)
  - Total Iron (MPDES effluent limitation and Aquatic Life Standard)
  - Total Lead (Human Health Standard and Aquatic Life Standard that is hardness dependent)
  - Total Mercury (Human Health Standard)
  - Settleable Solids (MPDES effluent limitation)
  - Total Suspended Sediments (MPDES effluent limitation)

3.7.6.2 Water Quality in the Indirect Effects Analysis Area

The existing water quality of streams in the indirect effects analysis area is described below in the context of coal combustion from the Colstrip and Rosebud Power Plants, specifically for the following constituents: mercury, selenium, copper, nitrate+nitrite, and total nitrogen. Water quality data were collected by DEQ, the Northern Cheyenne Tribe, and Montana PPL Corporation for Sarpy Creek (including its tributary East Fork), Armells Creek (including its tributaries East Fork and West Fork), Rosebud Creek (including its tributaries Lame Deer Creek, Miller Creek, Pony Creek, and Spring Creek), and the Yellowstone River (between the Cartersville Dam and the confluence with the Tongue River).

Castle Rock Lake is a reservoir located in Colstrip (**Figure 3.7-2**). It was constructed to provide water for the Colstrip Power Plant and was filled in 1978. The source of the water is the Yellowstone River, piped 30 miles to Castle Rock Lake. The city of Colstrip also uses the lake for its municipal water supply. Montana Fish, Wildlife and Parks (FWP) has a fish consumption advisory related to mercury for Castle Rock Lake (DEQ 2016e). Mercury was not tested in any samples from Castle Rock Lake.

A summary of stream water quality data for mercury, selenium, copper, nitrate+nitrite, and total nitrogen is provided in **Table 3.7-7**; these data were collected between 2000 and 2024 (EPA 2024h). An analysis of effects on stream water quality from deposition was limited to mercury, selenium, and copper (copper was predicted by the air-quality modeling to have the greatest deposition rate of all the modeled metals). Other metals were not evaluated because the deposition areas for antimony, arsenic, cadmium, chromium, and lead were predicted to be very small (within the Colstrip Power Plant site area). The standards for mercury, selenium, and copper are provided in **Table 3.7-4**, and the lowest standard is shown in **Table 3.7-5**. Exceedances of water quality standards are shown in bold text below in **Table 3.7-7**. Alkalinity of indirect effects analysis area streams has nearly always been greater than 100 mg/L and often has been several hundred mg/L, and pH averaged approximately 8 standard units from 2000 through 2024 (EPA 2024h).

Table 3.7-7. Summary of Mercury, Selenium, Copper, Nitrate+Nitrite, and Total Nitrogen Water Quality Data for Indirect Effects Analysis Area Streams.

Stream and Sampling Period	Mercury (mg/L)	Selenium (mg/L)	Copper (mg/L)	Nitrate + Nitrite (mg/L)	Total Nitrogen[1] (mg/L)
Sarpy Creek (and East Fork) 2005	BDL-**0.0001** (estimated[2])	BDL-0.002	BDL-0.008	BDL-0.395	1.11-**1.4**
Armells Creek (and East/West Forks) 2005-2022	BDL-0.000017	BDL-**0.06**	BDL-**1.07**	BDL-3.55	BDL-**33.6**
Rosebud Creek 2001-2024	BDL-**0.0011**	BDL-**0.008**	BDL-**0.77**	BDL-0.32	BDL-1.04
Rosebud Creek Tributary (Lame Deer Creek) 2005-2024	BDL	BDL-0.0025	BDL-0.005	BDL-1.4	BDL-0.97
Rosebud Creek Tributary (Miller Creek) 2015-2016	No data	BDL	BDL-0.002	BDL-0.05	BDL-1.06
Rosebud Creek Tributary (Pony Creek) 2015-2016	No data	BDL	BDL-0.004	BDL-0.07	0.62
Rosebud Creek Tributary (Spring Creek) 2015-2016	No data	BDL-0.003	BDL-0.012	BDL-0.14	1.11-1.22
Yellowstone River (Cartersville Dam to Tongue River) 2017-2019	0.0000053-0.00001	BDL	0.00047-0.005	BDL-0.26	0.23-0.62
Lowest water quality standard	0.00005 (HHS)	0.005 (ALS)	0.031 (ALS)[3]	10 (HHS)	1.3 (ALS)[1]

BDL = Below Detection Limit; HHS = Human Health Standard; ALS = Aquatic Life Standard.
[1.] Total nitrogen data include laboratory test results from water samples collected only during the period for which the total nitrogen standard is applicable (July 1 through September 30).
[2.] Laboratory test results were estimated due to uncertainty associated with total method error.
[3.] The copper standard is hardness-dependent and is based on an assumed hardness of 400 mg/L or greater.
Source: EPA 2024h.

An analysis of the data shows the following:

- For mercury, there was one exceedance of the standard in 2005 in Sarpy Creek between its confluences with Coral Creek and West Coral Creek, and there was one exceedance of the standard in 2004 in Rosebud Creek near the mouth. In the past 10 years, mercury concentrations measured in the streams in the indirect effects analysis area have been below the water quality standard (and only four results have been above laboratory detection limits).
- For selenium, there were eight exceedances of the standard between 2000 and 2011 in East Fork Armells Creek (seven exceedances at multiple locations) and in West Fork Armells Creek (one exceedance between its confluences with Trail Creek and East Cromo Creek), and there was one exceedance of the standard in 2004 in Rosebud Creek near the mouth. In the past 10 years, selenium concentrations measured in the streams in the indirect effects analysis area have been below the water quality standard.
- For copper, there were two exceedances of the standard at two locations on East Fork Armells Creek (one exceedance in 2007 at 1.07 mg/L and one exceedance in 2015 at 0.032 mg/L), and there was one exceedance of the standard in 2004 in Rosebud Creek near the mouth. In the past 10 years, copper concentrations measured in the streams in the indirect effects analysis area have been below the water quality standard, except for the one exceedance in East Fork Armells Creek in 2015 at 0.032 mg/L (slightly above the water quality standard of 0.031 mg/L).
- For nitrate+nitrite, all results were well below the standard.
- For total nitrogen, there was one exceedance of the standard in 2005 in Sarpy Creek between its confluences with West Coral Creek and Coral Creek, and there were 11 exceedances between 2017 and 2022 of the standard in Armells Creek (one exceedance in 2017 downstream of the East and West Fork confluence) and in East Fork Armells Creek (10 exceedances between 2017 and 2022 at multiple locations).

3.8 WATER RESOURCES – GROUNDWATER

3.8.1 Introduction

Since the issuance of the 2018 Final EIS, there have been some changed conditions relevant to groundwater (**Table 3.7-1)**. None of the changed groundwater conditions listed in **Table 3.7-1** substantially alter the analysis presented in the 2018 Final EIS. For example, AM5 to the Area B operating permit, which was approved in 2022, is for a mining area located within the Rosebud Creek groundwater basin. In contrast, Area F is located within West Fork Armells Creek groundwater basin; therefore, there is no interaction between the impacts on groundwater from AM5 and impacts from Area F. Groundwater has been continually monitored and reported annually prior to and following the start of Area F active mining in 2020, and the results do not significantly alter the analysis previously presented in the 2018 Final EIS.

As applicable, the affected environment sections below have been updated from the 2018 Final EIS to address relevant changed conditions, to incorporate groundwater information disclosed in the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), to incorporate annual monitoring data collected by Westmoreland Rosebud since the data evaluated in the 2018 Final EIS, and to incorporate updated hydrologic information reported in Westmoreland Rosebud's Annual Hydrology Reports. All other information on groundwater is available in **Section 3.8** of the 2018 Final EIS beginning on page 247.

3.8.1.1 Regulatory Framework

The complete regulatory framework applicable to groundwater is in **Section 3.8.1.1** of the 2018 Final EIS beginning on page 247. Since the 2018 Final EIS, the DEQ water quality standards have been updated, as described under surface water in **Section 3.7.1.1, Regulatory Framework**. DEQ's updated 2019 Circular 7 water quality standards for the parameters of interest are unchanged relative to the 2017 standards analyzed and disclosed in the 2018 Final EIS (Table 56) and therefore do not impact the baseline conditions or the impacts analyses presented in the 2018 Final EIS or those summarized in **Appendix 3** for groundwater (**Tables 27** through **31**) and springs (**Tables 11** through **24**).

There is little scientific consensus on recommended water quality limits for livestock. The state and EPA have not established ambient water quality criteria for livestock or wildlife. A summary of water quality criteria for livestock from several studies is provided in **Section 3.7, Water Resources – Surface Water**, **Table 3.7-5**. These criteria are also relevant to well water used for livestock. The criteria are not enforceable standards but are used as guidance in evaluating the suitability of water quality for optimal livestock performance. These criteria add to those previously disclosed but do not significantly impact the baseline conditions or the impacts analyses presented in the 2018 Final EIS. The limits are not enforceable standards but are used for guidance in evaluating suitability of pre- and postmining water quality for livestock use and represent values established from a variety of scientific studies. Even above the limits, harmful effects are not guaranteed or even necessarily likely. The criteria for livestock drinking water use are considered protective of wildlife drinking water use because wildlife are generally more acclimatized to naturally variable water quality than domesticated animals.

3.8.1.2 Analysis Area

The analysis areas for groundwater and the rationale for their use are described in detail in **Section 3.8.1.2** of the 2018 Final EIS beginning on page 249. The analysis area for direct effects on groundwater hydrology and quality is the project area[38] (**Figure 3.7-1**), which includes the area where mining and/or related disturbances would occur and the area outside of the permit boundary where direct effects on groundwater are predicted to occur based on modeling. The analysis area for indirect effects on groundwater is within the property boundary of the Colstrip Power Plant (owned by PPL Montana LLC, WPP LLC, and Colstrip Comm Serv LLC), because the Colstrip Power Plant boundary includes all groundwater impacted by operations at the plant (Hydrometrics 2015). Indirect effects from the storage of coal combustion products on groundwater at both the Rosebud and Colstrip Power Plants were analyzed (see **Section 4.8, Water Resources – Groundwater**).

3.8.2 Site Hydrogeology

Information on the affected environment site hydrogeology is available in the 2018 Final EIS in **Section 3.8.2** beginning on page 250. The discussion of springs from the 2018 Final EIS is included below to support the discussion of springs in **Section 3.7, Water Resources – Surface Water.**

3.8.2.1 Springs

Numerous springs have been identified in the vicinity of the project area (**Figure 3.7-1)**. Fourteen of the springs are numbered and have been periodically monitored by Westmoreland Rosebud (**Figure 2.2-7** in **Chapter 2**). Springs are typically located along or near drainages, and some maintain perennial or intermittent reaches of streams. **Table 3.8-1** provides a summary of the likely groundwater source to each spring.

Table 3.8-1. Source of Groundwater to Monitored Springs.

Spring	Groundwater Source	Spring	Groundwater Source
1	Overburden	8	Rosebud Coal and possibly clinker
2	Unknown	9	Overburden
3	Overburden	10	Overburden and possibly Rosebud Coal
4	Overburden	11	Rosebud/clinker and possibly overburden
5	Overburden	12	Unknown
6	Overburden	13	McKay Coal
7	Rosebud Coal	14	Sub-McKay and possibly alluvial groundwater

Source: PAP, Appendix J, Attachment B-J.

Springs 2 and 12 are located stratigraphically below the outcrop of the Rosebud Coal and could be receiving water from interburden sandstones or possibly the McKay Coal, like nearby Spring 13. Spring 3 is located stratigraphically above the outcrop of the Rosebud Coal so that it could be receiving water from sandstone in the overburden and/or the Rosebud Coal.

3.8.3 Conceptual Hydrogeological Model

Information on the conceptual hydrogeological model is available in the 2018 Final EIS in **Section 3.8.3** beginning on page 257.

[38]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.8.4 Groundwater Use

Information on groundwater use is available in the 2018 Final EIS in **Section 3.8.4** beginning on page 258.

3.8.5 Groundwater Quality

Information on analysis area groundwater quality is available in the 2018 Final EIS in **Section 3.8.5** beginning on page 258. Although there are updated groundwater monitoring data available for the analysis area, the new data do not significantly impact the baseline conditions; nor do they significantly alter the impacts analyses presented in the 2018 Final EIS. The baseline tables presented in this SEIS summarize water quality data collected following the data collection range summarized in the Final EIS and therefore allow the evaluation of any changes that have occurred since the 2018 Final EIS evaluation was conducted. In general, the Final EIS summarized groundwater data collected over the 2005-2016 timeframe, while this SEIS summarizes groundwater data collected between 2017 and 2023 (**Appendix 3 – Water Quality Tables: Tables 27 through 31**). In comparing the groundwater quality summarized in the Final EIS to that summarized here for the same hydrostratigraphic units in the project area, no significant changes are observed, and the SEIS baseline period is considered consistent with the Final EIS baseline conditions. Similar to the Final EIS baseline period evaluated, a few exceedances of human health water quality standards were observed during the SEIS baseline water quality evaluation period. Two exceedances for fluoride were observed in the overburden (WO-184 and WO-186), one exceedance of selenium in the overburden (WO-187), and one exceedance of fluoride in the sub-McKay (WD-189). All exceedances were observed during the June 2018 sampling event prior to mining in Area F. The general water quality descriptions of each hydrostratigraphic unit described in the 2018 Final EIS remain relevant and adequately describe the data collected and summarized for this SEIS.

The livestock exceedance discussion in the 2018 Final EIS was relative to the one set of criteria used during that evaluation. Due to the lack of scientific consensus on recommended water quality limits for livestock and since the state and EPA have not established ambient water quality criteria for livestock or wildlife, detailed exceedances relative to livestock criteria have not been highlighted for the baseline tables presented in this SEIS (**Appendix 3 – Water Quality Tables**). Baseline groundwater quality reflects exceedances of one or more parameters of livestock water quality guidelines. Though water resources have historically been used by livestock, as indicated by water rights, and although even above the limits, harmful effects are not guaranteed or even necessarily likely. The criteria for livestock drinking water use are considered protective of wildlife drinking water use because wildlife are generally more acclimatized to naturally variable water quality than domesticated animals. In general, baseline samples frequently exceed guideline values for livestock drinking water for TDS, magnesium, and sulfate concentrations with slight differences depending on the hydrostratigraphic unit evaluated and with alluvium and overburden groundwater typically displaying poorer water quality relative to the other units. Alkalinity, aluminum, arsenic, calcium, copper, fluoride, iron, lead, manganese, pH, and selenium concentrations also occasionally approach or exceed livestock guidelines. The quality of alluvium, overburden, Rosebud Coal, McKay Coal, and sub-McKay groundwater is considered marginally suitable for livestock drinking water uses.

3.9 WATER RESOURCES – WATER RIGHTS

3.9.1 Introduction

Since the issuance of the 2018 Final EIS, there have been some changed conditions relevant to water rights. These are the same as for surface water and are listed in **Table 3.7-1**. None of the changed conditions substantially alter the analysis presented in the 2018 Final EIS. Information on surface water and groundwater rights in the direct effect analysis area is available in **Section 3.9** of the 2018 Final EIS beginning on page 275 and in **Appendix E – List of Surface Water and Groundwater Rights** in that document. In response to the 2022 court order, the analysis area for direct and cumulative impacts on surface water was increased for this SEIS to include a portion of the Yellowstone River (see **Section 3.7, Water Resources – Surface Water**). The analysis area for indirect effects on surface water rights was also increased and is described in **Section 3.9.1.2, Analysis Area.** Due to the large number of water rights in the enlarged indirect effects analysis area, the discussion below is qualitative. Analysis areas for cumulative effects are described in **Chapter 5**.

3.9.1.1 Regulatory Framework

The regulatory framework applicable to water rights is unchanged since the 2018 Final EIS and is described in **Section 3.9.1.1** of the 2018 Final EIS beginning on page 275.

3.9.1.2 Analysis Area

The analysis area for direct impacts on water rights is unchanged from the 2018 Final EIS and is shown on **Figures 43** and **44** and described in **Section 3.9.1.2** of that document beginning on page 277. It includes the project area (where mining and related disturbance would occur)[39] as well as the surrounding area that may be affected by mining in the project area. The analysis area for indirect effects on surface water rights is the same as that used for surface water and is described above in **Section 3.7.1.2** and is shown on **Figure 3.7-2**. The indirect effects analysis area for groundwater rights is the same as that described for groundwater in **Section 3.8.1.2, Analysis Area**.

3.9.2 Existing Water Rights

Surface water and groundwater rights in the direct effects analysis area and the groundwater indirect effects analysis area are described in **Section 3.9.2** of the 2018 Final EIS beginning on page 278. Water rights were compiled for T2N R38E in the southeast corner of Treasure County and for T2N R39E in Rosebud County. **Appendix E** of the 2018 Final EIS provides a list of the 122 surface water and groundwater rights on record with the Water Rights Bureau that are within the direct analysis area as well as downgradient water rights in the indirect effects analysis area that may be affected by mine operations.

Surface water rights in the indirect effects analysis area include those with points of withdrawal within the Armells Creek watershed, and parts of the Sarpy Creek and Rosebud Creek watersheds. Water rights to the Yellowstone River between the Cartersville Dam (located near Forsyth between river miles 238 and 329) and the confluence with the Tongue River are also included. There are about 1,600 active surface water rights (subject water rights) on record with the Montana Department of Natural Resources and

39. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

Conservation that are within the indirect and cumulative effects analysis area. The subject water rights cumulatively include about 1,900 cfs of maximum diversion potential with priority dates that range from 1900 through 2023 and are used for a wide range of water supply purposes including domestic, fish and wildlife, flood control, industrial, irrigation, lawn and garden, mining, municipal, pollution abatement, recreation, sediment control, stock, wildlife, and waterfowl. Approximately 95 percent of the maximum diversion potential associated with the subject water rights is dedicated exclusively for irrigation purposes, and approximately 70 percent of the maximum diversion potential associated with the subject water rights is sourced from the Yellowstone River. There are approximately 100 active surface water rights on the Yellowstone River within the indirect effects analysis area with a maximum diversion potential of approximately 1,400 cfs. Most of those water rights are dedicated exclusively for irrigation purposes, including the largest three of those water rights (425 cfs, 144 cfs, and 109 cfs). The 69 cfs municipal and industrial water right used to supply water for the Colstrip Power Plant is also sourced from the Yellowstone River, upstream of Forsyth.

3.10 VEGETATION

3.10.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to vegetation. Please note that the following actions (**Table 3.10-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for vegetation. Detailed information on vegetation is available in **Section 3.10** of the 2018 Final EIS beginning on page 281. See **Section 3.13, Special Status Species** in this SEIS for a discussion of federally listed plant species.

Table 3.10-1. Vegetation: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for vegetation: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative vegetation impacts of Area F. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2020	The monarch butterfly (*Danaus plexippus plexippus*) was designated as a candidate species under consideration for listing as an endangered species (85 FR 243). The monarch's range includes southern Canada and the entire continental United States to South America. This distinctive, large (5.2 to 5.8 centimeters long at the forewing), orange-and-black butterfly overwinters in California and Mexico. Larval food plants include several species of *Asclepias* (milkweed – the primary host plant genus), *Apocynum*, *Calotropis*, *Matelea*, and *Sarcostemma*; adults feed on nectar from a variety of flowers (MNHP 2022a). Potential habitat (milkweed) likely occurs in Area F, but no critical habitat has been designated by the U.S. Fish and Wildlife Service (USFWS). The nearest known occurrences of monarch butterfly to Area F are documented along the Yellowstone River and Smith Creek north and west of Forsythe in Rosebud and Custer Counties (MNHP 2022b). See **Section 3.13, Special Status Species**, below and the Area F Biological Assessment (BA; OSMRE 2024) for a more detailed discussion of monarch butterfly and its vegetation needs.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2023	Westmoreland completes revegetation monitoring surveys and submits Annual Revegetation Monitoring Reports to Montana DEQ as a condition of its operating permits for the Rosebud Mine. The most recent reporting year available is 2023 (January 1, 2023, through December 31, 2023); this report was reviewed to confirm there have been no significant changes since the 2018 Final EIS (Cedar Creek Associates, Inc. 2023a).

3.10.1.1 Regulatory Framework

The regulatory framework applicable to vegetation is unchanged since the 2018 Final EIS and is described in **Section 3.10.1.1** of the 2018 Final EIS beginning on page 281.

3.10.1.2 Analysis Area

The analysis areas for vegetation and the rationale for their use are described in detail in **Section 3.10.1.2** of the 2018 Final EIS beginning on page 282. The analysis areas are the project area[40] (direct impacts) and the operational boundaries of the Colstrip and Rosebud Power Plants plus a 32-km area around each of the power plants (indirect impacts).

3.10.2 Vegetation Communities

Existing vegetation communities in the direct effects analysis area are described in **Section 3.10.2** of the 2018 Final EIS beginning on page 283. See **Section 3.13, Special Status Species** in this SEIS for a discussion of federally listed plant species.

3.10.3 Vegetation Communities in the Indirect Effects Analysis Area

Existing vegetation communities in the indirect effects analysis area are described in **Section 3.10.3** of the 2018 Final EIS beginning on page 289.

3.10.4 Noxious Weeds

Noxious weeds in the analysis area are described in **Section 3.10.4** of the 2018 Final EIS beginning on page 290.

[40]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.11 WETLANDS AND RIPARIAN ZONES

3.11.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to wetlands and riparian zones other than those listed above in **Table 3.7-1** for water resources. As described in **Chapter 2**, Westmoreland Rosebud began developing Area F in 2019 according to its state operating permit and Federal mining plan. As of 2023, no wetlands have been disturbed in the project area. Detailed information on wetlands is available in **Section 3.11** of the 2018 Final EIS beginning on page 291.

3.11.1.1 Regulatory Framework

The regulatory framework applicable to wetlands is described in **Section 3.11.1.1** of the 2018 Final EIS beginning on page 291. On May 25, 2023, the United States Supreme Court modified the definition of "waters of the U.S.," reducing the jurisdiction of the CWA over wetlands adjacent to bodies of water that do not have a continuous surface connection to other known waters of the U.S. As described in **Section 3.11.2.3** of the 2018 Final EIS, on page 297, the USACE had previously determined that all 12 wetlands in the analysis area are isolated and therefore non-jurisdictional. The Supreme Court ruling on the definition of waters of the U.S. does not change the status of the wetlands in the analysis area, which continue to be non-jurisdictional.

3.11.1.2 Analysis Area

The analysis areas for wetlands and the rationale for their use are described in detail in **Section 3.11.1.2** of the 2018 Final EIS beginning on page 293. For direct impacts, the analysis area is the project area[41] plus a 500-foot buffer, and for indirect impacts, the analysis area includes all of the Armells Creek watershed, and parts of the Sarpy Creek and Rosebud Creek watersheds within and downstream of the 32-km circular area (**Figure 49** in the 2018 Final EIS).

3.11.2 Wetlands in the Direct Effects Analysis Area

Existing wetlands in the direct effects analysis area are described in **Section 3.11.2** of the 2018 Final EIS beginning on page 294 and shown on **Figure 2.2-1** in **Chapter 2** of this SEIS.

3.11.3 Other Waters of the U.S. in the Direct Effects Analysis Area

Other waters of the U.S. in the direct effects analysis area are described in **Section 3.11.3** of the 2018 Final EIS beginning on page 297. See also the discussion in this SEIS in **Chapter 1, Section 1.4.3.2, U.S. Army Corps of Engineers**.

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[41]. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.11.4 Springs and Seeps in the Direct Effects Analysis Area

Springs and seeps in the direct effects analysis area (prior to ongoing mine development in Area F) are described in **Section 3.11.4** of the 2018 Final EIS beginning on page 298 and in this SEIS in **Section 3.7, Water Resources – Surface Water** and **Section 3.8.2.1, Springs**.

3.11.5 Wetlands in the Indirect Effects Analysis Area

Wetlands in the indirect effects analysis area are described in **Section 3.11.5** of the 2018 Final EIS beginning on page 298.

3.12 FISH AND WILDLIFE RESOURCES

3.12.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to fish and general wildlife other than those described for special status species in **Section 3.13**. Please note that the following actions (**Table 3.12-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for fish and general wildlife. Detailed information on fish and general wildlife is available in **Section 3.12** of the 2018 Final EIS beginning on page 303.

Table 3.12-1. Fish and Wildlife Resources: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for fish and wildlife and their habitats: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative wildlife impacts of Area F. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2020	The monarch butterfly (*Danaus plexippus plexippus*) was designated as a candidate species under consideration for listing as an endangered species (85 FR 243). The monarch's range includes southern Canada and the entire continental United States to South America. This distinctive, large (5.2 to 5.8 centimeters long at the forewing), orange-and-black butterfly overwinters in California and Mexico. Larval food plants include several species of *Asclepias* (milkweed – the primary host plant genus), *Apocynum*, *Calotropis*, *Matelea*, and *Sarcostemma*; adults feed on nectar from a variety of flowers (MNHP 2022a). Potential habitat (milkweed) likely occurs in Area F, but no critical habitat has been designated by the USFWS. The nearest known occurrences of monarch butterfly to Area F are documented along the Yellowstone River and Smith Creek north and west of Forsythe in Rosebud and Custer Counties (MNHP 2022b). See **Section 3.13, Special Status Species**, below and the Area F BA (OSMRE 2024) for a more detailed discussion of monarch butterfly and its vegetation needs.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2023	Westmoreland completed benthic aquatic macroinvertebrate surveys as a condition of its Area F operating permit (Cedar Creek Associates, Inc. 2023b).
2023	Westmoreland completes annual wildlife surveys and submits Annual Wildlife Monitoring Reports to Montana DEQ as a condition of its operating permits for the Rosebud Mine. The most recent reporting year available is 2023 (January 1, 2023, through December 31, 2023); this report (ICF 2024) was reviewed to confirm there have been no significant changes since the 2018 Final EIS.
2024	The western regal fritillary (*Argynnis idalia occidentalis*) was proposed for listing as a threatened species in August 2024 (89 FR 63888-63909, August 6, 2024). The regal fritillary is a large butterfly consisting of two subspecies found in the native grasslands of the central and northern Great Plains and portions of the Midwest (the western regal fritillary), and a single location in eastern Pennsylvania (the eastern regal fritillary) (USFWS 2024c). Regal fritillary habitat is composed of grasslands with necessary components of native violets (*Viola* spp.) for larvae to eat and nectar sources for adults. The species' account on the USFWS Environmental Conservation Online (ECOS) website lists the species as known or believed to occur in Rosebud County, but not in Treasure County, Montana. Mapping shows that the nearest potential habitat occurs east of Rosebud Creek, but it does not intersect the project area. See **Section 3.13, Special Status Species** below and the Area F BA (OSMRE 2024) for a more detailed discussion of the western regal fritillary and its vegetation needs.

3.12.1.1 Regulatory Framework

The regulatory framework for fish and general wildlife is unchanged since the Final EIS and is described in **Section 3.12.1.1** of the 2018 Final EIS beginning on page 303.

3.12.1.2 Analysis Area

The analysis areas for wildlife are described in detail in **Section 3.12.1.2** of the 2018 Final EIS beginning on page 282 along with the rationale for their use. For direct impacts, the analysis area is the project area[42] plus a 1-mile buffer (direct effects), and for indirect effects, the analysis area includes the operational boundaries of the Colstrip and Rosebud Power Plants plus a 32-km area around each of the power plants.

3.12.1.3 Fish and Wildlife Habitat Characteristics

Other than the Richard Springs Fire (burned Area B and former Permit Area E) and ongoing mining in Area F, the wildlife habitat characteristics in the analysis areas remain unchanged. Information on wildlife habitat is provided in **Section 3.12.1.3** of the 2018 Final EIS beginning on page 306.

3.12.2 Mammals

Information on mammals is provided in **Section 3.12.2** of the 2018 Final EIS beginning on page 307.

3.12.3 Big Game Animals

Information on big game animals is provided in **Section 3.12.3** of the 2018 Final EIS beginning on page 308.

3.12.4 Birds

Information on birds is provided in **Section 3.12.5** of the 2018 Final EIS beginning on page 312.

3.12.5 Reptiles, Amphibians, and Invertebrates

Information on reptiles, amphibians, and invertebrates is provided in **Section 3.12.5** of the 2018 Final EIS beginning on page 322. Information on the monarch butterfly is included in this SEIS in **Section 3.13, Special Status Species**, below and in the Area F BA (OSMRE 2024).

3.12.6 Aquatic Species

Information on aquatic species is provided in **Section 3.12.6** of the 2018 Final EIS beginning on page 323. Information on aquatic special status species (i.e., pallid sturgeon) is included in this SEIS in **Section 3.13, Special Status Species**, below and in the Area F BA (OSMRE 2024).

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42. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.13 SPECIAL STATUS SPECIES

3.13.1 Introduction

This section describes special status wildlife and plant species within the analysis areas. Special status species include federally listed threatened, endangered, and candidate species and other sensitive wildlife and plant species. Similar to the 2018 Final EIS, the special status species direct effects analysis area is the project area; however, the indirect effects analysis area and the cumulative effects analysis area, defined below in **Section 3.13.1.2, Analysis Area**, have been revised in response to the 2022 court order to include a portion of the Yellowstone River and a more robust analysis of indirect impacts of surface water withdrawals from the Yellowstone River on pallid sturgeon. Since the 2018 Final EIS was issued, there also have been several changed conditions relative to special status species (**Table 3.13-1**). A new BA (OSMRE 2024) considers these changed conditions and has been prepared to address the project's impacts on four species: pallid sturgeon, northern long-eared bat, monarch butterfly, and western regal fritillary. This section has been updated accordingly to describe and update special status species in the expanded indirect and cumulative effects analysis areas.

Table 3.13-1. Special Status Species: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for special status species and their habitats: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative wildlife impacts of Area F. • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2020	The monarch butterfly (*Danaus plexippus plexippus*) was designated as a candidate species under consideration for listing as an endangered species (85 FR 243). The monarch's range includes southern Canada and the entire continental United States to South America. This distinctive, large (5.2 to 5.8 centimeters long at the forewing), orange-and-black butterfly overwinters in California and Mexico. Larval food plants include several species of *Asclepias* (milkweed – the primary host plant genus), *Apocynum*, *Calotropis*, *Matelea*, and *Sarcostemma*; adults feed on nectar from a variety of flowers (MNHP 2022a). Potential habitat (milkweed) likely occurs in Area F, but no critical habitat has been designated by the USFWS. The nearest known occurrences of monarch butterfly to Area F are documented along the Yellowstone River and Smith Creek north and west of Forsythe in Rosebud and Custer Counties (MNHP 2022b). See **Section 3.13.2.3, Monarch Butterfly**, below and the Area F BA (OSMRE 2024) for a more detailed discussion of monarch butterfly and its vegetation needs.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F, but included portions of the indirect analysis area for special status species.
2023	Westmoreland completed aquatic macroinvertebrate surveys as a condition of its Area F operating permit (Cedar Creek Associates, Inc. 2023b).
2023	The northern long-eared bat, formerly listed as threatened under the Endangered Species Act (ESA), is now listed as endangered under the ESA as of March 31, 2023. The 2018 Final EIS relied on a programmatic BA and 4(d) rule for the impacts on the northern long-eared bat.
2023	Westmoreland completes annual wildlife surveys and submits Annual Wildlife Monitoring Reports to Montana DEQ as a condition of its operating permits for the Rosebud Mine. The most recent reporting year available is 2023 (January 1, 2023, through December 31, 2023); this report (ICF 2024) was reviewed to confirm there have been no significant changes since the 2018 Final EIS.
2023	Changes to the lists of Montana Natural Heritage Program (MNHP) species of concern (SOC) have been made since the 2018 Final EIS and are incorporated in the SEIS.
2024	Informal discussions with the USFWS on May 22, 2024, indicated that the BA for the project should address northern long-eared bat, pallid sturgeon, and monarch butterfly, since other federally listed and candidate species are not likely to occur in the analysis area. OSMRE submitted the draft BA on August 19, 2024, and a revised BA on October 8, 2024 (OSMRE 2024). See also **Section 6.1.2, Section 7 Consultation Process with the U.S. Fish and Wildlife Service**.
2024	The western regal fritillary (*Argynnis idalia occidentalis*) was proposed for listing as a threatened species in August 2024 (89 FR 63888-63909, August 6, 2024). The regal fritillary is a large butterfly consisting of two subspecies found in the native grasslands of the central and northern Great Plains and portions of the Midwest (the western regal fritillary), and a single location in eastern Pennsylvania (the eastern regal fritillary) (USFWS 2024c). Regal fritillary habitat is composed of grasslands with necessary components of native violets (*Viola* spp.) for larvae to eat and nectar sources for adults. The species' account on the USFWS ECOS website lists the species as known or believed to occur in Rosebud County, but not in Treasure County, Montana. Mapping shows that the nearest potential habitat occurs east of Rosebud Creek, but it does not intersect the project area. See **Section 3.13, Special Status Species** below and the Area F BA (OSMRE 2024) for a more detailed discussion of the western regal fritillary and its vegetation needs.

3.13.1.1 Regulatory Framework

Federal Requirements

Federally listed threatened and endangered species are protected under the ESA under 16 USC §§ 1531 to 1543 (Supp. 1996), as amended, and implemented by the USFWS and National Oceanic and Atmospheric Administration. The ESA defines an endangered species as “a species in danger of becoming extinct throughout all or a portion of its range” and a threatened species as “a species likely to become endangered in the foreseeable future” (50 CFR § 17.3). Candidate species are plants and animals for which there is sufficient information on their biological vulnerability to support Federal listing as threatened or endangered (63 FR 13347), but listing is precluded by other higher-priority listing activities. Potential effects on a federally listed species or its habitat resulting from a project with a Federal action require consultation with the USFWS under Section 7 of the ESA. MSUMRA requires this consultation for state permitting of coal mines (implemented by DEQ). Adverse modification of designated critical habitat for a federally listed species also requires consultation with the USFWS.

Information on the Bald and Golden Eagle Protection Act of 1940 and Migratory Bird Treaty Act can be found in **Section 3.12, Fish and Wildlife Resources** in the 2018 Final EIS.

State Requirements

FWP regulates wildlife and fish under the state Fish, Wildlife, and Parks Commission (Section 87-1-301, MCA) and designates state SOC in conjunction with the MNHP. The MNHP is operated by the University of Montana and contains the Montana State Library’s Natural Resource Information System. The MNHP and FWP designate the state SOC. The MNHP maintains the list of state SOC and uses the international Natural Heritage Program’s species ranking system ranging from 1 (highest risk, imperiled) to 5 (relatively stable). Designation of state SOC is not a statutory or regulatory classification; it aids in species conservation needs, data collection priorities, and agency management guidance. State SOC are native plant and animal species that are considered rare or at risk of becoming endangered or extirpated in Montana.

The state’s endangered or threatened species protections pursuant to MSUMRA can be found in **Section 3.12, Fish and Wildlife Resources**.

Local Requirements

There are no applicable local regulations for special status species within or near the analysis area.

3.13.1.2 Analysis Area

Direct Effects Analysis Area

The direct effects analysis area for special status species is the project area[43] plus a 15-mile buffer outside of the Area F permit boundary (**Figure 3.13-1** and **Figure 3.13-2**). The 15-mile perimeter, which was established by KC Harvey Environmental in conjunction with Western Energy (predecessor to Westmoreland Rosebud) for the original PAP, includes portions of Rosebud and Treasure Counties. Special status species potentially occurring in both counties were assessed for direct effects. Special status

43. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

species in the analysis area were assessed by reviewing data provided by ICF International (2011, 2013, 2014), DEQ, FWP, MNHP, and USFWS. This includes baseline surveys and annual and long-term monitoring reports for the Rosebud Mine and species occurrence data provided by MNHP. No federally listed threatened or endangered species are known to occur within the direct effects analysis area. General fish and wildlife species and a description of wildlife monitoring on the mine are discussed in **Section 3.12, Fish and Wildlife Resources**.

Indirect Effects Analysis Area

The indirect effects analysis area for special status species consists of the operational boundaries of the Colstrip and Rosebud Power Plants plus a 32-km buffer that includes the drainages of Sarpy, Armells, and Rosebud Creeks (**Figure 3.13-3**). This analysis area was determined as a result of trace-metal deposition modeling completed for the 2018 Final EIS that utilized soil trace-metal background concentrations from a USGS background study and air-quality modeling (Smith et al. 2013); see **Section 4.3, Air Quality**, for discussion of modeling methods and results. Of the eight trace metals modeled, mercury had the greatest deposition distance, about 32 km, inside which there could be potential impacts on soil and vegetation (and therefore on special status species habitat).

The indirect effects analysis area also includes a section of the Yellowstone River downstream from Area F that potentially provides habitat for the pallid sturgeon. Water is supplied to the Colstrip Power Plant by a diversion on the Yellowstone River near Nichols, Montana. As a result, the analysis area also includes the section of the Yellowstone River from the diversion point downstream to the confluence of the Yellowstone River and Tongue River. This reach of the Yellowstone River is approximately 57 miles long (**Figure 3.13-3**). The Cartersville Diversion Dam is located approximately 6.5 miles downstream from the diversion that supplies the Colstrip Power Plant and 235 miles upstream of the mouth of the Yellowstone River (USACE 2015). The Cartersville Diversion Dam is a barrier to fish passage under most flow conditions; however, sturgeon can navigate upstream over the dam during some flow conditions. The downstream extent of the action area on the Yellowstone River was designated at the Tongue River confluence as any potential impact from water withdrawal would be negated by flow contributions from the Tongue River, as well as by multiple other smaller tributaries. The Tongue River contributes more than 400 cfs of water on average to the Yellowstone River in comparison to the approximately 69 cfs of water that is diverted to supply the Colstrip Power Plant.

Finally, because the indirect effects analysis area includes portions of Rosebud, Treasure, Big Horn, and Powder River Counties, special status species that potentially occur in these counties were assessed for indirect effects.

3.13.1.3 Wildlife Habitat Characteristics

General information on wildlife habitat characteristics in the analysis area can be found in the 2018 Final EIS in **Section 3.12, Fish and Wildlife Resources**. As previously described, the Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but affected portions of the indirect analysis area for special status species.

A portion of the Yellowstone River was also added to the indirect effects analysis area. The analysis area includes the section of the Yellowstone River from the Cartersville Diversion Dam located near Forsythe and the confluence of the Yellowstone and Tongue Rivers. This reach of the Yellowstone River is approximately 50 miles long and provides habitat for the pallid sturgeon. Multiple diversions, mostly for agricultural and irrigation purposes, on the Yellowstone River also exist in the reach of the river between the Cartersville Diversion Dam and the Tongue River confluence as well as further upstream on the Yellowstone River.

3.13.2 Federally Listed Threatened, Endangered, and Candidate Species

According to an updated search of the USFWS Information, Planning, and Conservation System (IPaC), a total of four federally endangered species may be found in the analysis area (USFWS 2024a). Whooping crane (*Grus americana*), black-footed ferret (*Mustela nigripes*), North American wolverine (*Gulo gulo luscus*), and Ute ladies'-tresses orchid (*Spiranthes diluvialis*) were addressed in the 2018 Final EIS but are not present in the analysis area based on the latest IPaC data (USFWS 2024a). These species are not addressed further. **Table 3.13-2** gives a summary of federally listed/proposed species, designated/proposed critical habitat, species' habitat requirements, and occurrence information for species that are known to or may occur in the analysis areas. Habitat and potential occurrence of each species are discussed in greater detail below.

Table 3.13-2. Federally Endangered Species Potentially Occurring in the Analysis Area.

Common Name	Scientific Name	Status*	General Habitat Affinity	Habitat in Analysis Area
Mammals				
Northern long-eared bat	*Myotis septentrionalis*	T	Rock cavities and crevices, behind bark in trees, dead hardwood trees.	Yes
Fish				
Pallid sturgeon	*Scaphirhynchus albus*	E	Large turbid rivers, including accessible reaches of the Yellowstone River, with diverse habitat and natural hydrographs.	Yes
Insects				
Monarch butterfly	*Danaus plexippus*	C	Requires milkweed (*Asclepias* spp.) as larval host plants; meadow and riparian habitats support spring/summer breeding and late-season migration.	Yes
Western regal fritillary	*Argynnis idalia occidentalis*	PT	Tallgrass prairies, including dry upland, mesic, or wet areas. Requires violet species (*Viola* sp.) as a larval host plant. The range of western regal fritillary only overlaps the action area in a small area at the southern edge of the action area.	Yes

*E = Endangered; T = Threatened; C = Candidate for listing; PT Proposed Threatened.
Source: USFWS 2024a.

3.13.2.1 Northern Long-Eared Bat

The northern long-eared bat (also referred to as northern myotis or NLEB) has long ears and a dark brown pelage color. This species was listed as threatened in 2015, mainly due to significant population declines from the effects of white-nose syndrome. The listing status of the NLEB was changed to endangered with an effective date of March 31, 2023, due to continued population declines (88 FR 4908-4910, January 26, 2023). This species roosts in caves, cavities, or crevices and behind peeling bark in trees during the daytime hours (MNHP 2017). The species inhabits riparian areas relatively close to water.

The northern long-eared bat ranges from the southeast U.S. to northwest Canada. Montana is on the western edge of NLEB range. One hibernating individual was discovered in 1978, and two active individuals were documented in 2016 in northeastern Montana (Richland and Roosevelt Counties), about 190 miles north of the project area (MNHP 2017). Potential habitat for this species has been identified in Powder River County, although the species has never been documented in southeastern Montana. No NLEB individuals or populations have been documented within the analysis area (MNHP 2023). Potential foraging and roosting habitat (coniferous forest) are present in the action area, although hibernation is unlikely to occur in the analysis area (USFWS 2024b).

3.13.2.2 Pallid Sturgeon

The pallid sturgeon is listed as endangered throughout all of its known range. This species formerly inhabited the Missouri and Mississippi River systems from Montana to Louisiana. Threats to pallid sturgeon at the time of listing included the following primary factors:

I. Habitat alterations from channelization, impoundments, and altered flow regimes
II. Decreased water quality
III. Entrainment into diversions and ditches, particularly with age-0 and juvenile fishes
IV. Water temperature changes related to climate change
V. Habitat fragmentation and development in the river corridors
VI. Overexploitation and overharvest, primarily caused by similarities in the appearances of pallid sturgeon and shovelnose sturgeon (*S. platorhycnhus*), which is not a listed species (USFWS 2021)

This species inhabits large, slow, turbid waters with sandy bottoms. In Montana, this species is known to occur in the Missouri and Yellowstone Rivers. The diet of the pallid sturgeon is thought to consist of aquatic insects and small fish (MNHP 2014c). The biology and life history of the pallid sturgeon are described in greater detail in the 5-Year Status Review for Pallid Sturgeon (USFWS 2021) and in the BA (OSMRE 2024).

Pallid sturgeon have been documented within the analysis area in limited numbers. Pallid sturgeon were documented as being observed in the Yellowstone River in most years from 2009 through 2023, but most locations were downstream of the action area and the Intake Diversion Dam (MFWP 2024). Occurrences of pallid sturgeon in the Yellowstone River, including a small number of pallid sturgeon that accessed reaches of the Yellowstone River within the action area, were also documented in other sources (Bureau of Reclamation 2020; French 2019, 2022; USACE 2020; Rugg et al. 2023).

The Intake Diversion Dam largely prohibited upstream movement of sturgeon until 2022, when fish passage was improved (French 2022). However, some sturgeon, of both wild and hatchery origin, were observed utilizing the side channel to get over the dam when flows were high (French 2019; Bureau of Reclamation 2020), and translocation efforts also relocated or stocked sturgeon upstream of the dam in some years (Jaegar et al. 2005; USACE 2020). Because of fish passage improvements at the Intake Diversion Dam, the number of sturgeon moving into reaches further upstream on the Yellowstone River, including as far upstream as the Cartersville Diversion Dam, has increased and is expected to increase further. The Cartersville Diversion Dam, which is approximately 6.5 miles downstream of the diversion associated with the Colstrip Power Plant, likely continues to be a migration barrier under some flow conditions, but migration over the dam was documented in 2024 (A. McCullough, USFWS, personal communication, August 19, 2024).

3.13.2.3 Monarch Butterfly

The monarch butterfly was designated as a candidate species in December 2020 (85 FR 81813-81822, December 17, 2020) due to widespread drought, habitat loss, fragmentation, and low population abundance. Listing the monarch butterfly as endangered or threatened under the ESA is warranted but precluded by higher-priority species (USFWS 2020a).

North America contains two migratory populations of the monarch butterfly separated by the Rocky Mountains. The largest migratory population breeds across the central and eastern parts of the continent and winters in Mexico. A smaller migratory population breeds in western North America and winters primarily along the California coast south into Baja California, Mexico. During the summer breeding season, monarchs live from two to five weeks, during which time they mate and lay the eggs that become the next generation. Larval food plants include several species of *Asclepias* (milkweed – the primary host plant genus), *Apocynum*, *Calotropis*, *Matelea*, and *Sarcostemma*; adults feed on nectar from a variety of flowers (MNHP 2022a). Common places where milkweed occurs include shortgrass and tallgrass prairies, livestock pastures, agricultural margins, roadsides, wetland and riparian areas, sandy areas, and gardens, in addition to deserts, open forests, and woodlands. The species is known to occur throughout Montana during the summer and fall months at elevations between 2,000 and 3,000 feet in open places, native prairie, foothills, open valley bottoms, open weedy fields, roadsides, pastures, marshes, and suburban areas (MNHP 2022a). The primary threats to this species include loss of milkweed from herbicide use, conversion of grasslands to other uses, and loss of overwintering sites (USFWS 2020b). Additional threats include loss of nectar food sources in breeding and migration habitats, insecticide exposure, and climate change effects such as increasing storm frequency and intensity in overwintering sites (USFWS 2020b).

Potential habitat for monarch butterflies occurs in the analysis area, but no critical habitat has been designated. The nearest known occurrences of this species to the analysis area are documented along the Yellowstone River and Smith Creek north and west of Forsythe in Rosebud and Custer Counties (MNHP 2022b).

3.13.2.4 Western Regal Fritillary

The western regal fritillary was proposed for listing as a threatened species in August 2024 (89 FR 63888-63909, August 6, 2024). The regal fritillary is a large butterfly consisting of two subspecies found in the native grasslands of the central and northern Great Plains and portions of the Midwest (the western regal fritillary), and a single location in eastern Pennsylvania (the eastern regal fritillary) (USFWS 2024c). Regal fritillary habitat is composed of grasslands with necessary components of native violets (*Viola* spp.) for larvae to eat and nectar sources for adults (USFWS 2023). The life history of this species is described in the Regal Fritillary Species Status Assessment (USFWS 2023) and summarized here. The species has one annual generation. Egg-laying occurs in late summer and fall when individual females may lay hundreds to thousands of eggs in native grassland habitats. The species overwinters as first instar larvae in grassland vegetation, emerging in spring to search for violets (*Viola* spp.), their only larval food. The larvae pupate in the grasslands and emerge as adult butterflies beginning in late May through mid-July depending on their regional location (USFWS 2023).

The western regal fritillary currently occupies portions of 14 states, from Indiana to Colorado and from North Dakota to Oklahoma (USFWS 2023). States on the western and southern fringes of the regal fritillary's range are relatively sparsely occupied, with regal fritillaries occurring only in portions of those states, near their borders with adjacent occupied states (USFWS 2023).

The primary threats to this species are the expected continued loss and fragmentation of large, intact native grasslands through conversion by agriculture and development; invasive plants and woody vegetation; the reduction of violets and nectar sources from the broadcast application of herbicides; and periodic disturbances from fire, mowing, and haying (USFWS 2024c).

Montana is at the western periphery of the western regal fritillary range. The species' account on the USFWS ECOS website lists the species as known or believed to occur in Rosebud County, but not in Treasure County, Montana (USFWS 2024d). Habitat modeling by the USFWS (USFWS 2024d) shows the only potential habitat in the indirect effects analysis area occurs east of Rosebud Creek, on the southern edge of the action area, and does not intersect the project area. Past vegetation surveys have not identified extensive areas of native violets in the project area (Cedar Creek Associates, Inc. 2014, 2016). An unidentified violet species (*Viola* sp.) was documented in woody draw habitat in 2006; however, no violets were identified in grassland or other habitats (Cedar Creek Associates, Inc. 2016).

3.13.3 MNHP Species of Concern

A detailed discussion of MNHP SOC previously identified in the analysis area is provided in **Section 3.13.3** of the 2018 Final EIS. **Table 3.13-3** identifies MNHP SOC and their preferred habitats that have been documented in the Rosebud Mine 15-mile wildlife survey area (the same as the direct effects analysis area) since 1973; this list has been updated since the 2018 Final EIS using new MNHP data (MNHP 2024).

Table 3.13-3. MNHP Species of Concern Documented in the Direct Effects Analysis Area.[1]

Common Name	Scientific Name	Status	General Habitat Affinity	Likely to Occur in Direct Effects Analysis Area? (Y/N)
Amphibians				
Great plains toad	*Anaraxus cognatus*	S3	Grasslands, and shrublands with nearby water sources including wetlands, stock tanks, streams, springs, and stock ponds	Y
Northern leopard frog	*Lithobates (Rana) pipiens*	S1, S4[2]	Wetlands, stock tanks, streams, springs, stock ponds	Y
Birds				
American bittern	*Botaurus lentiginosus*	S3; B	Large freshwater wetlands composed of cattails and bulrushes	N
Northern goshawk	*Accipiter gentilis*	S3; B	Mature or old-growth, coniferous, or mixed conifer/aspen forests with relatively open understories	Y
American white pelican	***Pelecanus erythrorhynchos***	**S3; B**	**Aquatic and wetland habitats, including rivers, lakes, reservoirs (both large and small), estuaries, bays, marshes**	**Y**
Baird's sparrow	***Centronyx bairdii***	**S3; B**	**Native prairie with little to no grazing**	**Y**
Black rosy-finch	***Leucosticte atrata***	**S3; B**	**Cultivated lands, open areas, and around human habitation during migration**	**Y**
Black tern	*Childonias niger*	S3; B	Wetlands, marshes, prairie potholes, and small ponds with emergent vegetation	N

Table 3.13-3. MNHP Species of Concern Documented in the Direct Effects Analysis Area.[1]

Common Name	Scientific Name	Status	General Habitat Affinity	Likely to Occur in Direct Effects Analysis Area? (Y/N)
Black-backed woodpecker	***Picoides arcticus***	**S3; B**	**Early successional, burned forest of mixed conifer, lodgepole pine, Douglas-fir, and spruce-fir**	**N**
Black-billed cuckoo	*Coccyzus erythropthalmus*	S3; B	Riparian woodlands	Y
Black-crowned night heron	***Nycticorax nycticorax***	**S3; B**	**Shallow marshes and other wetland areas**	**Y**
Bobolink	***Dolichonyx oryzivorus***	**S3; B**	**Nests built in tall grass and mixed-grass prairies**	**Y**
Brewer's sparrow	*Spizella breweri*	S3; B	Sagebrush shrublands	Y
Brown creeper	***Certhia americana***	**S3; B**	**Coniferous and mixed coniferous-deciduous forests, preferring mature and old-growth stands with high canopy cover**	**N**
Burrowing owl	*Athene cunicularia*	S3; B	Open grasslands with abandoned burrows dug by mammals	N
Caspian tern	*Hydroprogne caspia*	S2; B	Large rivers, lakes, and reservoirs	N
Cassin's finch	***Certhia americana***	**S3; B**	**Every major forest type in Montana, including riparian cottonwood, especially common in ponderosa pine and postfire forests**	**N**
Clark's grebe	***Aechmophorus clarkii***	**S3; B**	**Breeds only at very large lakes and reservoirs in Montana**	**N**
Clark's nutcracker	*Nucifraga columgiana*	S3; B	Conifer forests	Y
Common loon	*Gavia immer*	S3; B	Mountain lakes with emergent vegetation	N
Common tern	*Sterna hirundo*	S3; B	Large rivers, lakes, and reservoirs	N
Evening grosbeak	***Coccothraustes vespertinus***	**S3; B**	**Mixed coniferous and spruce-fir forests of western Montana**	**N**
Ferruginous hawk	*Buteo regalis*	S3; B	Shrub-grasslands, mixed grass prairie, sagebrush grasslands and sagebrush steppe	Y
Forster's tern	*Sterna forsteri*	S3; B	Wetlands	N
Franklin's gull	*Larus pipixcan*	S3; B	Wetlands	N
Golden eagle	*Aquila chrysaetos*	S3; BGEPA	Canyons, cliffs, and bluffs	Y
Gray-crowned finch	*Leucosticte tephrocotis*	S2; B, S5	Alpine cliffs, glaciers, and snowfields above timberline.	N
Great blue heron	*Ardea herodias*	S3; B	Riparian areas along major rivers and lakes	Y[3]
Greater sage grouse	*Centrocercus urophasianus*	S2	Shrub-grasslands, mixed-grass prairie, sagebrush grasslands, and sagebrush steppe	N
Green-tailed towhee	***Pipilo chlorurus***	**S3; B**	**Species-rich shrub communities**	**N**
Horned grebe	*Podiceps auritus*	S3; B	Wetlands, freshwater ponds, and marshes	N

Table 3.13-3. MNHP Species of Concern Documented in the Direct Effects Analysis Area.[1]

Common Name	Scientific Name	Status	General Habitat Affinity	Likely to Occur in Direct Effects Analysis Area? (Y/N)
Least tern	***Sternula antillarum***	**S1; B**	**Unvegetated sand-pebble beaches and islands of large reservoirs and rivers in northeastern and southeastern Montana**	**N**
Lewis' woodpecker	*Melanerpes lewis*	S2; B	Riparian woodlands	Y
Loggerhead shrike	*Lanius ludovicianus*	S3, B	Upland shrublands	Y
Long-billed curlew	*Numenius americanus*	S3, B	Mixed-grass prairie and moist meadows	Y
Peregrine falcon	*Falco peregrinus*	S3; B	Cliffs and canyons	Y
Pinyon jay	*Gymnorhinus cyanocephalus*	S3; B	Low-elevation ponderosa pine limber pine-juniper woodlands	Y
Red-headed woodpecker	*Melanerpes erythrocephalus*	S2; B	Riparian woodlands	Y
Sage thrasher	*Oreoscoptes montanus*	S3; B	Upland shrublands	Y
Sprague's pipit	*Anthus spragueii*	S3; B	Mixed-grass grasslands	N
Thick-billed longspur	***Rhynchophanes mccownii***	**S3; B**	**Semi-arid shortgrass steppe, characteristically open with sparse vegetation**	**Y**
Trumpeter swan	*Cygnus buccinator*	S3; B	Lakes, ponds, and reservoirs	N
Veery	***Catharus fuscescens***	**S3; B**	**Damp, deciduous forests in the east; riparian habitats**	**N**
Yellow-billed cuckoo	***Coccyzus americanus***	**S3; B**	**Open woodland, deciduous riparian woodland**	**Y**
Mammals				
Black-tailed prairie dog	*Cynomys ludovicianus*	S3	Shortgrass prairie, grasslands	N
Eastern red bat	***Lasiurus borealis***	**S3**	**Migrates through eastern Montana, particularly along wooded and riparian areas**	**Y**
Fringed myotis	*Myotis thysanodes*	S3	Riparian areas within coniferous woodlands, caves; typically roosts in rock crevices, caves, abandoned buildings	Y
Hoary bat	*Lasiurus cinereus*	S3	Deciduous and occasionally coniferous woodlands; typically roosts in trees	Y
Little brown myotis	*Myotis lucifugus*	S3	Variety of habitats including buildings, woodlands, caves and mines; forages over water	Y
Long-eared myotis	***Myotis evotis***	**S3**	**Wide range of rocky and forested habitats over a broad elevation gradient**	**Y**
Long-legged myotis	***Myotis volans***	**S3**	**Forested mountain regions and river bottoms, also at high elevations**	**Y**
Merriam's shrew	*Sorex merriami*	S3	Shrublands, grasslands, and agricultural lands dominated by pasture grasses	Y
Pallid bat	*Antrozous pallidus*	S3	Woodlands, including ponderosa forests and shrublands	Y
Spotted bat	***Euderma maculatum***	**S3**	**Open arid and other habitats near cliffs**	**N**
Townsend's big-eared bat	*Corynorhinus townsendii*	S3	Woodlands, rocky outcrops, caves, tunnels, and abandoned mines; occasionally roosts in tree cavities	Y

Table 3.13-3. MNHP Species of Concern Documented in the Direct Effects Analysis Area.[1]

Common Name	Scientific Name	Status	General Habitat Affinity	Likely to Occur in Direct Effects Analysis Area? (Y/N)
Reptiles				
Plains hognose snake	*Heterodon nasicus*	S2	Sagebrush-grasslands and gravelly and sandy soil	Y
Short-horned lizard	*Phyrnosoma herandesi*	S3	Sandy gravelly soil	Y
Snapping turtle	*Chelydra serpentine*	S3	Prairie rivers and streams	N
Spiny softshell	***Apalone spinifera***	**S3**	**Rivers, creeks, lakes, and impoundments**	**N**
Western milksnake	*Lapmpropeltis triangulum*	S2	Rocky outcrops, shrublands, grasslands	Y
Western smooth greensnake	*Opheodrys vernalis*	S2	Wetlands, forested areas with open meadows	Y

S1: Very high risk of extirpation in the state due to very restricted range, steep declines, severe threats, and other factors.
S2: At high risk of extinction or extirpation in the state due to very limited and/or declining numbers, range, and/or habitat or extirpation in the state.
S3: At risk of extinction or extirpation in the state due to very limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
S4: At a fairly low risk of extirpation in the state due to an extensive range and/or many populations or occurrences but with possible cause for some concern.
B: Protected under the Migratory Bird Treaty Act.
BGEPA: Protected under the Bald and Golden Eagle Protection Act.
[1.] Species in bold are newly added since the 2018 Final EIS.
[2.] Northern leopard frog is critically imperiled in mountain areas in western Montana. This species is apparently secure on the Great Plains and is not considered a SOC in eastern Montana.
Source: Adams and Hayes 2000; Barrett 1998; ICF 2014; FWP 2014, MNHP 2024.

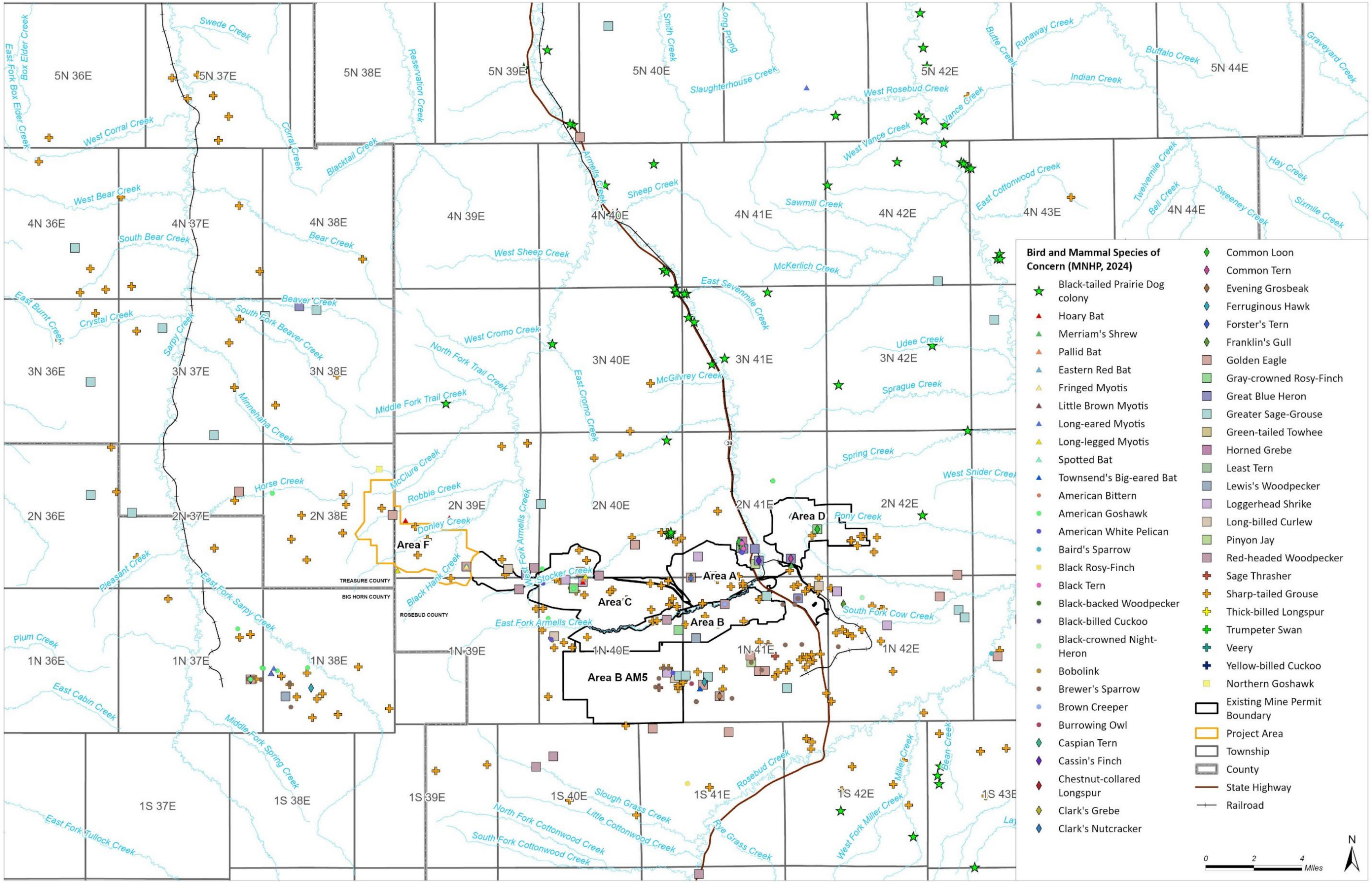

Figure 3.13-1. Bird and Mammal Species of Concern, Locations in the Direct Effects Analysis Area.

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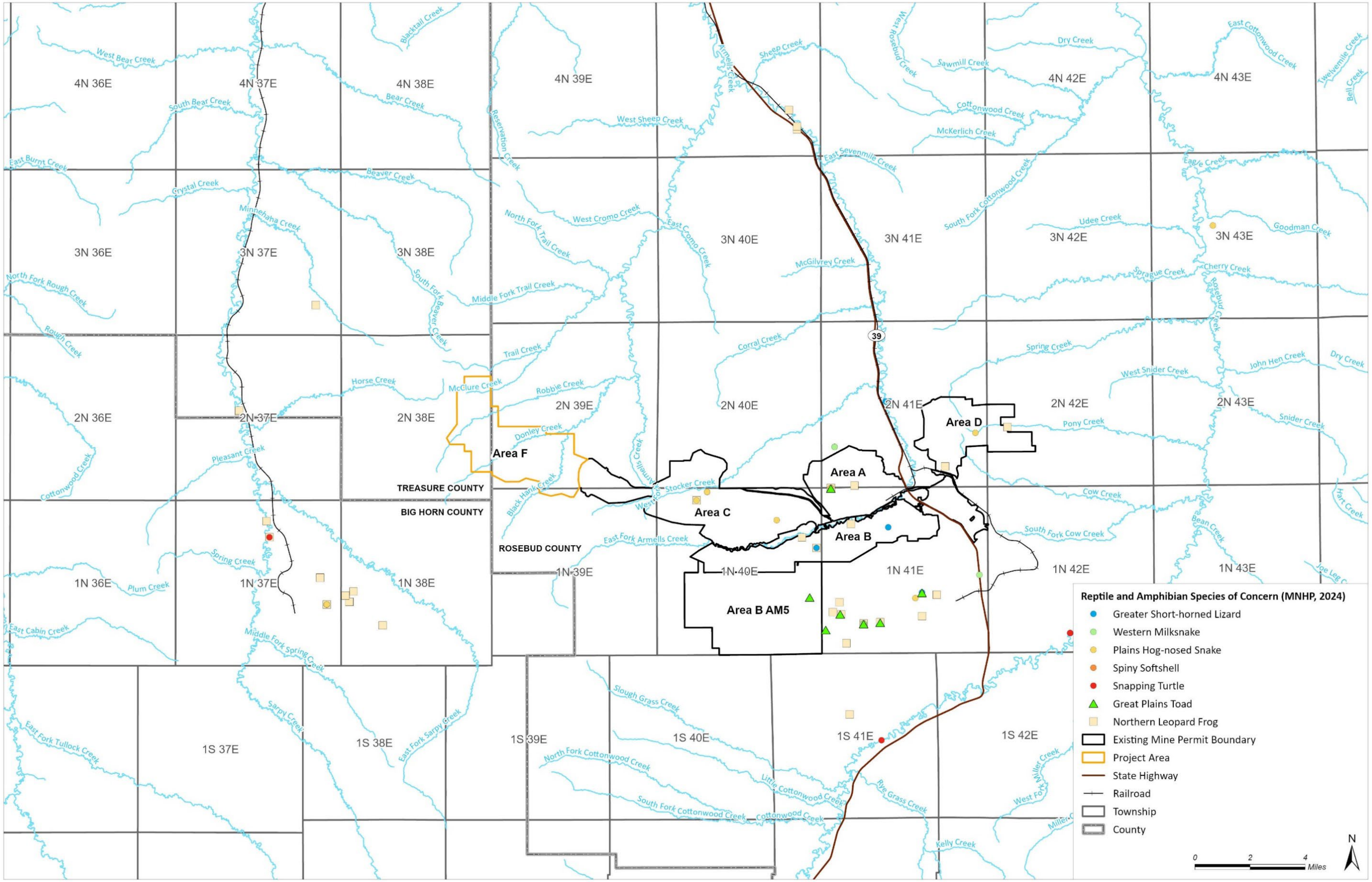

Figure 3.13-2. Reptile and Amphibian Species of Concern, Locations in the Direct Effects Analysis Area.

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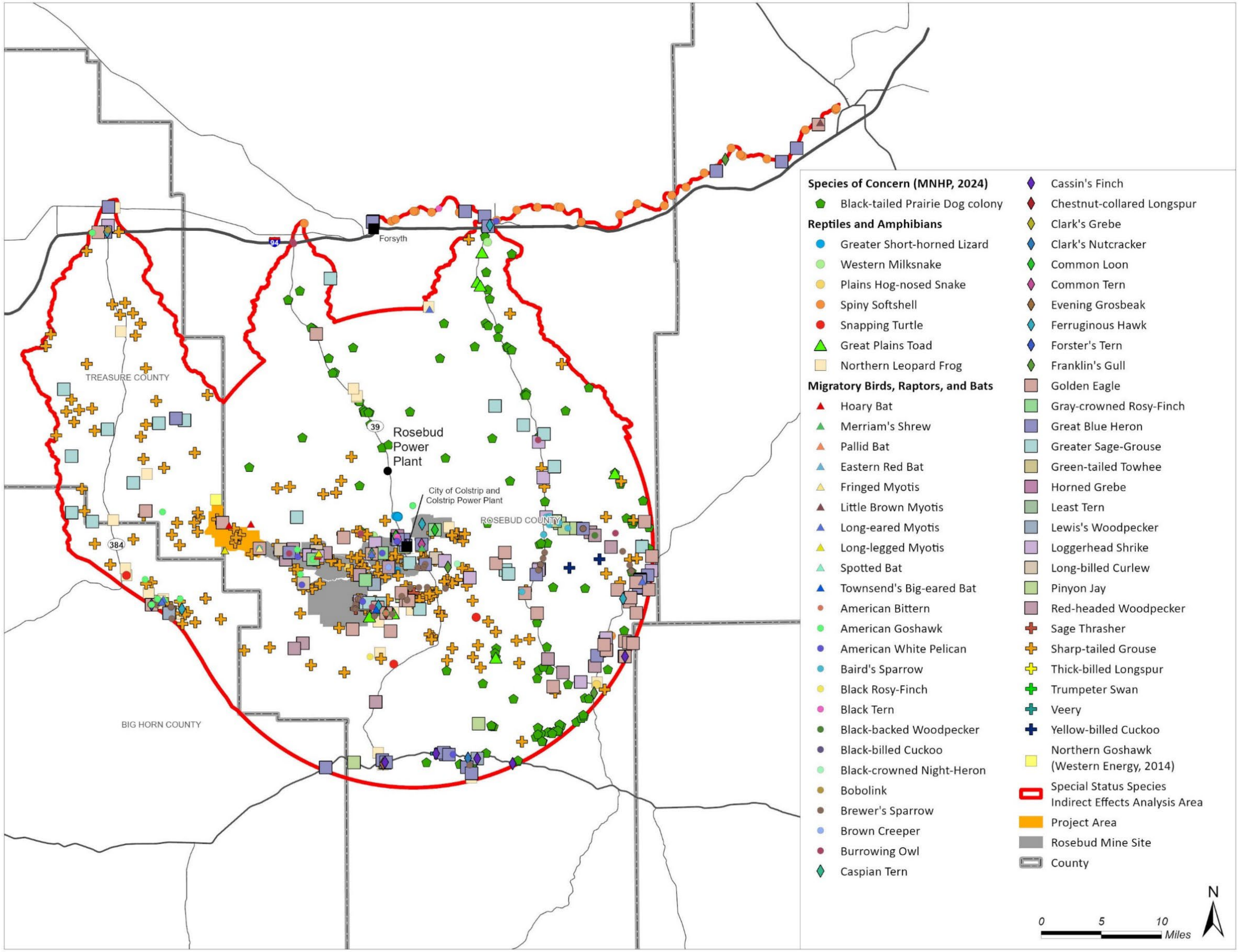

Figure 3.13-3. Special Status Species Documented in the Indirect Effects Analysis Area.

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3.13.3.1 Mammals

Bats

Five bat species documented in the direct effects analysis area are MNHP SOC and are listed above in **Table 3.13-3**: Townsend's big-eared bat, little brown myotis, hoary bat, pallid bat, and fringed myotis (**Section 3.12, Fish and Wildlife Resources** in the 2018 Final EIS).

Figure 3.13-4. Fringed Myotis.
Source: Montana Field Guide, Kristi DuBois.

Most Montana bat species are likely to occur within the indirect effects analysis area, including the following SOC: hoary bat, pallid bat, eastern red bat, fringed myotis, little brown myotis, long-eared myotis, long-legged myotis, spotted bat, and Townsend's big-eared bat (**Figure 3.13-3**). General bat species are described in more detail under **Section 3.12, Fish and Wildlife Resources** in the 2018 Final EIS.

3.13.3.2 Upland and Other Game Birds

Greater Sage-Grouse

The greater sage-grouse is listed as a Montana SOC. The species was federally listed as a candidate species; however, in 2015 the USFWS determined that the listing was "not warranted" and that the greater sage-grouse remains relatively abundant throughout its range (USFWS 2015).

The ecology of the greater sage-grouse and its occurrence in the analysis area are described in **Section 3.13.3.2** of the 2018 Final EIS. There is no change in the status of this species since the 2018 Final EIS. No sage grouse were observed in the analysis area during surveys in 2023 (ICF 2023).

Figure 3.13-5. Greater Sage-Grouse.
Source: freebeekeeper.com.

3.13.3.3 Migratory Birds

Each of the songbird SOC listed above potentially occurs in the indirect effects analysis area where habitat is present (MNHP and FWP 2017).

Shorebirds and Waterfowl

Because aquatic habitat is limited in the direct effects analysis area, herons, cranes, egrets, and other waterfowl have not been documented nesting in the area.

Raptors

Three SOC have been documented on the Rosebud Mine: golden eagle, northern goshawk, and burrowing owl. Both the golden eagle and northern goshawk potentially occur statewide. The burrowing owl occurs in the eastern two-thirds of the state. All three species potentially occur within the direct and indirect effects analysis area.

3.13.3.4 Reptiles

Three reptile SOC – the western milksnake, western hognose snake, and short-horned lizard – have been documented in upland grassland and shrubland habitat adjacent to the project area on or adjacent to portions of the Rosebud Mine. The three reptile species occur throughout the western two-thirds of the state and potentially occur within the direct and indirect effects analysis areas, where suitable habitat exists. Reptile SOC documented in the indirect effects analysis area include greater short-horned lizard, western milksnake, plains hognose snake, and spiny softshell.

3.13.3.5 Amphibians

The northern leopard frog, Great Plains toad, and plains spadefoot toad have been documented on or near the mine. The three amphibian species, similar to the reptile SOC, occur throughout the western two-thirds of the state and potentially occur within the direct and indirect effects analysis areas, where suitable habitat exists (MNHP and FWP 2017).

Figure 3.13-6. Northern Leopard Frog.

Source: U.S. Fish and Wildlife Service.

3.13.4 Special Status Plant Species

3.13.4.1 Sensitive Plant Species

Federally Listed Threatened, Endangered, and Candidate Species

Four plant species are listed as federally threatened in Montana including Spalding's catchfly (*Silene spaldingii*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*), water howellia (*Howellia aquatilis*), and whitebark pine (*Pinus albicaulis*). None of these federally listed threatened vegetation species are listed as potentially occurring in the analysis area (USFWS 2024a). No federally listed plant species were documented in the project area during the field surveys in 2005–2007 (PAP, Appendix E).

MNHP Species of Concern

Thirteen vegetation SOC potentially occur in Rosebud, Treasure, and Big Horn Counties (**Table 3.13-4**; MNHP 2015). The project area contains suitable habitat for nine SOC; however, no vegetation SOC occurrences have been documented within the project area. None of the SOC were documented during the field assessments in 2005–2007. Six vegetation SOC occur in Treasure and Rosebud Counties beyond a 12-mile radius of the project area (MNHP 2017). Each plant SOC that potentially occurs in project area also potentially occurs in the indirect effects analysis area (MNHP and FWP 2017).

Table 3.13-4. MNHP Plant Species of Concern in Rosebud, Treasure, Big Horn, and Powder River Counties, and Montana's Federally Listed Plant Species.

Common Name	Scientific Name	Status	General Habitat Affinity	Suitable Habitat Present in the Project Area?
Alderleaf mountain-mahogany	*Cercocarpus montanus*	S2/S3	Open slopes and breaks on the plains	No
Barr's milkvetch	*Astragalus barrii*	S3	Sparsely vegetated knobs and buttes; often along rivers or streams	Yes
Bractless blazingstar	*Mentzelia nuda*	S1/S2	Sandy or gravelly soil of open hills and roadsides on the plains	No
Bush morning-glory	*Ipomoea leptophylla*	S1/S2	Open prairie habitats in sandy or gravelly soil	Yes
Heavy sedge	*Carex gravida*	S3	Green ash ravines and woody draws	No
Lead plant	*Amorpha canescens*	SH	Grasslands and woodlands; often in sandy soil	Yes
Lichen	*Psora rubiformis*	S1/S2	On soil and in fissures of rock in alpine areas	No
Little Indian breadroot	*Pediomelum hypogaeum*	S3/S4	Sandy soil of grasslands and open pine woodlands	Yes
Narrowleaf milkweed	*Asclepias stenophylla*	S2	Sandy soil of prairies and open pine woodland	Yes
Nuttall desert-parsley	*Lomatium nuttallii*	S2	Open pine woodlands 3,400 to 7,200 feet in elevation	Yes
Persistent-sepal yellow-cress	*Rorippa calycina*	SH	Moist sandy to muddy banks of streams, stock ponds, and reservoirs	Yes
Plains phlox	*Phlox andicola*	S3/S4	Sparsely vegetated outcrops; sandy soil in grasslands and pine woodlands	Yes
Spalding's catchfly	*Silene spaldingii*	S2, FT	Open mesic grasslands in valleys and foothills in northwest Montana	No
Ute ladies'-tresses orchid	*Spiranthes diluvialis*	S1/S2, FT	Alkaline wetlands, swales, and old meander channels on the edge of wetlands	No
Water howellia	*Howellia aquatilis*	S3, FT	Small depressional wetlands in Swan Valley	No
Whitebark pine	*Pinus albicaulis*	S3, FT	Subalpine and krummholtz habitats	No
Woolly twinpod	*Physaria didymocarpa* var. *lanata*	S2/S3	Sandy, often calcareous soil of open grassland or shrubland slopes	Yes

S1: At very high risk of extinction or extirpation in the state due to extremely limited and/or rapidly declining numbers, range, and/or habitat, or extirpation in the state.
S2: At high risk of extinction or extirpation in the state due to very limited and/or declining numbers, range, and/or habitat, or extirpation in the state.
S3: At risk of extinction or extirpation in the state due to limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
SH: Historical, known only from records usually 40 or more years old; may be rediscovered.
FT: Federally Threatened.
Source: MNHP 2017.

3.14 CULTURAL AND HISTORIC RESOURCES

3.14.1 Introduction

Since the issuance of the 2018 Final EIS, there has been additional information relevant to cultural and historical resources, but this does not substantially change the analysis presented in the EIS. Please note that the following actions (**Table 3.14-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for cultural and historical resources. As applicable, the affected environment sections have been updated below. Detailed cultural resources information is available in **Section 3.14** of the 2018 Final EIS beginning on page 344.

Table 3.14-1. Cultural Resources: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2022	AM5 Permit Area B was approved by DEQ in 2022 after preparation of an EIS that considered the cumulative cultural and historic resources impacts of Area F.

3.14.1.1 Regulatory Framework

The regulatory framework for cultural and historical resources is unchanged since the Final EIS and is described in **Section 3.14.1.1** of the 2018 Final EIS beginning on page 344.

3.14.1.2 Analysis Area

The analysis area for impacts on cultural and historical resources is the area of potential effect, which is the project area[44] (**Figure 2.2-1**); the rationale for the use of this area is provided in **Section 3.14.1.2** of the 2018 Final EIS beginning on page 346.

3.14.2 Cultural Context

The cultural context is described in **Section 3.14.2** of the 2018 Final EIS beginning on page 348.

3.14.3 Documented Cultural Resources

Documented cultural resources are described in **Section 3.14.3** of the 2018 Final EIS beginning on page 349. Additional information on documented cultural resources has been added from the 2023 Annual Mining Report (Westmoreland Rosebud 2024b). A total of 108 cultural resources have been documented

[44] As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

within the Area F Permit Boundary (see **Section 4.14.1, Analysis Methods**, in the 2018 Final EIS), including 2 historic districts, 75 prehistoric archaeological sites, 26 historic-period archaeological sites, and 5 multicomponent (both prehistoric and historic) archaeological sites (Fredlund 1980; Meyer 2010; Meyer and Ferguson 2012). Eighteen of these sites are eligible for the National Register of Historic Places (NRHP), and nine have unevaluated or undetermined eligibility and are treated as eligible. The remaining cultural resources are not eligible for the NRHP.

Mitigation, which is summarized below, has been implemented for four NRHP-eligible sites in the area of potential effect pursuant to the memorandum of agreement. All other eligible or unevaluated/undetermined resources have been avoided.

- Site 24RB958 (prehistoric components of historic homestead site): Excavation. No further work recommended.
- Site 24RB2334: Excavation. No further work recommended.
- Site 24RB2339 (Black Hank Site): Excavation. No further work recommended.
- Site 24RB2438: Excavation. No further work recommended.

Adverse effects on the remaining potential historic properties would be resolved through the executed Programmatic Agreement (PA) entered into by Western Energy (now Westmoreland Rosebud), the State Historic Preservation Office, DEQ, BLM, and OSMRE. The PA is in Appendix H of the 2018 Final EIS. The PA provides for continuing compliance with Section 106 of the National Historic Preservation Act over the life of mining operations. The PA also includes stipulations to treat unanticipated discoveries during mining operations.

3.14.4 Tribal Consultation

Tribal consultation completed during preparation of the EIS is described in **Section 6.1.3** of the 2018 Final EIS. Consultation that has occurred during the preparation of this SEIS is described below in **Section 6.1.3, Section 106 and Tribal Consultation Processes**.

3.15 SOCIOECONOMIC CONDITIONS

3.15.1 Introduction

Socioeconomics describes a combination of the economic and social level of a specific population of people based on income, education, demographics, and occupation. The economic and social position of an individual or family, in relation to others, is taken into account when describing socioeconomics. Since the issuance of the 2018 Final EIS, changes in operations at the Colstrip Power Plant and in other permit areas of the Rosebud Mine have occurred (**Table 3.15-1**). As a result, the socioeconomic conditions in the analysis area have changed somewhat from what was presented in the Final 2018 EIS in **Section 3.15**, beginning on page 351. This section discusses the current socioeconomic conditions within and near the analysis area, as well as the regulatory framework.

Table 3.15-1. Socioeconomic Conditions: Changed Conditions Since 2018 Final EIS.

Year	Change
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for socioeconomic conditions: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative socioeconomic impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2020	Active mining began in Area F in August 2020.
2021	A statutory amendment to the MFSA allowed operators, such as Talen Montana, the operator of the Colstrip Power Plant, to change their fuel source without amending the MFSA Certificate (Section 75-20-228, MCA).
2022	Talen Energy, the power plant operator and one of the owners, declared bankruptcy on May 9, 2022. The U.S. Bankruptcy Court in Houston, Texas, approved a Chapter 11 plan of reorganization on December 15, 2022. See updated ownership and operations information in **Chapter 1, Section 1.2.2.1, Colstrip Power Plant**.
2022	Units 1 and 2 of the Colstrip Power Plant shut down in January 2020, earlier than the date disclosed in the Final EIS (July 1, 2022); impacts associated with the shutdown of Units 1 and 2 were previously considered (see **Section 4.15, Socioeconomic Conditions** in the 2018 Final EIS).
2024	The BLM prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the MCFO planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing Federal leases with sufficient coal reserves to maintain existing mine production levels until 2035 for Spring Creek Mine and 2060 for Rosebud Mine (BLM 2024a); see **Table 5.2-1**.

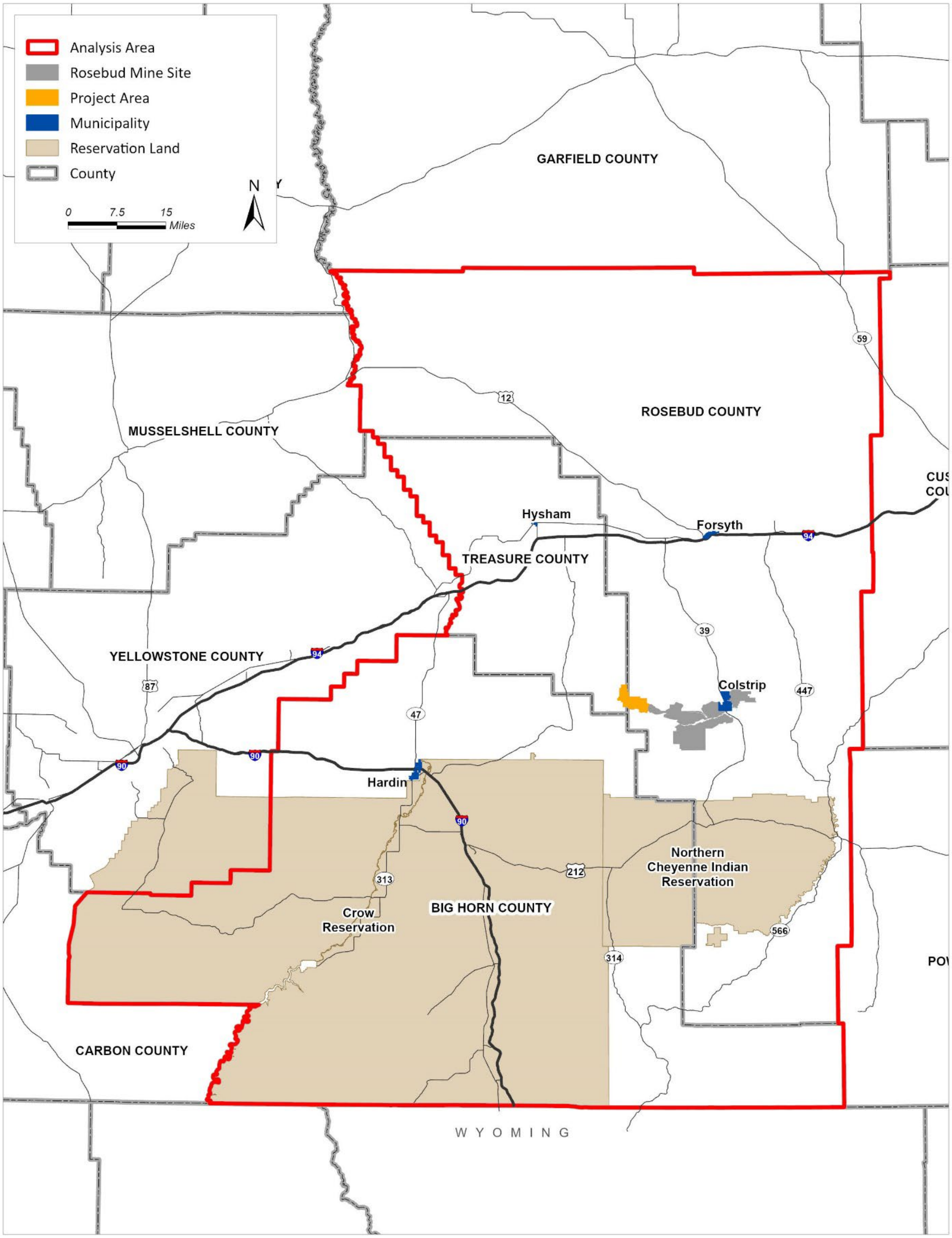

Figure 3.15-1. Socioeconomic Analysis Area.

3.15.1.1 Regulatory Framework

The regulatory framework applicable to socioeconomic conditions is unchanged since the 2018 Final EIS and is described in **Section 3.15.1.1** of the 2018 Final EIS beginning on page 351.

3.15.1.2 Analysis Area

The analysis area for direct and indirect socioeconomic effects is Rosebud, Treasure, and Big Horn Counties (**Figure 3.15-1**) and is the same analysis area used for the 2018 Final EIS. The rationale for using this analysis area is provided in **Section 3.15.1.2** of the 2018 Final EIS beginning on page 353.

3.15.2 Population and Demographics

As shown in **Table 3.15-2**, the population and demographics of the analysis area have decreased in several counties and towns since preparation of the 2018 Final EIS. Population and Demographics information is provided in **Section 3.15.2** of the 2018 Final EIS beginning on page 355.

Table 3.15-2. Rosebud, Treasure, and Big Horn Counties Population (1970–2022).

Jurisdiction	1970	1980	1990	2000	2010	2015	2022
Rosebud County	6,032	9,899	10,505	9,383	9,233	9,352	8,310
% change	—	64.1	6.1	-10.7	-1.6	1.3	-11.1
Forsyth	1,873	2,553	2,178	1,944	1,777	1,874	1,458
% change	—	36.3	-14.7	-10.1	-8.6	5.5	-22.2
Colstrip	—	—	—[1]	2,346	2,214	2,289	2,327
% change	—	—	—	-22.7	-5.6	3.4	1.7
Treasure County	1,069	981	874	861	718	812	680
% change	—	-8.2	-10.9	-1.5	-16.6	13.1	-16.3
Hysham	373	449	361	330	312	363	232
% change	—	20.3	-19.6	-8.6	-5.5	16.3	-36.1
Big Horn County	10,057	11,096	11,337	12,671	12,865	13,341	13,090
% change	—	10.3	2.2	11.8	1.5	3.5	-1.9
Hardin	2,733	3,300	2,940	3,384	3,668	3,754	3,803
% change	—	20.8	-10.9	15.1	8.4	2.3	1.3
Montana	694,409	786,690	799,065	902,125	989,415	1,014,699	1,122,867
% change	—	13.3	1.6	12.9	9.7	2.6	10.7

Source: Montana Department of Commerce 2012a, 2012b, and 2012c; USCB 2016, USCB 2022.

3.15.3 Incorporated Population Centers

Information on incorporated population centers is provided in **Section 3.15.3** of the 2018 Final EIS beginning on page 355. Population projections for the counties and incorporated municipalities were initially provided in **Table 78** of the 2018 Final EIS, these projections anticipated steady population growth for Rosebud and Big Horn Counties from 2015 to 2030, while forecasting a slight decline in Treasure County’s population over the same period. However, the actual population data for 2022 reveals deviations from these projected trends for 2030.

Rosebud County's population was projected to grow by 12.1 percent from 2020 to 2025. Contrary to these projections, the actual population in 2022 showed an 11.1 percent decline from 2015. Forsyth was projected to increase by 7.7 percent by 2025, but it experienced a 22.2 percent decline by 2022. Similarly, Colstrip was anticipated to grow by 9.8 percent by 2025, but only saw a modest increase of 1.7 percent by 2022. Treasure County was projected to see a decrease of 9.7 percent from 2020 to 2025. However, by 2022, the population had already fallen by 16.3 percent from 2015, indicating a more severe decline than anticipated. Hysham, the largest community in Treasure County, was projected to decrease by 30.3 percent by 2025, but its population fell by 36.1 percent by 2022. Big Horn County was expected to experience steady growth of 4.3 percent from 2015 to 2025. Instead, the population slightly decreased by 1.9 percent by 2022. Hardin was projected to experience substantial growth of 30.3 percent by 2025, but only saw a modest increase of 1.3 percent by 2022. These deviations in population predictions may be attributed to the unexpected closure of Colstrip Units 1 & 2, as well as decreased coal production.

3.15.4 Public Services and Infrastructure

Public services (schools, law enforcement, fire protection, and health care) and infrastructure (water supply and wastewater treatment) information is provided in **Section 3.15.4** of the 2018 Final EIS beginning on page 360.

3.16 ENVIRONMENTAL JUSTICE

3.16.1 Introduction

Since the issuance of the 2018 Final EIS, there have been some changed conditions relevant to environmental justice (**Table 3.16-1**). None of the changed conditions significantly alter the analysis presented in the 2018 Final EIS, as all the previously identified environmental justice communities remain at that status. As applicable, key sections have been updated below. Detailed information on environmental justice is available in **Section 3.16** of the 2018 Final EIS beginning on page 363.

Table 3.16-1. Environmental Justice: Changed Conditions Since 2018 Final EIS.

Year	Change
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for socioeconomic conditions: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative socioeconomic impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D in the** 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2020	Active mining began in Area F in August 2020.
2021	Recent executive orders issued by President Biden address climate change and environmental justice: • Executive Order (EO) 13985, Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. This EO sets expectations for a whole-government approach to advancing equity for all, including meaningfully engaging with rural communities and stakeholders and addressing their concerns with respect to the potential environmental impacts. • EO 13990, Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis, requires the use of best available science in Federal decision making, including capturing the full costs of GHG emissions as accurately as possible. • EO 14008, Tackling the Climate Crisis at Home and Abroad, requires a government-wide approach to the climate crisis and encourages broad participation in the goal of conserving 30 percent of U.S. land and waters by 2030. • EO 14096 (2023), Revitalizing Our Nation's Commitment to Environmental Justice for All. This EO mandates NEPA reviews to evaluate direct, indirect, and cumulative effects on Environmental Justice (EJ) communities, requires early and meaningful involvement of EJ communities in the NEPA process, and mandates Federal agencies to consider measures to address and prevent disproportionate and adverse environmental health impacts on EJ communities, including cumulative impacts of pollution and other burdens like climate change. It also requires Federal agencies to create new EJ Strategic Plans and assess efforts biannually, ensuring compliance with the Civil Rights Act Title VI. Documentation of previous public involvement and outreach for the project, including to EJ communities, is documented in the 2018 Final EIS in **Section 1.5, Public Outreach**, and in **Chapter 6, Consultation Processes**. Outreach and public involvement completed for this SEIS process are described in **Section 1.5, Public Outreach**, and in **Section 6.1, Consultation Processes**. • EO 14091 (2023), Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. This EO enhances Federal programs' ability to promote equity and support underserved communities by addressing systemic barriers, calls for the collection and utilization of data to measure and advance equity across all government programs, and strengthens engagement with underserved communities to ensure Federal resources and benefits are equitably distributed.
2022	Units 1 and 2 of the Colstrip Power Plant shut down in January 2020, earlier than the date disclosed in the Final EIS (July 1, 2022); impacts associated with the shutdown of Units 1 and 2 were previously considered (see **Section 4.15, Socioeconomic Conditions** in the 2018 Final EIS).
2024	The BLM prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the MCFO planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing Federal leases with sufficient coal reserves to maintain existing mine production levels until 2035 for the Spring Creek Mine and 2060 for the Rosebud Mine (BLM 2024a); see **Table 5.2-1**.
2024	Recent CEQ updates to NEPA Regulations (40 CFR §§ 1500 to 1508) place new emphasis on consideration of environmental justice concerns and climate change in NEPA analyses. These revisions require Federal agencies to evaluate potential impacts on minority and low-income populations, assess GHG emissions and climate change effects, ensure meaningful public participation, and restore key procedural requirements.

3.16.1.1 Regulatory Framework

The regulatory framework applicable to environmental justice is in **Section 3.16.1.1** of the 2018 Final EIS beginning on page 363. The regulatory updates since 2018 (see list in **Table 3.16-1**) include executive orders related to climate and environmental justice issued by President Biden and new NEPA regulations issued by CEQ in 2024.

3.16.1.2 Analysis Area

The environmental justice analysis areas (the socioeconomics analysis area shown on **Figure 3.15-1** for direct and indirect social and economic effects and the air quality analysis area described in **Section 3.3.1.2** for direct and indirect human health and safety effects) used for analysis in the SEIS are the same as those used in the 2018 Final EIS. The rationale for their use is described in **Section 3.16.1.2** of the 2018 Final EIS beginning on page 364.

3.16.2 Minority Populations

As shown in **Table 3.16-2**, there have been changes to minority populations in the analysis area since the 2018 Final EIS was prepared; see initial descriptions in **Section 3.16.2** of the 2018 Final EIS beginning on page 364; although the environmental justice designation for these communities remains the same. The ACS estimates indicate that the total minority population in Rosebud County has increased by 7.2 percentage points since 2016, now comprising 48.5 percent of the county's total population. In contrast, Treasure County experienced a decrease in total minority populations by 1.7 percentage points, now making up 9.1 percent of the total population. Big Horn County saw an increase in its total minority population by 3.3 percentage points, now accounting for 73.81 percent of the total population.

The Crow and Northern Cheyenne Indian Reservations continue to play a significant role in the demographic makeup of these counties. The ACS 2022 data shows that American Indian or Alaska Natives account for 81.0 percent of the population on the Crow Reservation and 91.9 percent on the Northern Cheyenne Indian Reservation, slightly up from 78.5 percent and 91.7 percent, respectively, in 2016. This reflects an increase of 2.5 percentage points on the Crow Reservation and 0.2 percentage points on the Northern Cheyenne Indian Reservation. Montana’s overall American Indian or Alaska Native population proportion decreased from 7.9 percent in 2016 to 5.4 percent in 2022, a decrease of 2.5 percentage points.

For the American Indian or Alaska Native population, Treasure County saw a significant change from 2.8 percent in 2016 to 0.2 percent in 2022, a decrease of 2.6 percentage points. Rosebud County's American Indian or Alaska Native population increased from 36.4 percent in 2016 to 38.2 percent in 2022, an increase of 1.8 percentage points. In Big Horn County, the minority population remained relatively stable, changing from 64.9 percent in 2016 to 65.1 percent in 2022, an increase of 0.2 percentage points.

The closure of Colstrip Units 1 and 2 substantially impacted the regional economy, particularly affecting demographics in Treasure County. According to the updated IMPLAN analysis (BBC 2024b) in **Appendix 4**, the retirement of Colstrip Units 1 and 2 required Colstrip to reduce its workforce from 400 workers to 250 workers, which led to a reduction in revenue, employment, and economic output in the region, resulting in job losses and economic downturn (BBC 2024b, BBC 2017). This economic downturn likely contributed to the outmigration of minority populations seeking employment opportunities elsewhere, including a 2.6 percent decline in the American Indian population and 1.7 percent decline in total minority populations in Treasure County, as compared to the 3.5 percent increase in the state.

Conversely, the ongoing operations of the Rosebud Mine and the presence of the Northern Cheyenne Indian Reservation have supported significant employment for Native Americans in Rosebud County, contributing to the stability and slight growth in minority populations. The demographic stability in Big Horn County reflects the ongoing influence of the Crow Reservation and associated economic activities, which continue to support local employment and economic stability.

The geographic proximity to these economic activities plays a significant role in these demographic trends. Rosebud and Big Horn Counties, being closer to the Rosebud Mine and the Crow and Northern Cheyenne Reservations, benefit more directly from the employment and economic opportunities provided by these entities. In contrast, Treasure County, which is closer to Colstrip Units 1 and 2, experienced more direct negative impacts from their closure, leading to population decline.

Table 3.16-2. Comparison of Minority Race, Hispanic and Latino, and Total Minority Populations within the Analysis Area.

Population/ Geography	U.S.	Montana	Big Horn County	Rosebud County	Treasure County	Northern Cheyenne Indian Reservation	Crow Reservation
2016 Data Used in 2018 Final EIS							
All minority race	26.4	10.8	66.7	39.0	10.2	92.6	79.5
American Indian	1.5	7.9	64.9	36.4	2.8	91.7	78.5
Hispanic or Latino	17.1	3.3	5.2	4.2	6.9	3.3	3.1
Total minority population	33.7	13.0	70.5	41.3	10.8	93.2	82.2
2022 Data							
All minority race	39.1	14.9	65.1	46.3	5.6	95.1	83.85
American Indian	1.0	5.4	65.1	38.2	0.2	91.9	81.0
Hispanic or Latino	19.1	4.4	6.3	5.3	4.3	2.3	1.6
Total minority population	42.35	16.5	73.81	48.5	9.1	95.9	84.4

Source: USCB 2016 and ASC 5-Year Estimates Table B03002, 2022.

3.16.3 Low-Income Populations

According to 2022 Census Bureau data, Big Horn County had minority populations, indigenous populations, and low-income populations exceeding state averages (73.81 percent, 65.1 percent, and 25.7 percent, respectively). In addition to Big Horn County, Rosebud County had minority, indigenous, and low-income populations that exceed the state level (48.5 percent, 38.2 percent, and 20.4 percent, respectively). Treasure County had minority, indigenous, and low-income populations below the respective state populations (9.1 percent, 0.2 percent, and 9.9 percent).

As shown in **Table 3.16-3**, there have been changes to low-income populations in the analysis area since the 2018 Final EIS was prepared; see descriptions in **Section 3.16.3** of the 2018 Final EIS beginning on page 365. The changes in poverty rates within the analysis area from the 2018 Final EIS in comparison to the most recent ACS data available (2022) for Rosebud and Big Horn Counties are largely minor, given that these counties continue to experience poverty rates that are substantially higher than both the US and State of Montana's averages, designating the areas as low-income communities. Treasure County, however, had a substantial reduction in poverty rate of 10.7 percent, which is now lower than the US and state poverty rates. All regions, except for the Northern Cheyenne Indian Reservation, experienced a decline in poverty rates in total and among American Indian populations, however, these reductions did not significantly impact the economic vulnerabilities in the regions, as the poverty rates remain significantly higher than both the US and State of Montana's averages, except for Treasure County.

The Northern Cheyenne Indian Reservation experienced an increase in poverty rates (8.5 percent) and among American Indian populations. The retirement of Colstrip Units 1 and 2 may have contributed to this increase in poverty rates, as the reduction in mine production following the retirement of the two units at Colstrip reduced the mine's total contribution to regional employment, and specifically the Northern Cheyenne Indian Reservation by approximately 55 jobs and $9 million dollars in annual economic output for the tribe (BBC 2024b).

The decline of poverty rates from 20.6 percent in 2016 to 9.9 percent in 2022, paired with a reduction in total and minority populations (see **Table 3.15-2** and **Table 3.16-2**) in Treasure County may also be attributed to the loss of economic opportunities following the retirement of Colstrip Units 1 and 2. This population shift and economic realignment suggest that those affected by the retirement of Units 1 and 2 relocated to seek different economic opportunities, leading to a reduced population and potentially increased per capita economic activity among those who remained in Treasure County. Conversely, the Northern Cheyenne Reservation did not experience similar outmigration, as they are likely to be less mobile than other populations due to family and cultural ties to the reservation and have limited transportation options for commuting to other economic centers. This resulted in a higher concentration of poverty among the residents who remained.

Table 3.16-3. Individual Poverty Rates within the Analysis Area.

Population/ Geography	U.S.	Montana	Big Horn County	Rosebud County	Treasure County	Northern Cheyenne Indian Reservation	Crow Reservation
2016 Data Used in 2018 Final EIS							
Poverty Rate (percent)	15.5	15.2	29.2	21.9	20.6	24.4	37.4
American Indian Poverty Rate (percent)	28.3	38.2	41.0	47.5	0	36.5	49.8
2022 Data							
Poverty Rate (percent)	12.6	12.1	25.7	20.4	9.9	32.9	29.7
American Indian Poverty Rate (percent)	21.7	32.7	31.7	39.7	0	40.8	33.8

Source: USCB 2016 and ACS 5-Year Estimates Table S1701.

3.17 VISUAL RESOURCES

3.17.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to visual resources. Please note that the following actions (**Table 3.17-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for visual resources. Detailed information on visual resources is available in **Section 3.17** of the 2018 Final EIS beginning on page 367.

Table 3.17-1. Visual Resources: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for visual resources: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative visual resource impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2022	On August 10, 2022, Montana submitted its Regional Haze SIP for the Second Planning Period to the EPA. This plan fulfills the requirements of the Regional Haze Rule (40 CFR § 51, Subpart P) by establishing long-term strategies to achieve the 2028 reasonable progress goals. These goals are to improve existing visibility in mandatory Class I areas, prevent future impairment of visibility by manmade sources, and meet the national goal of natural visibility conditions in all mandatory Class I areas by 2064. The SIP demonstrates Montana is on track to meet the national goal of natural visibility conditions in all mandatory Class I areas by 2064.

3.17.1.1 Regulatory Framework

The regulatory framework for visual resources has been updated to include the Montana SIP discussed in **Table 3.17-1**. The regulatory framework applicable to visual resources is otherwise unchanged and is described in **Section 3.17.1.1** of the 2018 Final EIS beginning on page 367. The update discussed above would not substantially change the results of the 2018 Final EIS.

3.17.1.2 Analysis Area

The analysis areas for visual resources, which are the viewshed of the proposed project (direct effects) and the air quality analysis area described in **Section 3.3.1.2** (indirect effects), are described in detail in **Section 3.17.1.2** of the 2018 Final EIS beginning on page 367.

3.17.2 Visual Character

The visual character of the analysis area is described in **Section 3.17.2** of the 2018 Final EIS beginning on page 368.

3.18 RECREATION

3.18.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to recreation. Please note that the following actions (**Table 3.18-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for recreation. Detailed information on recreation is available in **Section 3.18** of the 2018 Final EIS beginning on page 370.

Table 3.18-1. Recreation Resources: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for recreation: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative recreation impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.

3.18.1.1 Regulatory Framework

The regulatory framework for recreation is unchanged since the Final EIS and is described in **Section 3.18.1.1** of the 2018 Final EIS beginning on page 370.

3.18.1.2 Analysis Area

The analysis areas for recreation, which are the project area plus a 2,000-foot buffer (direct impacts) and the air quality analysis area described in **Section 3.3.1.2** (indirect effects), are described detail in **Section 3.18.1.2** of the 2018 Final EIS beginning on page 371.

3.18.2 Recreation Opportunities

Recreation opportunities in the analysis area are described in **Section 3.18.2** of the 2018 Final EIS beginning on page 371.

3.19 PALEONTOLOGY

3.19.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to paleontology, other than development of and active mining in Area F. Detailed information on paleontology is available in **Section 3.19** of the 2018 Final EIS beginning on page 373.

3.19.1.1 Regulatory Framework

The regulatory framework for paleontology is unchanged since the Final EIS. The regulatory framework applicable to paleontology is described in **Section 3.19.1.1** of the 2018 Final EIS beginning on page 373.

3.19.1.2 Analysis Area

The analysis area for direct and indirect impacts on paleontology is the project area,[45] which was also the analysis area used in the 2018 Final EIS.

3.19.2 Affected Environment

The affected environment and pre-disturbance paleontology surveys conducted in the analysis area are described in **Section 3.19.2** of the 2018 Final EIS beginning on page 373.

45. As Westmoreland Rosebud has developed Area F, on-the-ground conditions have necessitated minor changes to the project area, which is the Area F permit boundary (now 6,773 acres instead of 6,746 acres), and to the configuration of the disturbance boundary (now 4,288 acres instead of 4,260 acres); these minor revisions were reviewed and approved by DEQ pursuant to MSUMRA and MEPA and are described in **Section 2.2.2.2, Area F Operations and Development**.

3.20 ACCESS AND TRANSPORTATION

3.20.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to transportation. Please note that the following actions (**Table 3.20-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for transportation. Detailed information on access and transportation is available in **Section 3.20** of the 2018 Final EIS beginning on page 377.

Table 3.20-1. Access and Transportation: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	A 4.2-mile segment of the Horse Creek Road in Rosebud County was relocated as part of the development of Area F (see additional discussion in **Section 2.2.2.2, Area F Operations and Development, Road Construction and Relocations**).
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for access and transportation: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative access and transportation impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.

3.20.1.1 Regulatory Framework

The regulatory framework for access and transportation is unchanged since the Final EIS and is described in **Section 3.20.1.1** of the 2018 Final EIS beginning on page 377.

3.20.1.2 Analysis Area

The analysis area for impacts on access and transportation (the road network used by the mine and power plants and the project area) is described in detail in **Section 3.20.1.2** of the 2018 Final EIS beginning on page 378.

3.20.2 Mine Access and Internal Road System

Mine access and the internal road system are described in **Section 3.20.2** of the 2018 Final EIS beginning on page 379.

3.20.3 Regional Transportation System

The regional transportation system is described in **Section 3.20.3** of the 2018 Final EIS beginning on page 380.

3.21 SOLID AND HAZARDOUS WASTE

3.21.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to solid and hazardous waste. Please note that the following actions (**Table 3.21-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for solid and hazardous waste. Detailed information on solid and hazardous waste is available in **Section 3.21** of the 2018 Final EIS beginning on page 382.

Table 3.21-1. Solid and Hazardous Waste: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019 and active mining began in August 2020, potentially generating waste. Westmoreland Rosebud is managing disposal of any waste generated from Area F under its Waste Management Program, which consists of a Solid and Hazardous Waste Management Plan (Western Energy 2009), a Spill Prevention Control and Counter Measure Plan, and a Contingency and Emergency Response Plan (Western Energy 2017b).
2020	Units 1 and 2 of the Colstrip Power Plant were retired from use on January 2, 2020, and January 3, 2020, respectively. Due to this retirement, the annual total of Toxic Release Inventory (TRI) chemicals for land-disposal releases are now likely lower than the annual TRI total presented in **Table 87** in **Section 3.21.2.4** of the 2018 Final EIS.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for solid and hazardous waste: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative solid and hazardous waste impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2023	Westmoreland prepares and submits an Annual Hazardous Waste Report to Montana DEQ as a condition of its operating permits for the Rosebud Mine. The most recent reporting year available is 2023 (January 1, 2023, through December 31, 2023); this report (Westmoreland Rosebud 2024c) was reviewed to confirm there have been no significant changes since the 2018 Final EIS.

3.21.1.1 Regulatory Framework

The regulatory framework for solid and hazardous waste is unchanged since the Final EIS and is described in **Section 3.21.1.1** of the 2018 Final EIS beginning on page 382.

3.21.1.2 Analysis Area

The analysis areas for solid and hazardous waste, which are the Rosebud Mine site (direct impacts) and the sites of the Colstrip and Rosebud Power Plants (including the off-site coal combustion residuals storage areas), are described in detail in **Section 3.21.1.2** of the 2018 Final EIS beginning on page 383.

3.21.2 Waste Disposal Practices

Waste disposal practices are described in **Section 3.21.2** of the 2018 Final EIS beginning on page 383.

3.22 NOISE

3.22.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to noise. Please note that the following actions (**Table 3.22-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for noise. Information on noise is available in **Section 3.22** of the 2018 Final EIS beginning on page 392.

Table 3.22-1. Noise: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020, potentially generating noise.
2020	Units 1 and 2 of the Colstrip Power Plant were retired from use on January 2, 2020, and January 3, 2020, respectively. Due to this retirement, existing noise may be less (e.g., quieter) than what was described in **Section 3.22.2, Existing Noise Sources**, in the 2018 Final EIS.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for noise: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative noise impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.

3.22.1.1 Regulatory Framework

The regulatory framework for noise is unchanged since the Final EIS and is described in **Section 3.22.1.1** of the 2018 Final EIS beginning on page 392.

3.22.1.2 Analysis Area

The analysis areas for direct and indirect noise impacts (the nearest residences to the project area, the Colstrip Power Plant, and the Rosebud Power Plant) are described in detail in **Section 3.22.1.2** of the 2018 Final EIS beginning on page 392.

3.22.1.3 Noise Terminology

Noise terminology is provided in **Section 3.22.1.3** of the 2018 Final EIS beginning on page 393.

3.22.2 Existing Noise Sources

Existing noise sources are described in **Section 3.22.2** of the 2018 Final EIS beginning on page 398.

3.23 LAND USE

3.23.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to land use. Please note that the following actions (**Table 3.23-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for land use. Information on land use is available in **Section 3.18** of the 2018 Final EIS beginning on page 398.

Table 3.23-1. Land Use: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Coal Company filed for bankruptcy on March 2, 2019, and was acquired by Westmoreland Rosebud Mining, LLC, a subsidiary of Westmoreland Mining, LLC. A minor revision (**Table 2.2-5**) was approved by DEQ on March 14, 2019, for Westmoreland Rosebud Mining, LLC, to be the contract miner at the Rosebud Mine. The permit transfer from Western Energy Company to Westmoreland Rosebud Mining, LLC, was submitted on April 12, 2019, and subsequently approved by DEQ.
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for land use: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative land use impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).
2024	The BLM prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the MCFO planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing Federal leases with sufficient coal reserves to maintain existing mine production levels until 2035 for the Spring Creek Mine and 2060 for the Rosebud Mine (BLM 2024a); see **Table 5.2-1**.

3.23.1.1 Regulatory Framework

Except for changed ownership or other slight adjustments to lease and deed agreements, the regulatory framework for land use is unchanged since the Final EIS and is described in **Section 3.23.1.1** of the 2018 Final EIS beginning on page 398. Updated lease information is shown on **Figure 1.1-3** in **Chapter 1**.

3.23.1.2 Analysis Area

The analysis areas for land use, which are the project area plus a 2,000-foot buffer (direct impacts) and the locations of the Colstrip and Rosebud Power Plants plus a 0.5-mile buffer (indirect effects), are described in detail in **Section 3.23.1.2** of the 2018 Final EIS beginning on page 399.

3.23.2 Land Ownership

The project area encompasses 6,773 acres with three private surface owners (**Table 91** and **Figure 65** in the 2018 Final EIS): Westmoreland Rosebud, Great Northern Properties LP, and the Booth Land and Livestock Company. The subsurface mineral estate is both privately (3,479 acres) and federally (3,294 acres) owned. Westmoreland Rosebud holds leases for the Federal (MTM 082186) and private coal private coal (1001 and 1001-A) in the project area (**Figure 1.1-3** and **Table 2.2-7**). Detailed land ownership information is provided in **Section 3.23.2** of the 2018 Final EIS beginning on page 399.

3.23.3 Primary Pre-mining Land Uses (Direct Effects Analysis Area)

Primary pre-mining land uses are described in **Section 3.23.3** of the 2018 Final EIS beginning on page 403.

3.23.4 Other Pre-mining Land Uses (Direct Effects Analysis Area)

Other pre-mining land uses are described in **Section 3.23.4** of the 2018 Final EIS beginning on page 404.

3.23.5 Land Use in the Indirect Effects Analysis Area

Pre-mining land uses are described in **Section 3.23.5** of the 2018 Final EIS beginning on page 405.

3.24 SOIL

3.24.1 Introduction

Since the issuance of the 2018 Final EIS, there have been no substantial new circumstances or information relevant to soil. Please note that the following actions (**Table 3.24-1**) have occurred since the issuance of the 2018 Final EIS but would not substantially change the affected environment previously described for soil. Detailed information on soil is available in **Section 3.24** of the 2018 Final EIS beginning on page 406.

Table 3.24-1. Soil: Changed Conditions Since the 2018 Final EIS.

Year	Change
2019	Westmoreland Rosebud began developing Area F in 2019, and active mining began in August 2020 according to its state operating permit and Federal mining plan. As of December 2023, Westmoreland Rosebud has disturbed 582 acres in the project area; 494 acres of that disturbance is due to active mining, and the remainder is due to site development, such as roads and soil and/or spoil stockpiles. See **Tables 2.2-3** and **2.2-4** in **Chapter 2** above for current disturbance at the Rosebud Mine and Westmoreland Rosebud's posted reclamation bonds. Soil is being salvaged and stockpiled in the project area as described in **Section 2.4.3.6, Soil Removal and Stockpiling**, of the 2018 Final EIS, beginning on page 57.
2019-2022	In terms of other permit areas of the Rosebud Mine, the following may contribute to changed conditions for soil: • AM5 to Permit Area B was approved by DEQ in 2022 after preparation of an EIS pursuant to MEPA that considered the cumulative soil impacts of Area F. The project area approved in DEQ's ROD for Area B AM5 was roughly half the size of the area that was analyzed in the 2018 Final EIS (see **Chapter 5** and **Appendix D** in the 2018 Final EIS). • Area D is no longer actively mined and is being reclaimed. • Area E has received full bond release and is no longer a Montana coal mine.
2021	The Richard Springs Fire began in a coal seam approximately 10 miles southwest of Colstrip on August 8, 2021, and burned 171,130 acres in the vicinity of the Rosebud Mine Area B, including Area B AM5, and reclaimed Area E. It was not in the same drainages as Area F but is considered in **Chapter 5** (cumulative effects).

3.24.1.1 Regulatory Framework

The regulatory framework for soil is unchanged since the 2018 Final EIS and is described in **Section 3.24.1.1** of the 2018 Final EIS beginning on page 406.

3.24.1.2 Analysis Area

The analysis areas for soil, which are the proposed disturbance area (direct impacts) and the operational boundaries of the Colstrip and Rosebud Power Plants plus a 32-km irregular buffer (indirect effects), are described in detail in **Section 3.24.1.2** of the 2018 Final EIS beginning on page 407.

3.24.2 Soil Map Units and Descriptions

Soil map units and descriptions are in **Section 3.24.2** of the 2018 Final EIS beginning on page 410.

3.24.3 Suitability for Reclamation

Soil suitability for reclamation is discussed in **Section 3.24.3** of the 2018 Final EIS beginning on page 414.

3.25 RESOURCES CONSIDERED BUT DISMISSED

Resources considered but dismissed are described in **Section 3.25** of the 2018 Final EIS. Only one resource area, alluvial valley floors, was considered but not carried forward for detailed analysis. A discussion of alluvial valley floors and the rationale for not including a detailed analysis is provided in **Section 3.25.1** of the 2018 Final EIS beginning on page 418. During preparation of this SEIS, no additional resources were considered but dismissed from detailed analysis.

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CHAPTER 4. ENVIRONMENTAL CONSEQUENCES (DIRECT AND INDIRECT IMPACTS)

4.1 INTRODUCTION

This chapter discloses and analyzes the direct and indirect environmental effects that may result from selection and implementation of the alternatives described in **Chapter 2** of this Supplemental Environmental Impact Statement (SEIS); these effects are summarized at the end of **Chapter 2** in **Table 2.8-1**. The National Environmental Policy Act (NEPA) (described in **Chapter 1**) requires Federal agencies to examine and disclose to the public the potential impacts on the human environment of proposed projects or activities that require state or Federal approval. Cumulative impacts are presented in **Chapter 5**.

In this SEIS, an environmental impact or effect is any change from the present condition of any resource or issue (**Table 3.1-1**) that may result because of implementing one of the alternatives. Impacts may be beneficial or adverse and are defined as short-term, long-term, or both (see analysis definitions in **Appendix 1**). Analyses in this chapter have been updated to address the September 30, 2022, court order and to incorporate any new information available since the 2018 Final EIS (see **Section 1.1, Introduction**). Specifically, this chapter contains analysis of greenhouse gas (GHG) emissions, the indirect effects of mine expansion on water withdrawals from the Yellowstone River, and a reasonable range of alternatives. Impacts analyses and conclusions in this SEIS were based on the review of existing literature and studies, information provided by resource specialists and other agencies, professional judgment, agency staff insights, and public input; resource-specific analysis methodologies are provided in the introductions to each resource section.

As discussed in **Chapter 2**, the alternatives considered in this SEIS have been updated from those considered in the 2018 Final EIS. Alternative 4 – Proposed Action (Current Federal Mining Plan) is very similar to the Proposed Action (Alternative 2) analyzed in the 2018 Final EIS. Therefore, impacts analyses presented in this chapter are similar to and reference the effects analyses presented for Alternative 2 in the 2018 Final EIS. Alternative 1 – No Action was revised to account for ongoing mining and associated disturbance that has been occurring in the project area since 2019 according to approved state operating permit C2011003F and the 2019-approved Federal mining plan. Alternative 5 – Partial Mining Alternative was developed to further explore a reasonable range of possible alternatives to allow for meaningful public input and informed agency decision making.

In general, the types of direct and indirect impacts under Alternatives 1 and 5 would be the same as for Alternative 4, but impact intensities would be lower due to shorter periods of mining operations, fewer acres disturbed in the project area, and fewer tons of coal mined as compared to Alternative 4. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**. The alternative selected for this project may have ramifications for the operations of the Rosebud Mine as a whole. Based on production estimates for Area B and other currently approved permit areas, including Area F, the operational life of the Rosebud Mine is assumed to end in 2045 (**Section 2.2.6, Life of Operations**). Full development of Area F under Alternative 4, which is consistent with the approved state operating permit C2011003F and the 2019-approved Federal mining plan, is expected to be about 20 years (through 2039). Ceasing production in Area F earlier than 2039 (either 2025 under Alternative 1 or 2030 under Alternative 5) would cause Westmoreland Rosebud to shift mining operations to other approved permit areas, such as Area B, potentially leading to increased production rates for those permit areas and potential closure of the Rosebud Mine earlier than 2045.

4.2 TOPOGRAPHY

This section discloses the direct and indirect effects on topography resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine topography conditions and the analysis areas used for this impacts analysis are described in **Section 3.2, Topography**.

4.2.1 Analysis Methods and Impact and Intensity Thresholds

Topography impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.2.1** of the 2018 Final EIS, beginning on page 423. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on topography are the same as those defined in the 2018 Final EIS in **Table 96**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.2.2 Alternative 1 – No Action

The types of direct and indirect topography impacts under Alternative 1 (as described in this SEIS)[46] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. As with Alternative 4, the impacts on topography during mining would be noticeable within the analysis area and would result in short-term major adverse impacts on topography. In the short-term following reclamation, the impacts from erosion on topography would be minor, and the surface topography of the analysis area would resemble that of the postmining topography (PMT) initially contoured following mining activities.

Under Alternative 1, direct and indirect topography impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and the PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.2.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect topography impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.2.3** of the 2018 Final EIS, beginning on page 424. Under Alternative 4, half a million tons more coal would be mined[47] and approximately 28 acres more would be disturbed than under Alternative 2. Reclamation would occur

46. Direct and indirect topography impacts of Alternative 1 – No Action were described in **Section 4.2.2** of the 2018 Final EIS, beginning on page 423. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

47. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.2.3.1 Direct Impacts

Under Alternative 4 (as with Alternative 2), the postmining landscape of the analysis area would be restored following mining operations to the approximate original contour to facilitate postmining land uses. The PMT that Westmoreland Rosebud would meet at final bond release is the currently approved PMT shown in **Figure 2.2-6**. The PMT shows the general topography (ridges, drainages, slopes, etc.) that would serve as Westmoreland Rosebud's grading template for matching the pre-mine topography, which is described in the 2018 Final EIS in **Section 3.2, Topography** and **Figure 13**.

Annually (during operations), Westmoreland Rosebud would provide the Montana Department of Environmental Quality (DEQ) with an updated topographic map showing all existing areas to be graded, the amount of pit advance, and the actual graded contours. This map would be included in Westmoreland Rosebud's Annual Report for the project. During the final phases of spoil grading, surface drainages would be reconstructed to the approved approximate PMT. Cross-sections would be utilized to evaluate the blending of undisturbed terrain and disturbed ground to provide a smooth and stable transition in the topography.

Two postmining feature types, rock piles and cliffs, would be designed to mitigate the loss of sandstone outcrops and cliffs/bluffs that are common feature types on the pre-mine landscape. Highwall-reduction alternatives may be considered for replacement of bluff features that existed before mining. Sandstone cliff features may be created with DEQ approval in lieu of highwall reduction. Sandstone rock piles would be created and opportunistically placed on upland situations, ridges, hilltops, and sideslopes in the analysis area. With concurrence of DEQ, rocks and boulders may be placed on native areas within the permitted disturbance limits. Westmoreland Rosebud would demonstrate both slope stability and replacement of pre-mine features during the permitting process for each of these features.

Drainage-basin design would be based on pre-mine conditions. With the exception of haul-road crossings, Westmoreland Rosebud would leave the main channels of Black Hank, Donley, McClure, and Robbie Creeks undisturbed in Alternative 4, which is the same as described for Alternative 2 in the 2018 Final EIS. Reclaimed drainage basins – valleys, channels, streams (perennial, intermittent, and ephemeral), and floodplains – would be constructed to meet approved PMT and approximate original contours, and to enable the drainage channels to remain in dynamic equilibrium with the drainage basin system. **Figure 13** in the 2018 Final EIS presents the pre-mine topography with drainage divides. A pre-mine and postmine comparative analysis of geomorphic characteristics of the analysis area would be used to determine reclamation recontouring and drainage and to ensure that drainages and slope contours are designed and constructed consistent with the approved PMT (**Figure 2.2-6**).

During final grading, Westmoreland Rosebud may be able to incorporate additional drainage features to more closely approximate original contours and avoid geomorphic problems including long uniform slopes, inappropriate channel or slope profiles, or inadequate drainage density. Examples of some of the diversity features that Westmoreland Rosebud may be able to include during final grading include additional tributaries, over-steep slopes of various exposures in headwater locations, incised tributary or dry-wash areas, complex side slopes, small anomalies (i.e., hogbacks and knolls), and scoria pits. These features are not shown on **Figure 2.2-6**, but probable locations are shown on Exhibit B of the Permit

Application Package (PAP). Impacts on topography would occur on 4,288 acres of previously undisturbed land within the analysis area. During operations, mining within Area F would lower the surface elevation, resulting in a steep topographic gradient toward the open pit. Areas of soil and overburden piles would result in an increase in surface elevation where these piles were stored. The impacts on topography during mining would be noticeable within the analysis area and would result in short-term major adverse impacts on topography.

In the short term following reclamation, the impacts from erosion on topography would be minor, and the surface topography of the analysis area would resemble that of the PMT initially contoured following mining activities.

4.2.3.2 Indirect Impacts

Under Alternative 4, as with Alternative 2, Westmoreland Rosebud would mix geologically distinct layers into spoil consisting of fragments of sandstone, siltstone, mudstone, and claystone in the analysis area. The resulting fine-grained sediment generated due to the breakdown of these stones into fragments would result in a well-graded mixture of lithified and non-lithified material comprising the material used to backfill the analysis area. Indirect long-term minor adverse impacts on topography from differential erosion of the spoil would include the preferential erosion of the softer stone fragments and non-lithified sediment relative to the harder stone fragments. This would occur first within the created areas of drainage within the backfill and then extend out to the hillsides over time. The initial impact on topography would be the creation of a hummocky terrain with fragments of more resistant stone scattered throughout the analysis area. This topographic terrain would persist until the erosion of the backfilled material was complete.

Because drainage basins would not be mined, unaltered competent geologic layers of lithified material would be located in proximity to softer backfilled material in the areas where the coal was mined and backfilled with material softer in competency. Long-term differential erosion of these two dissimilar materials over an unknown geologic time would likely result in the topographic inversion of the area: the undisturbed drainage valleys would become buttes over time as the backfill would erode more easily. This would represent a long-term major adverse impact that would be measurable but would have a relatively minor impact on future users.

4.2.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect topography impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. As with Alternative 4, the impacts on topography during mining would be noticeable within the analysis area and would result in short-term major adverse impacts on topography. In the short-term following reclamation, the impacts from erosion on topography would be minor, and the surface topography of the analysis area would resemble that of the PMT initially contoured following mining activities.

Under Alternative 5, direct and indirect topography impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding topography impacts) would be 9 years shorter under

Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.2.5 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitments of resources would be similar to those described in **Section 4.2.5** of the 2018 Final EIS. Alteration of the previously undisturbed pre-mine topography would be an irreversible impact on the area topography. Although the postmining grading of the land surface would closely mimic the pre-mine topography, subtle variations would be noticeable when the pre-mine and postmining topographic maps are compared.

4.3 AIR QUALITY

This section discloses the direct and indirect effects on air quality resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Existing air quality and the analysis areas used for this impacts analysis are described in **Section 3.3, Air Quality**.

4.3.1 Analysis Methods and Impact and Intensity Thresholds

Air quality impacts of Alternatives 1, 4, and 5 were evaluated using modeling and analyses completed for Alternative 2 and presented in the 2018 Final EIS. Analysis methods are provided in **Section 4.3.1** of the 2018 Final EIS, beginning on page 430, and additional detail is provided in **Appendix D** of the 2018 Final EIS. As previously noted, emissions used in the air quality impacts analysis in the 2018 Final EIS are likely an overestimate of current conditions, primarily due to the early retirement of Units 1 and 2 of the Colstrip Power Plant; when current data were available (e.g., from DEQ and publicly available on the Environmental Protection Agency's [EPA's] website), the information was updated in **Section 3.3, Air Quality**. The Office of Surface Mining Reclamation and Enforcement (OSMRE) and the EIS consultant team reviewed the changed conditions and determined that the analyses for Alternative 2 in the 2018 Final EIS were still valid and could be used to consider SEIS alternatives. Air quality and emissions information, as well as coal production estimates, presented in DEQ's *Rosebud Mine Area B AM5 Final Environmental Impact Statement* (DEQ 2022) and the Bureau of Land Management's (BLM's) *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) also was reviewed and found to be consistent with the analyses presented in the 2018 Final EIS. Based on these reviews, OSMRE determined that new air quality modeling was not needed to understand the impacts of the alternatives described in this SEIS. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on air quality are the same as those defined in the 2018 Final EIS in **Table 98**.

Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.3.2 Alternative 1 – No Action

The types of direct and indirect air quality impacts under Alternative 1 (as described in this SEIS)[48] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, disturbance would be limited to the southeastern portion of the project area (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

Under Alternative 1, direct and indirect air quality impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Direct criteria air pollutants (CAPs) and hazardous air pollutants (HAPs) emissions, as well as impacts on air-quality-related values, such as visibility, would occur for a shorter period under

48. Direct and indirect air quality impacts of Alternative 1 – No Action were described in **Section 4.3.2** of the 2018 Final EIS, beginning on page 430. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

Alternative 1 (14 years less) than under Alternative 4. As with Alternative 4, direct air quality impacts would be short-term, minor, and adverse.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes CAP and HAP emissions in the analysis area, contributing to indirect impacts (detailed in Alternative 4), including degraded air quality, visibility impairment (haze), and deposition of trace metals, SO_2, and NO_2 in analysis area soils and waterways. As with Alternative 4, these indirect air quality impacts would be minor and adverse. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years (along with associated indirect impacts), which is 14 years fewer than under Alternative 4. Therefore, CAP, HAP, and GHG emissions under Alternative 1 would be lower in the analysis area, leading to 14 fewer years of degraded air quality, visibility impairment, and deposition of trace metals, SO_2, and NO_2.

4.3.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect air quality impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those summarized for Alternative 2 in **Section 4.3.3** of the 2018 Final EIS, beginning on page 430 and described in detail in **Appendix D** of the 2018 Final EIS. Under Alternative 4, half a million tons more coal would be mined[49] and approximately 28 acres more would be disturbed over a 20-year mine life as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in the 2018 Final EIS in **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

The direct impacts of Alternative 4, as well as indirect impacts due to coal combustion, are disclosed below. Similar to Alternative 2 in the 2018 Final EIS, the direct and indirect components of Alternative 4 would have a minor or negligible impact on air quality and air-quality-related values in the analysis area.

4.3.3.1 Direct Impacts

The direct air quality impacts of Alternative 4 would be a consequence of the emissions from the mining, processing, and handling of project area coal (including transportation to the power plants by haul truck and conveyor) as well as reclamation of the areas disturbed by these actions. The sources of air pollution include fugitive dust sources (i.e., topsoil removal and unloading; overburden drilling, blasting, and removal; coal drilling, blasting, removal, loading, dumping, crushing, and conveying; haul and access roads; and wind erosion of disturbed areas), mobile sources (i.e., haul/water trucks, graders, dozers, and waste coal hauling to the Rosebud Power Plant), portable/stationary engines, and explosive use for overburden and coal blasting. Emissions from Area F are regulated by Montana Air Quality Permit (MAQP) #1570-09, and MAQP #4436-01 regulates emissions from the portable crusher facility.

The potential to emit (PTE) of Area F CAP emission sources was quantified for the 2018 Final EIS (based on Area C operations) by Bison Engineering using the combined coal production limit in MAQP #1570-09 for Areas A and C and activity data from the year of highest coal production, 2008. The

[49]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

maximum additional haul road distance (approximately 5 miles or 8 km) was conservatively used in estimating the additional project area emissions from hauling. The existing PTE from Area C and additional PTE from the project area previously quantified in the 2018 Final EIS were utilized to estimate emissions of criteria and HAPs attributable to the direct impacts of Alternative 4. The estimated PTE did not include emissions from the hauling of waste coal to the Rosebud Power Plant. Therefore, those emissions were estimated using the EPA Motor Vehicle Emissions Simulator model (www.epa.gov/moves) with vehicle data provided by Western Energy (provided in **Appendix D-8** of the 2018 Final EIS).

Projections of future annual coal production from the Rosebud Mine (project area and the other areas of the mine) were provided in **Table 99** in the 2018 Final EIS; that table is likely an overestimate of annual coal production based on current conditions. For example, no coal was mined from Area A or Area C in 2023 (**Table 2.2-2**), and DEQ selected and approved an agency alternative, Alternative 3 – Lee Coulee Only, that cut estimated production from Area B Amendment 5 (AM5) to 42.9 million tons, which is less than half of the 104.3 million tons total AM5 production considered in the 2018 Final EIS (DEQ 2022). **Table 4.3-1** provides updated projected annual coal production rates for the Rosebud Mine. As described in **Section 2.2.6, Life of Operations**, changes to production rates, additions of other mine permit areas, reduced mining in Area F, or changed market conditions may influence the operational life of the Rosebud Mine as a whole or of individual permit areas.

Table 4.3-1. Projected Annual Coal Production for Rosebud Mine by Area.

Year	Projected Annual Coal Production (tons/year)		
	Area F (tons ×1,000)	Area B (pursuant to AM5)	Estimated Total Rosebud Mine Production
2023	4.6*	2.5*	7.1
2024	4	3.1	7.1
2025	4	3.2	7.2
2026	4	6.9	10.9
2027	4	2.3	6.3
2028	4	3.0	7
2029	4	2.3	6.3
2030	4	2.2	6.2
2031	4	2.7	6.7
2032	4	5.1	9.1
2033	4	4.6	8.6
2034	4	4.5	8.5
2035	4	3.2	7.2
2036	4	4.4	8.4
2037	4	2.2	6.2
2038	4	3.5	7.5
2039	1.6	4.2	5.8
2040	-	3.5	3.5
2041	-	6.6	6.6
2042	-	3.9	3.9
2044	-	2.7	2.7
2045		0.0	0

*Tonnage provided for 2023 is actual production from the mine. Total production in 2023 was 7.1 million tons. **Table 99** in the 2018 Final EIS predicted that total mine production in 2023 would be 7.5 million tons.
Source: Area F production estimate based on Table 303-2 from Area F Operating Permit Minor Revision 16 (2022). Area B AM5 production estimate based on Table E-2 in the 2022 Rosebud Mine Area B AM5 Final EIS, Appendix E (DEQ 2022).

Project Area Criteria Air Pollutant Emissions

The estimated project area CAP emission inventory from the 2018 Final EIS (**Table 100**), which is replicated below in **Table 4.3-2**, is a reasonable estimate for Alternative 4 but may overestimate CAP emissions attributable to the project, because some updates such as production data in **Table 4.3-1** are not accounted for in **Table 4.3-2**.

Table 4.3-2. Estimated Emissions Due to Project Area.

Emission Source(s)	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOCs
	(tons/year)					
Topsoil removal	18.73	1.87	--	--	--	--
Topsoil dumping	0.68	0.10	--	--	--	--
Overburden drilling	0.26	0.03	--	--	--	--
Overburden blasting – cast blasting	28.85	1.66	--	--	--	--
Overburden removal by dragline	60.11	5.30	--	--	--	--
Overburden handling by truck/shovel	94.08	2.37	--	--	--	--
Overburden dumping	0.68	0.10	--	--	--	--
Overburden handling by dozer	9.28	5.13	--	--	--	--
Haul roads – travel	196.01	19.48	--	--	--	--
Access roads – unpaved	60.56	6.06	--	--	--	--
Coal drilling	0.05	0.00	--	--	--	--
Coal blasting	10.57	0.61	--	--	--	--
Coal removal	0.06	0.01	--	--	--	--
Mobile sources diesel exhaust – haul/water trucks	9.12	9.12	235.56	56.78	0.29	14.97
Mobile sources diesel exhaust – grader	0.06	0.06	0.96	0.33	0.00	0.08
Mobile sources diesel exhaust – dozers	3.53	3.41	78.99	22.91	0.08	5.26
Explosives	--	--	73.21	288.52	8.61	--
Disturbed acres – complete (<2 yr.)	9.95	0.99	--	--	--	--
Disturbed acres – complete (>2 yr.)	0.00	0.00	--	--	--	--
Disturbed acres – facilities	0.00	0.00	--	--	--	--
Disturbed acres – partial (<1 yr.)	33.52	3.35	--	--	--	--
Disturbed acres – partial (>1 yr.)	29.88	2.99	--	--	--	--
Disturbed acres – pits, peaks, soil stripping	266.53	26.65	--	--	--	--
Portable/stationary equipment – gasoline engines	0.25	0.25	4.08	2.48	0.21	7.58
Waste coal hauling to Rosebud Power Plant	0.26	0.22	6.30	1.73	0.00	0.30
Truck dump – coal	0.05	0.01	--	--	--	--
Coal crushing	0.12	0.01	--	--	--	--
Coal conveyors to the Colstrip Power Plant	0.02	0.00	--	--	--	--
Total	**833.19**	**89.80**	**399.09**	**372.75**	**9.19**	**28.19**

Project Area Hazardous Air Pollutant Emissions

Under Alternative 4, the project area would also be a source of HAPs. Raw coal contains a large number of HAPs, and the mining, processing, and handling of project area coal would result in the emission of the HAP-containing fugitive coal dust. In addition, the use of diesel equipment throughout the project area and the associated support facilities would result in the emission of diesel particulate matter (DPM). DPM is not currently regulated by the EPA but is considered a carcinogenic air toxin (EPA 2002).

Coal fugitive dust sources due to Alternative 4 include coal drilling, coal blasting, coal removal, coal truck dump, coal crushing, and coal conveyors and would be the same as those disclosed for Alternative 2 in the 2018 Final EIS. Potential project area HAP emissions from fugitive coal dust were quantified for Alternative 2 as the product of project area PM_{10} emissions[50] from these sources and the average

[50]. As shown in **Table 3.3-2**, since issuance of the 2018 Final EIS and development of Area F, PM_{10} emissions for the Rosebud Mine have remained the same as or less than those used in air quality modeling.

concentration of HAPs in project area coal across 13 samples (PPL Montana 2014) (see **Appendix D** in the 2018 Final EIS). The estimated HAP emissions from fugitive coal dust are shown in **Table 4.3-3** (**Table 101** from the 2018 Final EIS). More than 97 percent of fugitive coal dust emissions from the project area are the result of coal blasting, which occurs in the active mining passes. Under Alternative 4, 71.3 million tons of coal[51] would be removed from Area F in a process that involves coal drilling, coal blasting, coal removal, coal truck dump, coal crushing, and coal handling (conveyors and haul trucks).

Table 4.3-3. Project Area Trace Metal HAP Emissions from Fugitive Coal Dust.

Metal HAP	Concentration in Project Area Coal[1] (ppm)	HAP Emissions (lb/year)
Antimony	0.30	6.52E-03
Arsenic	0.72	1.56E-02
Beryllium	0.28	6.08E-03
Cadmium	0.04	8.69E-04
Chromium	2.56	5.56E-02
Copper	5.05	1.10E-01
Lead	3.75	8.15E-02
Manganese	70.59	1.53E+00
Mercury	0.03	5.68E-04
Nickel	0.91	1.98E-02
Selenium	0.55	1.20E-02

ppm = parts per million; lb/year = pound(s) per year.
1. HAP concentration is the moisture-corrected average value from 13 samples of project area coal.

All fine particulate matter emissions ($PM_{2.5}$)[52] from diesel sources (i.e., haul/water trucks, graders, dozers, and waste coal haul trucks) were considered to be DPM. The potential project area DPM emissions from the 2018 Final EIS are provided in **Table 4.3-4**. Haul/water trucks, which operate on the haul roads between the project area and the coal processing facilities in Area C, contribute the majority of project area DPM emissions.

Table 4.3-4. Potential Project Area DPM Emissions.

Emission Source(s)	DPM[1] (tons/year)
Mobile sources diesel exhaust – haul/water trucks	9.12
Mobile sources diesel exhaust – grader	0.06
Mobile sources diesel exhaust – dozer	3.41
Waste coal hauling to Rosebud Power Plant	0.22
Total Project Area DPM	**12.81**

1. Project area DPM estimates are conservative because the maximum distance between project area and coal processing facilities in Area C was used in calculating additional hauling emissions.

Air Concentrations and Related Values

Criteria Air Pollutants and Precursors

As modeled for Alternative 2, the direct impacts on NO_2 (see **Figure 71** in the 2018 Final EIS) would be mostly within or adjacent to the Rosebud Mine; the same would be true for Alternative 4. The maximum values in the analysis area of the eighth-highest 1-hour daily maximum NO_2 and annual average NO_2 concentrations would be 39.4 and 2.5 ppb, respectively, both within the project area. Impacts would be lower (1-hour and annual concentrations less than 30 and 1.6 ppb, respectively) outside the proposed project area where the public would typically have access. The direct impacts on O_3 (see **Figure 72** in the 2018 Final EIS) would be seen mostly in Rosebud, Custer, Treasure, and Bighorn Counties.

51. As compared to removal of 70.8 million tons of coal under Alternative 2.
52. As shown in **Table 3.3-2**, since issuance of the 2018 Final EIS and development of Area F, $PM_{2.5}$ emissions for the Rosebud Mine have remained the same as or less than those used in air quality modeling.

As modeled for Alternative 2, project area impacts on NO_2 and O_3 concentrations in the analysis area would be well below the National Ambient Air Quality Standards (NAAQS) and Montana Ambient Air Quality Standards (MAAQS) (provided in **Section 3.3.1.1**, **Ambient Air Quality Standards** of the 2018 Final EIS). Although the form of the MAAQS for 1-hour NO_2 is different from that of the NAAQS, the MAAQS is three times that of the NAAQS (300 ppb vs. 100 ppb), so impacts much lower than the NAAQS would also imply compliance with the MAAQS. NO_2 and O_3 concentrations due to all cumulative sources in the analysis area are below the NAAQS and MAAQS (see **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS). Thus, direct impacts for NO_2 and O_3 in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse.

Direct impacts on $PM_{2.5}$ and PM_{10} air concentrations would be within or near the Rosebud Mine. As modeled for Alternative 2, the spatial peaks of the eighth-highest daily average $PM_{2.5}$ and the annual average $PM_{2.5}$ (see **Figure 73** in the 2018 Final EIS) would be 6.0 $\mu g/m^3$ and 1.8 $\mu g/m^3$, respectively. Both of these peaks would occur within the project area. When considering areas outside the project area, the corresponding concentrations would be typically less than 3.7 $\mu g/m^3$ and 1.0 $\mu g/m^3$, respectively, and would drop further with distance from the project area. The spatial maxima of the second-highest daily average and annual average PM_{10} due to direct impacts (see **Figure 74** in the 2018 Final EIS) would be 54.1 $\mu g/m^3$ and 15.9 $\mu g/m^3$, respectively, both occurring again within the project area. Outside the project area, the corresponding concentrations would be typically less than 29 $\mu g/m^3$ and 9 $\mu g/m^3$, respectively, and drop further with distance. Concentrations of $PM_{2.5}$ and PM_{10} modeled and reported here include both primary emitted PM and secondary formation of PM from emissions of NO_x, volatile organic compounds (VOCs), and SO_2.

Project area impacts on $PM_{2.5}$ and PM_{10} concentrations would be well below the NAAQS and MAAQS. Thus, current compliance of the mine with the NAAQS and MAAQS is expected to continue with project area operations. Direct impacts for $PM_{2.5}$ and PM_{10} in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse. Background concentrations due to other sources were considered in the context of cumulative effects (see **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS).

The maximum values in the analysis area of direct contributions to the fourth-highest 1-hour and second-highest 3-hour SO_2 would be 13.3 ppb and 7.0 ppb, respectively (see **Figure 75** in the 2018 Final EIS). The maximum values for the second-highest 24-hour SO_2 and annual average SO_2 would both be less than 0.1 ppb (see **Figure 76** in the 2018 Final EIS). The SO_2 concentrations would be well below the NAAQS and MAAQS, including the forms of the standard (24-hour and annual) where the MAAQS is more stringent than the NAAQS. Background concentrations due to other sources were considered in the context of cumulative effects (see **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS). Direct impacts for SO_2 in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse.

The negligible contributions of direct impacts on areas currently designated as non-attainment/ maintenance for SO_2 and PM_{10} in Montana and for PM_{10} and O_3 in Wyoming are documented in **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS.

Impacts of CO are discussed in **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS; modeling results for Alternative 2 (here applied to Alternative 4) show that the cumulative effects for CO after considering all sources including direct, indirect, and other sources are well below the NAAQS and the MAAQS. Thus, direct impacts under Alternative 4 for CO would be short-term, minor, and adverse.

Impacts on Pb are discussed under HAPs below.

The project area is expected to have minimal impact on or is not relevant to the MAAQS for settleable PM, hydrogen sulfide, fluoride in forage, and visibility for the reasons provided in the 2018 Final EIS. Hydrogen sulfide and fluoride emissions are negligible from the project area.

The Montana visibility standard is applicable only to Class I areas. Visibility impairment due to direct impacts at Federal and tribal Class I areas is shown to be negligible in the air-quality-related values discussion below.

Air-Quality-Related Values

Nitrogen and Sulfur Deposition

The modeled sulfur deposition for Alternative 2 (here applied to Alternative 4) consists of wet and dry deposition of SO_2 and particulate sulfate; the latter may be emitted or formed in the atmosphere from SO_2. Modeled nitrogen deposition includes wet and dry deposition of the following nitrogen compounds: nitric oxide (NO), NO_2, dinitrogen pentoxide (N_2O_5), nitrous acid (HNO_2), nitric acid (HNO_3), peroxynitric acid (HNO_4), particulate nitrate (NO_3^-), organic nitrates, and the reduced nitrogen compounds of NH_3 and particulate ammonium (NH_4^+).

Within the analysis area for direct impacts, Alternative 2 modeled annual nitrogen deposition due to direct impacts would range from 0 to 0.6 kg/ha and sulfur deposition would vary from 0 to 0.1 kg/ha (see **Appendix D** in the 2018 Final EIS). There are no regulatory thresholds with regard to atmospheric deposition of air emissions. Therefore, modeled annual deposition for Alternative 2 (here applied to Alternative 4) was compared to the modeled cumulative annual deposition if the project area had not been approved (Alternative 1 in the 2018 Final EIS) to assess the relative intensity of impacts.

To identify potential impacts on sensitive areas, the direct impacts on NO_2 and SO_2 deposition were examined at Federal and tribal Class I areas in the cumulative effects analysis area (a map of these areas is shown in **Section 3.3.1.2, Analysis Area** in the 2018 Final EIS). **Table 4.3-5** (**Table 103** in the 2018 Final EIS) shows the modeled annual total (i.e., wet + dry) deposition of NO_2 and SO_2 due to direct impacts at Class I areas. The “maximum” value for each Class I area represents the maximum across all model grid cells spanning that area, and the “average” value is the average across all grid cells in the area.

As modeled for Alternative 2 (and here applied to Alternative 4), annual nitrogen deposition due to direct impacts would vary from 0.0001 kg/ha to 0.0084 kg/ha across all Class I areas when considering the spatial maximum in each area and from 0.0000 kg/ha to 0.0045 kg/ha when considering the average in each area. The Northern Cheyenne Reservation was modeled to experience the highest nitrogen deposition due to direct impacts across Class I areas. When conservatively considering the maximum deposition due to direct impacts across all model grid cells spanning the Northern Cheyenne Reservation, the Class I area closest to the project area, the contribution of direct impacts to nitrogen deposition was 0.4 percent of the modeled cumulative annual deposition if the project area were not approved (**Appendix D** in the 2018 Final EIS). The corresponding relative impact at other Class I areas is 0.0 percent. Thus, direct impacts on nitrogen deposition at Class I areas under Alternative 4 (as with Alternative 2) would be negligible.

Annual sulfur deposition due to direct impacts was modeled at 0.0000 kg/ha at all Class I areas except at the Northern Cheyenne Reservation, where it was 0.0004 kg/ha, when considering the spatial maximum in each area. This value is negligible relative to the modeled cumulative annual deposition if the project were not approved (Alternative 1). When considering the spatial average across each area, sulfur deposition would be 0.0000 kg/ha at all Class I areas except at the Northern Cheyenne Reservation, where it would be 0.0002 kg/ha. Thus, direct impacts on sulfur deposition at Class I areas under Alternative 4 (as with Alternative 2) would be negligible.

Table 4.3-5. Modeled Annual Nitrogen and Sulfur Deposition due to Direct Impacts at Class I Areas.

Class I Area	Nitrogen Maximum (kg/ha)	Nitrogen Average (kg/ha)	Sulfur Maximum (kg/ha)	Sulfur Average (kg/ha)
Badlands National Park	0.0004	0.0004	0.0000	0.0000
Bridger	0.0001	0.0001	0.0000	0.0000
Fitzpatrick	0.0001	0.0001	0.0000	0.0000
Fort Peck Indian Reservation	0.0004	0.0002	0.0000	0.0000
Gates of the Mountains Wilderness	0.0001	0.0001	0.0000	0.0000
Grand Teton National Park	0.0001	0.0000	0.0000	0.0000
Lostwood National Wildlife Refuge	0.0001	0.0001	0.0000	0.0000
Lostwood Wilderness	0.0001	0.0001	0.0000	0.0000
Medicine Lake (Class I)	0.0001	0.0001	0.0000	0.0000
North Absaroka	0.0003	0.0001	0.0000	0.0000
Northern Cheyenne	0.0084	0.0045	0.0004	0.0002
Teton	0.0001	0.0000	0.0000	0.0000
Theo Roosevelt National Park	0.0006	0.0004	0.0000	0.0000
UL Bend National Wildlife Refuge	0.0006	0.0005	0.0000	0.0000
UL Bend Wilderness	0.0006	0.0004	0.0000	0.0000
Washakie	0.0002	0.0001	0.0000	0.0000
Wind Cave National Park	0.0005	0.0004	0.0000	0.0000
Yellowstone National Park	0.0001	0.0000	0.0000	0.0000

kg = kilograms; ha = hectare.

Visibility Impairment

Based on guidance from the Federal Land Managers' Air Quality Related Values Work Group (2010), 0.5 and 1.0 represent levels at which the source is considered to contribute to regional haze visibility impairment or cause such visibility impairment. Under Alternative 4 (as with Alternative 2), direct impacts on haze visibility impairment would be negligible at all Class I areas, as the modeled change in haze index does not exceed 0.5 or 1.0 at any Class I area. The 98th percentile value over the year would be highest at the Northern Cheyenne Reservation with a value of 0.377 (**Table 4.3-6**, which is **Table 104** from the 2018 Final EIS). Visibility impairment is expected to be negligible under any alternative.

Table 4.3-6. Visibility Impacts from Direct Emissions at Class I Areas.

Class I Area	Number of Days in Year		98th percentile Δdv over year
	Δdv > 1.0	Δdv > 0.5	
Badlands National Park	0	0	0.014
Bridger	0	0	0.002
Fitzpatrick	0	0	0.002
Fort Peck Indian Reservation	0	0	0.027
Gates of the Mountains Wilderness	0	0	0.002
Grand Teton National Park	0	0	0.001
Lostwood National Wildlife Refuge	0	0	0.016
Lostwood Wilderness	0	0	0.014
Medicine Lake (Class I)	0	0	0.019
North Absaroka	0	0	0.005
Northern Cheyenne	0	0	0.377
Teton	0	0	0.002
Theo Roosevelt National Park	0	0	0.030
UL Bend National Wildlife Refuge	0	0	0.015
UL Bend Wilderness	0	0	0.018
Washakie	0	0	0.005
Wind Cave National Park	0	0	0.008
Yellowstone National Park	0	0	0.003

dv = deciviews; Δdv = change in deciviews.

Hazardous Air Pollutants

Mining and associated activities under Alternative 4 would be a source of both fugitive coal dust and DPM, and thus would increase the ambient air concentration and deposition of HAPs in the analysis area. As modeled for Alternative 2 (and applied here to Alternative 4), the maximum annual average air concentration and annual deposition of PM_{10} fugitive coal dust emissions would be 0.15 $\mu g/m^3$ and 153.1 kg/ha, respectively, and would occur within the boundaries of the project area, while falling off rapidly with distance from the mine (see **Figure 77** in the 2018 Final EIS). For example, the annual average air concentration and annual deposition are typically less than 0.05 $\mu g/m^3$ and 50.0 kg/ha outside the mine, respectively.

These maxima along with the known concentrations in project area coal were used to estimate the maximum annual concentrations and annual deposition of trace metal HAPs with known concentrations in project area coal (**Table 4.3-7**, which is **Table 105** from the 2018 Final EIS). This approach conservatively considers all areas within the project area even though the public do not typically have access to these areas.

Table 4.3-7. Maximum Annual Average Air Concentration and Annual Deposition of HAPs from Project Area Fugitive Coal Dust Emissions.

Metal HAP	Maximum Annual Average Air Concentration[1] ($\mu g/m^3$)	Maximum Deposition[1] (kg/ha-year)
Antimony	4.50E-08	4.59E-05
Arsenic	1.08E-07	1.10E-04
Beryllium	4.20E-08	4.28E-05
Cadmium	6.00E-09	6.12E-06
Chromium	3.84E-07	3.92E-04
Copper	7.58E-07	7.73E-04
Lead	5.63E-07	5.74E-04
Manganese	1.06E-05	1.08E-02
Mercury	4.50E-09	4.59E-06
Nickel	1.36E-07	1.39E-04
Selenium	8.25E-08	8.42E-05

$\mu g/m^3$ = micrograms per cubic meter; kg/ha-year = kilogram per hectare per year.
[1.] These results conservatively consider all areas within the project area permit boundary even though the public do not typically have access to these areas.

While the forms of the Pb NAAQS and MAAQS are different from the annual average concentration reported above, these modeled concentrations due to direct impacts would be negligible relative to the NAAQS/MAAQS values and would meet the NAAQS and MAAQS.

The annual average DPM concentration resulting from project area emissions (maximum concentration of 0.22 $\mu g/m^3$) would occur within the Area F boundary and would fall off rapidly with distance from the mine. For example, DPM concentrations are typically less than 0.1 $\mu g/m^3$ outside the mine.

DPM concentrations resulting from project area emissions would be spread throughout both the project area and Area C. This is because the majority of project area DPM emissions result from haul/water truck operations on the haul roads between the project area and the coal processing facilities in Area C. In contrast, project area fugitive coal dust emissions are almost entirely (greater than 97 percent) from coal blasting, which would occur only in the mining passes of the project area.

4.3.3.2 Indirect Impacts of Coal Combustion

Emissions of Criteria and Hazardous Air Pollutants

The indirect effects of Alternative 4, as with Alternative 2 from the 2018 Final EIS, would be the result of the combustion of project area coal; under Alternative 4, 71.3 million tons (approximately half a million tons more coal as compared to Alternative 2) would be available for combustion. Under Alternative 4, indirect combustion effects would last for approximately 20 years (through 2039) because coal mined in the project area would be burned in Units 3 and 4 of the Colstrip Power Plant and the waste coal would be burned at the Rosebud Power Plant. Emission inventories (**Table 4.3-8**) do not include on-road and non-road mobile exhaust emissions for these facilities and were estimated for analysis purposes (see **Section 4.3.3.2** in the 2018 Final EIS). On-road and non-road exhaust emissions would be expected to be very small at the Colstrip Power Plant because of limited use of mobile source equipment at the facility.

Fugitive dust, petroleum product evaporation, and diesel generator emissions from the Colstrip Power Plant are provided below as facility totals, as well as the calculated on-road and non-road emissions. These emissions were apportioned between Units 1 and 2, and Units 3 and 4 to allow for determination of the indirect effects of Alternative 2 in the 2018 Final EIS; these emissions would be expected to be similar for Alternative 4. The resulting emission inventories estimates for Colstrip Units 3 and 4 and the Rosebud Power Plant from the 2018 Final EIS **Table 106** are replicated below in **Table 4.3-8** and are anticipated to be representative of maximum CAP emissions under Alternative 4 (see current CAP emissions for the power plants, which are currently combusting Area F coal, in **Table 3.3-3** to support this assessment).

Table 4.3-8. CAP Emissions from Colstrip Units 3 and 4 and the Rosebud Power Plant.[1]

Emission Source(s)	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOCs
Colstrip Units 3 and 4	(tons/year)					
Boiler – Unit 3	788.32	632.93	4611.53	859.66	2543.08	120.32
Boiler – Unit 4	824.91	662.30	4725.22	899.48	2622.98	125.90
Coal Storage Pile	10.16	1.52	0	0	0	0
Fugitive dust – haul roads	0.28	0.00	0	0	0	0
Diesel emergency generator	0.0177	0.0171	0.56	0.29	0.14	0.0023
On-road mobile	0.0126	0.0075	0.32	2.35	0.0012	0.50
Non-road mobile	0.0143	0.0138	0.12	2.25	0.0003	0.10
Rosebud Power Plant	(tons/year)					
Boiler	16.52	5.04	856.39	3.42	1195.30	6.71
Fugitive dust – haul roads	7.81	1.17	0	0	0	0
Coal unloading, crushing, conveying and storage	3.22	0.54	0	0	0	0
Limestone handling system	0.60	0.10	0	0	0	0
Ash conveying, storage, and silo-unloading	2.13	0.33	0	0	0	0
Ash dump area fugitives	0.15	0.02	0	0	0	0
Ash truck unloading	3.91	0.60	0	0	0	0
Open coal storage	0.27	0.19	0	0	0	0

[1.] Emissions are rounded to two decimal places, except when additional significant figures are required to highlight differences or to show differences between pollutants.
Source: DEQ Annual Emission Inventory Reporting Records for 2015.

The HAP emissions from the combustion of project area coal in Colstrip Units 3 and 4 and the Rosebud Power Plant are attributable to the indirect effects of Alternative 4. The emission and deposition of eight trace metal HAPs were modeled in the 2018 Final EIS for Alternative 2 to quantify the air quality impacts of HAP emissions. These trace metals were antimony, arsenic, cadmium, chromium, copper, lead, selenium, and mercury and are the same HAPs used for the deposition analysis (see **Deposition Analysis Area for Special Status Species due to Indirect Combustion Impacts** in the 2018 Final EIS).

Emission rates of the selected metals from the Colstrip and Rosebud Power Plants were estimated (see **Section 4.3.3.2** in the 2018 Final EIS for a summary of the methods used). The calculated emission rates other than mercury from the 2018 Final EIS in **Table 107** are replicated below in **Table 4.3-9** and are anticipated to be representative of maximum metal HAP emissions under Alternative 4 (see current metal HAP emissions for Colstrip Units 3 and 4, which are currently combusting coal from Area F and Area B, in **Table 3.3-5** to support this assessment). The calculated speciated mercury emissions rates from the 2018 Final EIS in **Table 108** are replicated below in **Table 4.3-10** and are anticipated to be representative of mercury emissions under Alternative 4 (see current mercury emissions for Colstrip Units 3 and 4, which are currently combusting coal from Area F and Area B, in **Table 3.3-4** to support this assessment).

The use of the total HAP emissions from Colstrip Power Plant Units 3 and 4 and the Rosebud Power Plant to represent the indirect effects of Alternative 2 (here applied to Alternative 4) is a conservative approach (i.e., protective of the environment) as it assumes that the project area would supply all of the coal combusted in these facilities, whereas coal may also be supplied to the power plants from the other active areas of the mine, such as Area B, and thus actual indirect emissions attributable to Area F would be lower.

Table 4.3-9. Selected Metal HAP Emission Rates for Colstrip Units 3 and 4 and the Rosebud Power Plant.

Pollutant	Emission Rates			
	Colstrip Units 3 and 4		Rosebud Power Plant	
	(lb/year)	(g/s)	(lb/year)	(g/s)
Antimony	123.92	1.78E-03	4.61	6.63E-05
Arsenic	286.59	4.12E-03	6.34	9.12E-05
Cadmium	77.75	1.12E-03	1.73	2.49E-05
Chromium	411.30	5.92E-03	16.14	2.32E-04
Copper [1]	1711.56	2.46E-02	74.38	1.07E-03
Lead	670.03	9.64E-03	6.92	9.95E-05
Selenium	1216.67	1.75E-02	28.83	4.15E-04

lb/year = pounds per year; g/s = gram per second.

Table 4.3-10. Mercury Emission Rates from Colstrip Units 3 and 4 and the Rosebud Power Plant.

Year	Colstrip Units 3 and 4						Rosebud Power Plant					
	Hg^0		Hg^{2+}		HgP		Hg^0		Hg^{2+}		HgP	
	(lb/ year)	(g/s)	(lb/ year)	(g/s)	(lb/ year)	(g/s)	(lb/ year)	(g/s)	(lb/ year)	(g/s)	(lb/ year)	(g/s)
2011	42.40	6.10E-04	42.94	6.18E-04	0.86	1.24E-05	0.36	5.19E-06	1.20	1.72E-05	0.01	1.72E-07
2012	37.40	5.38E-04	43.48	6.25E-04	0.82	1.17E-05	0.61	8.77E-06	2.02	2.91E-05	0.02	2.90E-07
2013	32.60	4.69E-04	48.18	6.93E-04	0.82	1.17E-05	0.33	4.76E-06	1.10	1.58E-05	0.01	1.57E-07
2014	39.00	5.61E-04	63.07	9.07E-04	1.03	1.48E-05	0.33	4.70E-06	1.08	1.56E-05	0.01	1.55E-07
2015	54.40	7.82E-04	65.29	9.39E-04	1.21	1.74E-05	0.22	3.11E-06	0.72	1.03E-05	0.01	1.03E-07
AVG	**41.16**	**5.92E-04**	**52.59**	**7.56E-04**	**0.95**	**1.36E-05**	**0.37**	**5.31E-06**	**1.22**	**1.76E-05**	**0.01**	**1.75E-07**

lb/y = pounds per year; g/s = gram per second.

Air Concentrations of Criteria Pollutants

The indirect impacts of burning project area coal at Colstrip Units 3 and 4 and the Rosebud Power Plant are described below for Alternative 4 (based on modeling completed for Alternative 2 and the rationale for this approach provided above). The spatial distribution of these indirect impacts is shown on **Figure 79** through **Figure 84** in the 2018 Final EIS. The indirect impacts are conservative as the total emissions from Colstrip Units 3 and 4 and the Rosebud Power Plant were used in modeling although Area F may not supply all of the coal combusted in these units.

The maximum modeled values in the analysis area of the eighth-highest 1-hour daily maximum NO_2 and annual average NO_2 concentrations would be 24.0 ppb and 0.3 ppb, respectively. Indirect combustion impacts of Alternative 4 on NO_2 concentrations in the analysis area (based on Alternative 2 modeling) would be well below the NAAQS and MAAQS. As noted under **Section 5.3.2, Cumulative Effects, Air Quality** in the 2018 Final EIS, NO_2 concentrations due to all cumulative sources in the analysis area are below the NAAQS and MAAQS. Therefore, indirect impacts for NO_2 in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse.

The highest modeled concentrations in the analysis area of 1-hour and 8-hour O_3 in the form of the MAAQS and NAAQS, respectively, because of indirect impacts are 6.8 ppb in Rosebud County to the southeast of the mine and 4.9 ppb in Bighorn County to the south. Ozone concentrations due to all cumulative sources in the analysis area are also below the NAAQS and MAAQS (**Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS). Thus, indirect impacts for O_3 in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse.

The highest modeled indirect impacts on daily and annual $PM_{2.5}$ in the analysis area would be 1.8 $\mu g/m^3$ near the Colstrip Power Plant and 0.5 $\mu g/m^3$ near the Rosebud Power Plant, respectively. The daily and annual $PM_{2.5}$ concentrations would be well below the NAAQS. There are no MAAQS for $PM_{2.5}$. The highest modeled indirect impacts in the analysis area on daily and annual average PM_{10} would be 5.8 $\mu g/m^3$ and 2.8 $\mu g/m^3$, respectively, both near the Rosebud Power Plant. These peak concentrations are well below the NAAQS and MAAQS, respectively. Indirect impacts for $PM_{2.5}$ and PM_{10} in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse. Background concentrations due to other sources are considered in the context of cumulative effects (see **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS).

The maximum modeled indirect impacts on 1-hour, 24-hour, and annual average SO_2 are 18.7 ppb, 4.8 ppb, and 0.4 ppb, respectively; all three are seen adjacent to the Rosebud Power Plant. The maximum modeled indirect impact on 3-hour SO_2 is 18.2 ppb, found near the Colstrip Power Plant. The SO_2 concentrations are well below the NAAQS and MAAQS, including the forms of the standard (24-hour and annual) where the MAAQS are more stringent than the NAAQS. Background concentrations due to other sources are considered in the context of cumulative effects (**Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS). Thus, indirect impacts for SO_2 in the analysis area under Alternative 4 (as with Alternative 2) would be short-term, minor, and adverse.

Impacts on CO are discussed under **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS; modeling results show that the cumulative effects for CO after considering all sources are well below the NAAQS and the MAAQS. Thus, direct impacts for CO would be negligible.

Air-Quality-Related Values

Indirect impacts of burning project area coal on air-quality-related values – acidic deposition (of nitrogen and sulfur) and visibility – are discussed below and are based on analysis completed for Alternative 2 in the 2018 Final EIS.

Nitrogen and Sulfur Deposition

Alternative 2 modeled annual nitrogen deposition due to indirect impacts would range from 0 to 0.2 kg/ha within the indirect/cumulative effects analysis area, while sulfur deposition varies from 0 to 0.7 kg/ha (see **Appendix D** in the 2018 Final EIS). There are no regulatory thresholds for atmospheric deposition of air emissions. Therefore, indirect impacts on deposition due to Alternative 4 (based on Alternative 2 modeling) were compared to total modeled cumulative deposition if the project area were not approved (Alternative 1 in the 2018 Final EIS) to assess the relative intensity of impacts.

Indirect impacts on nitrogen and sulfur deposition were examined at Federal and tribal Class I areas in the analysis area. **Table 110** in the 2018 Final EIS (replicated below in **Table 4.3-11**) provided the modeled annual total deposition of nitrogen and sulfur due to indirect impacts at Class I areas (a map of these areas is shown in **Section 3.3.1.2, Analysis Area** in the 2018 Final EIS).

Indirect impacts on nitrogen deposition at Class I areas in the analysis area under Alternative 4 (as with Alternative 2) would be long-term, minor, and adverse. Impacts would be long-term because the effect of the deposition would occur beyond the period of deposition. Indirect impacts on sulfur deposition at Class I areas in the analysis area under Alternative 4 (as with Alternative 2) would be long-term, minor, and adverse.

Table 4.3-11. Modeled Annual Nitrogen and Sulfur Deposition Due to Indirect Impacts at Class I Areas.

Class I Area	Nitrogen Maximum (kg/ha)	Nitrogen Average (kg/ha)	Sulfur Maximum (kg/ha)	Sulfur Average (kg/ha)
Badlands National Park	0.0122	0.0094	0.0074	0.0057
Bridger	0.0020	0.0011	0.0021	0.0009
Fitzpatrick	0.0022	0.0012	0.0019	0.0012
Fort Peck Indian Reservation	0.0100	0.0055	0.0072	0.0036
Gates of the Mountains Wilderness	0.0026	0.0025	0.0022	0.0019
Grand Teton National Park	0.0015	0.0008	0.0008	0.0004
Lostwood National Wildlife Refuge	0.0026	0.0022	0.0026	0.0021
Lostwood Wilderness	0.0028	0.0026	0.0024	0.0023
Medicine Lake (Class I)	0.0043	0.0037	0.0036	0.0028
North Absaroka	0.0058	0.0022	0.0029	0.0013
Northern Cheyenne	0.1415	0.0704	0.1752	0.0722
Teton	0.0022	0.0011	0.0020	0.0007
Theo Roosevelt National Park	0.0100	0.0073	0.0075	0.0055
UL Bend National Wildlife Refuge	0.0115	0.0093	0.0062	0.0058
UL Bend Wilderness	0.0098	0.0083	0.0064	0.0056
Washakie	0.0052	0.0019	0.0048	0.0017
Wind Cave National Park	0.0145	0.0115	0.0091	0.0071
Yellowstone National Park	0.0025	0.0010	0.0013	0.0006

kg = kilograms; ha = hectare.

Visibility Impairment

The potential haze visibility impairment due to indirect impacts was also considered in the 2018 Final EIS. The modeled change in haze index due to indirect impacts of Alternative 2 (here applied to Alternative 4) were compared to annual average natural conditions (in terms of the number of days the haze index value would exceed 0.5 or 1.0 at any Class I area) and reported in **Table 111** of the 2018 Final EIS (replicated below in **Table 4.3-12**). Indirect impacts of Alternative 4 (as with Alternative 2) on haze visibility impairment at Class I areas would be short-term, minor, and adverse.

Table 4.3-12. Visibility Impacts from Indirect Emissions at Class I Areas.

Class I Area	Number of Days in Year		98th percentile Δdv over year
	Δdv > 1.0	Δdv > 0.5	
Badlands National Park	2	8	0.504
Bridger	0	0	0.091
Fitzpatrick	0	0	0.114
Fort Peck Indian Reservation	7	14	0.841
Gates of the Mountains Wilderness	0	0	0.076
Grand Teton National Park	0	0	0.064
Lostwood National Wildlife Refuge	1	4	0.308
Lostwood Wilderness	1	4	0.279
Medicine Lake (Class I)	3	9	0.680
North Absaroka	0	0	0.143
Northern Cheyenne	20	96	1.425
Teton	0	0	0.090
Theo Roosevelt National Park	4	11	0.773
UL Bend National Wildlife Refuge	1	3	0.243
UL Bend Wilderness	1	2	0.237
Washakie	0	0	0.132
Wind Cave National Park	0	2	0.338
Yellowstone National Park	0	0	0.088

dv = deciviews; Δdv = change in deciviews.

Hazardous Air Pollutants

The methods used for estimating the annual deposition for the modeled trace metal and mercury emissions resulting from the combustion of Area F coal are described in **Section 4.3.3.2** in the 2018 Final EIS. The maximum modeled deposition of each trace metal was provided in **Table 112** of the 2018 Final EIS (replicated below in **Table 4.3-13**). Deposition under Alternative 4 would be similar to what was described for Alternative 2 in the 2018 Final EIS. There are no regulatory thresholds for atmospheric deposition of HAPs. Mercury deposition due to indirect impacts of Area F coal combustion constitutes a small fraction (a few percent) of total mercury deposition in the region (see discussion in 2018 Final EIS under **Mercury Deposition** in **Section 5.3.2.2, Cumulative Impacts on Air Quality**). Therefore, indirect impacts of Alternative 4 (as with Alternative 2) on mercury deposition would be long-term, minor, and adverse. Impacts are long-term because the effect of the mercury deposition would occur beyond the period of deposition due to Colstrip and Rosebud Power Plant emissions from Area F.

Table 4.3-13. Modeled Maximum Total Deposition of Trace Metals.

Chemical	Maximum Total Annual Deposition[1] (μg/m^2-year)
Antimony	9.31E+00
Arsenic	2.15E+01
Cadmium	5.83E+00
Chromium	3.09E+01
Copper	1.28E+02
Lead	5.01E+01
Mercury	1.45E+00
Selenium	9.12E+01

μg/m^2-year = micrograms per square meter per year.
[1.] AERMOD was run from 2011 to 2015, and the annual total deposition (wet + dry) for each year was averaged at each receptor.

Deposition Analysis Area for Special Status Species Due to Indirect Combustion Impacts

To establish the analysis area for special status species (see **Section 4.13, Special Status Species** in the 2018 Final EIS) for indirect effects, the atmospheric dispersion and deposition of selected trace metal HAPs emitted as a result of the combustion of project area coal were simulated by applying the AERMOD model. This methodology is described in the 2018 Final EIS, **Section 4.3.3.2**.

4.3.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect air quality impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, disturbance would be limited to the southern portion of the project area (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, direct and indirect air quality impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Direct CAP and HAP emissions, as well as impacts on air-quality-related values, such as visibility, would occur for a shorter period under Alternative 5 (9 years less) than under Alternative 4. As with Alternative 4, direct air quality impacts would be short-term, minor, and adverse.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes CAP and HAP emissions to the analysis area air, contributing to indirect impacts (detailed in Alternative 4), including degraded air quality, visibility impairment (haze), and deposition of trace metals, SO_2, and NO_2 in analysis area soils and waterways. As with Alternative 4, these indirect air quality impacts would be minor and adverse. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years (along with associated indirect impacts), which is 9 years fewer as compared to Alternative 4. Therefore, CAP, HAP, and GHG emissions would be lower in the analysis area, leading to 9 fewer years of degraded air quality, visibility impairment, and deposition of trace metals, SO_2, and NO_2.

4.3.5 Irreversible and Irretrievable Commitment of Resources

The irreversible and irretrievable commitment of resources is not applicable to air quality.

4.4 CLIMATE AND CLIMATE CHANGE

This section discloses the direct and indirect effects on climate resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. This analysis has been revised to address the deficiencies identified in the 2022 court order of inadequate GHG emissions analysis and failure to analyze a reasonable range of alternatives in violation of NEPA. Existing climate conditions and the analysis areas used for this impacts analysis are described in **Section 3.4, Climate and Climate Change**.

4.4.1 Analysis Methods and Impact and Intensity Thresholds

Climate impacts were evaluated in this SEIS by contextualizing GHG emissions across alternatives, relative to GHG emissions from other sources, relative to emissions reduction goals, and using the social cost of GHGs. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**. There are no impact and intensity thresholds available to characterize the significance of the effect of a single action on global climate change.

The global, national, regional, and state climate and GHG emission trends are described in **Sections 4.4.2.1** through **4.4.2.3** of the 2018 Final EIS. Applicable updates to national and Montana state climate and emissions trends are discussed in **Section 3.4.2.1, Climate and Emissions Trends**. Climate change and GHG emission sources in the region were recently evaluated by the BLM in support of the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a), and the data presented in that document are generally consistent with what was presented in the 2018 Final EIS. The EPA tracks and publishes total U.S. annual GHG emissions in the *Inventory of U.S. Greenhouse Gases and Sinks*. The 2018 Final EIS used the 2017 inventory, which covered 2015 GHG emissions data; the most recent inventory was issued in 2024 and covers 2022 GHG emissions data (EPA 2024d). Data and emissions trends from the recent inventory were compared to the data used in the 2018 Final EIS. Based on this review and comparisons of production (see **Chapters 1** and **2**) and air quality emissions data as well (see **Section 4.3.1**), the future GHG emissions described for other Rosebud Mine permit areas (e.g., mining, crushing, hauling, conveying, etc.) and for the Colstrip and Rosebud Power Plants (e.g., combustion, coal handling, etc.) are anticipated to be the same or less than what was described in **Section 4.4.2.4** and **Section 4.4.2.5** of the 2018 Final EIS.

4.4.2 Alternative 1 – No Action

The types of direct and indirect climate impacts under Alternative 1 (as described in this SEIS)[53] would be similar on an annual basis to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, disturbance would be limited to the southeastern portion of the project area (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

As with Alternative 4, direct GHG emissions from the project area (e.g., mining, etc.) and associated activities in other permit areas (e.g., crushing, hauling, conveying, etc.) and indirect GHG emissions (e.g., power plant operations and worker commutes) would contribute incrementally to the existing climate and

[53] Direct and indirect climate impacts of Alternative 1 – No Action were described in **Section 4.4.2** of the 2018 Final EIS, beginning on page 473. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

emissions trends discussed in **Sections 3.4.2, Climate Conditions**. Under Alternative 1, direct and indirect climate impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. **Table 4.4-1** provides an estimate of the total GHG emissions (direct effect) from the project area under Alternative 1. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4. Therefore, the indirect effects of annual GHG emissions from the power plants as described in **Table 4.4-3** would occur for 14 years fewer under Alternative 1 as compared to Alternative 4.

Total GHG emissions (direct and indirect) attributable to Alternative 1 are compared to total GHG emissions from Alternative 4 (Proposed Action) and Alternative 5 in **Table 4.4-5**. The social costs of GHG emissions are discussed below in **Section 4.4.5,** and summarized by alternative in **Table 4.4-13**.

Table 4.4-1. Total Annual GHG Emissions from Mining and Development of Area F and Associated Activities in other Permit Areas (Alternative 1).

Year of Active Mining	Projected Coal Production (MT)	GHG Emissions (MT/year)			
		CO_2	CH_4	N_2O	CO_2e
1 (2020)	200,000	1,863	134	0.0045	5,628
2	900,000	8,385	604	0.1013	25,326
3	4,000,000	37,266	2,685	0.45	112,559
4	4,000,000	37,266	2,685	0.45	112,559
5	4,000,000	37,266	2,685	0.45	112,559
6 (2025)	4,000,000	37,266	2,685	0.45	112,559
Total	**17,100,000[1]**	**159,312**	**11,478**	**1.91**	**481,190**

MT/year = metric tons per year.
[1.] Estimated acreage and tonnage are based on Table 303-2 from Area F Operating Permit Minor Revision 16.

4.4.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Climate impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan), which would include direct GHG emission impacts from the project area and other permit areas (e.g., mining, crushing, hauling, conveying, etc.) and indirect GHG emission impacts (due to power plant operations and worker commutes), would be similar to those described for Alternative 2 in **Section 4.4.3** of the 2018 Final EIS, beginning on page 486. Under Alternative 4, half a million tons more coal would be mined[54] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

[54.] See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

The following sections detail direct GHG emission impacts from the project area (e.g., mining, etc.) and associated activities in other permit areas (e.g., crushing, hauling, conveying, etc.) and indirect GHG emission impacts (due to power plant operations and worker commutes). Total GHG emissions attributable to Alternative 4 (Proposed Action) are compared to total GHG emissions from Alternative 1 (No Action) and Alternative 5 (Partial Mining Alternative) in **Table 4.4-5**. The social costs of these GHG emissions are discussed below in **Section 4.4.7, Social Cost of GHGs,** and summarized by alternative in **Table 4.4-13**.

4.4.3.1 Direct Impacts

GHG emissions were disclosed in the 2018 Final EIS (**Table 121**) for Alternative 2 based on an Area F annual production rate of 4 million tons per year and the production schedule provided in the PAP.[55] As described in **Section 2.2.2.2, Area F Operations and Development**, the currently approved production schedule, which was approved by DEQ in Minor Revision (MR) 16 and is the assumed rate for Alternative 4, is somewhat different from the original estimate (see **Table 2.2-8** for a comparison). **Table 4.4-2** below uses the 2018 Final EIS estimated annual GHG emission rate (apportioned based on 4 million tons per year of production) but applies it to the Alternative 4 annual production schedule to provide an estimate of total GHG emissions from the project area under Alternative 4. Maximum annual GHG emissions (calculated based on 4 million tons/year) for each source category (e.g., mobile, portable, fugitive, etc.) are provided in **Table 122** of the 2018 Final EIS and are assumed to be the same for Alternative 4.

Under Alternative 4, direct GHG emissions associated with the project (e.g., mining, crushing, hauling, conveying, etc.) would contribute incrementally to the existing climate and emissions trends discussed in **Sections 3.4.2, Climate Conditions**. However, total annual projected GHG emissions for the project, calculated using conservative assumptions (see 2018 Final EIS), comprise a very small fraction of the total annual state, regional, and national GHG emissions. Total GHG emissions from other sources may decrease further with the ongoing transition to renewable energy sources across the country; nonetheless, project area GHG emissions would continue to constitute a very small fraction of the future emissions. The social costs of these GHG emissions are discussed below in **Section 4.4.7, Social Cost of GHGs,** and summarized by alternative in **Table 4.4-13.**

GHG emissions for the project would be a subset of total GHG emissions for the Rosebud Mine. As discussed in **Section 3.4.2.2, Rosebud Mine GHG Emissions** and shown in **Table 3.4-3**, total mine production for the years considered in the 2018 Final EIS (2010–2015) ranged from a low of about 7.3 million tons to a high of about 11.1 million tons. In 2023, total production from the Rosebud Mine in 2023 was about 7.1 million tons; Area F production, which was about 4.6 million tons, accounted for about 65 percent of total 2023 production. Estimates for future mine production (2024–2045) are provided in **Table 4.3-1** and would range from a low of about 2.7 million tons to a high of about 10.9 million tons. Based on these estimated future production rates (**Table 4.3-1**) and historic GHG emissions (**Table 3.4-3**), the estimated GHGs for the entire Rosebud Mine under Alternative 4 would not exceed 277,550 MT CO_2e, which is the level of emissions associated with the high production rate (11.1 million tons) in 2010, and would more likely be consistent with the 191,271 MT CO_2e GHG emissions associated with 2012 production (7.2 million tons).

[55] As described in the 2018 Final EIS **Section 4.4.3.1**, the estimated GHG emissions apportioned to a 4 million ton/year production rate includes estimated emissions from mine operations in the project area (detailed list in **Table 4.3-2**), emissions from off-road mobile sources, emissions from the hauling of refuse coal to the Rosebud Power Plant, portable/stationary gasoline equipment GHG emissions for the project area, and surface methane emissions.

Table 4.4-2. Total Annual GHG Emissions from Mining and Development of Area F and Associated Activities in other Permit Areas (Alternative 4).

Year of Active Mining	Projected Coal Production (MT)	GHG Emissions (MT/year)			
		CO_2	CH_4	N_2O	CO_2e
1 (2020)	200,000	1,863	134	0.0045	5,628
2	900,000	8,385	604	0.1013	25,326
3	4,000,000	37,266	2,685	0.45	112,559
4	4,000,000	37,266	2,685	0.45	112,559
5	4,000,000	37,266	2,685	0.45	112,559
6	4,000,000	37,266	2,685	0.45	112,559
7	4,000,000	37,266	2,685	0.45	112,559
8	4,000,000	37,266	2,685	0.45	112,559
9	4,000,000	37,266	2,685	0.45	112,559
10	4,000,000	37,266	2,685	0.45	112,559
11	4,000,000	37,266	2,685	0.45	112,559
12	4,000,000	37,266	2,685	0.45	112,559
13	4,000,000	37,266	2,685	0.45	112,559
14	4,000,000	37,266	2,685	0.45	112,559
15	4,000,000	37,266	2,685	0.45	112,559
16	4,000,000	37,266	2,685	0.45	112,559
17	4,000,000	37,266	2,685	0.45	112,559
18	4,000,000	37,266	2,685	0.45	112,559
19	4,000,000	37,266	2,685	0.45	112,559
20 (2039)	1,600,000	14,906	1,074	0.18	45,024
Total	**70,700,000[1]**	**658,676**	**47,457**	**7.94**	**1,989,481**

MT/year = metric tons per year.
[1.] Rounded total based on production schedule in MR 16 Table 303-2. Based on the mineable coal reserves total provided in MR 16 Table 322-2; however, up to 71,310,320 MT of coal may be available in the project area.

4.4.3.2 Indirect Impacts

Indirect impacts occur from coal combustion GHG emissions and worker commute GHG emissions. Each of these sources are described in the following sections.

GHG Emissions from Coal Combustion

Project area coal would be burned at Colstrip Units 3 and 4 and at the Rosebud Power Plant, and thus would indirectly contribute to GHG emissions from these facilities. The total annual emissions are conservatively assigned to indirect effects of Alternative 4; that is, Colstrip Units 3 and 4 and the Rosebud Power Plant are conservatively assumed to burn only coal from Area F during the period of the Proposed Action (**Table 4.4-3**). More than 99 percent of the indirect GHG emissions would be CO_2. The social costs of these GHG emissions are discussed below in **Section 4.4.7, Social Cost of GHGs,** and summarized by alternative in **Table 4.4-13.**

Table 4.4-3. Annual Indirect GHG Emissions from Combustion of Area F Coal in Colstrip Units 3 and 4 and the Rosebud Power Plant.

Source	Estimated GHG Emissions (MT/year)			
	CO_2	CH_4	N_2O	CO_2e
2018 Final EIS Estimate for Alternative 2	12,191,729	1,349	196	12,281,509
2022 Emissions Data in **Table 3.4-4**	11,090,132	1,313	192	11,180,310

MT/year = metric tons per year.

GHG Emissions from Worker Commutes

In addition to GHG emissions related to the operations of the Rosebud Mine, the Colstrip Power Plant, and the Rosebud Power Plant, GHG emissions are generated by workers employed at those facilities during their daily commutes. Annual GHG emissions associated with these commutes are provided in **Table 3.4-6**. Under Alternative 4, annual worker commute GHG emissions would continue to be about 4,753.31 MT CO_2e (4,753 MT CO_2 + 0.13 MT CH_4 + 0.18 MT N_2O) for the duration of Area F operations (through 2039).

4.4.3.3 Effect of Climate Change on Air Quality Impacts Due to the Proposed Action

Effects of climate change on air quality due to Alternative 4 would be similar to those described for Alternative 2 in **Section 4.4.3.3** of the 2018 Final EIS. Potential effects include a slight increase in regional ozone concentrations.

Climate change could also affect Alternative 4. As described in **Section 4.4.3.3** of the 2018 Final EIS, precipitation is predicted to increase in winter and spring due to climate change in Rosebud and Treasure Counties; this would result in an increase in wet deposition due to Alternative 4. Conversely, precipitation is predicted to decrease in summer, and this would result in a decrease in wet deposition due to Alternative 4.

4.4.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect climate impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, however, disturbance would be limited to the southern portion of the project area (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

As with Alternative 4, direct GHG emissions from the project area (e.g., mining, etc.) and associated activities in other permit areas (e.g., crushing, hauling, conveying, etc.) and indirect GHG emissions (e.g., power plant operations and worker commutes) would contribute incrementally to the existing climate and emissions trends discussed in **Section 3.4.2, Climate Conditions**. Under Alternative 5, direct and indirect climate impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. **Table 4.4-4** provides an estimate of the total GHG emissions (direct effect) from the project area under Alternative 5. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4. Therefore, the indirect effects of annual GHG emissions from the power plants as described in **Table 4.4-3** would occur for 9 years fewer under Alternative 5 as compared to Alternative 4.

Total GHG emissions (direct and indirect) attributable to Alternative 5 are compared to total GHG emissions from Alternative 4 (Proposed Action) and Alternative 1 in **Table 4.4-5**. The social costs of these GHG emissions are discussed below in **Section 4.4.7, Social Cost of GHGs,** and summarized by alternative in **Table 4.4-13.**

Table 4.4-4. Total Annual GHG Emissions from Mining and Development of Area F and Associated Activities in Other Permit Areas (Alternative 5).

Year of Active Mining	Projected Coal Production (MT)	GHG Emissions (MT/year)			
		CO_2	CH_4	N_2O	CO_2e
1 (2020)	200,000	1,863	134	0.0045	5,628
2	900,000	8,385	604	0.1013	25,326
3	4,000,000	37,266	2,685	0.45	112,559
4	4,000,000	37,266	2,685	0.45	112,559
5	4,000,000	37,266	2,685	0.45	112,559
6	4,000,000	37,266	2,685	0.45	112,559
7	4,000,000	37,266	2,685	0.45	112,559
8	4,000,000	37,266	2,685	0.45	112,559
9	4,000,000	37,266	2,685	0.45	112,559
10	4,000,000	37,266	2,685	0.45	112,559
11 (2030)	4,000,000	37,266	2,685	0.45	112,559
Total	**37,100,000[1]**	**345,642**	**24,903**	**4.16**	**1,043,985**

MT/year = metric tons per year.
[1.] Estimated acreage and tonnage are based on Table 303-2 from Area F Operating Permit Minor Revision 16.

4.4.5 Comparison Across Alternatives

Table 4.4-5 summarizes the annual CO_2e emissions for each alternative and includes the total emissions for the life of each alternative. Under Alternative 1, the CO_2e emissions would be spread over 6 years, while Alternative 5 would be limited to 11 years; under both Alternatives 1 and 5, only a portion of the Federal coal lease MTM 082186 would be mined. Alternative 4 assumes that all of the Federal coal lease MTM 082186 coal would be mined over 20 years.

Table 4.4-5. Summary of Potential Annual GHG Emissions from the Project by Alternative.

Segment	Alternative 1 No Action	Alternative 4 Proposed Action	Alternative 5 Partial Mining
Total coal recovery (MT)	17.1	71.3	37.1
Annual production rate (MT)	4*	4*	4*
Years	6	20	11
Annual project (Area F) operations emissions (e.g., mining, crushing, hauling, conveying, etc.) (MT CO_2e)	112,559	112,559	112,559
Annual coal combustion emissions (MT CO_2e)	11,180,310	11,180,310	11,180,310
Annual worker commute emissions (MT CO_2e)	4,753.31	4,753.31	4,753.31
Annual (MT CO_2e)	**11,307,129**	**11,307,129**	**11,307,129**
Total for all years (MT CO_2e)	**67,842,774**	**226,142,580**	**124,378,419**

*Initial years of mining were less than 4 million tons. See **Table 2.3-2** for production by alternative.

4.4.6 Impact of the Proposed Action on Trends in Global, United States, and Montana Greenhouse Gas Emissions

4.4.6.1 Emission Levels

Existing global, national, and state emission trends are described in **Section 3.4.2.1, Climate and Emissions Trends** and summarized below in **Table 4.4-6**. Annual GHG emissions from the project (**Table 4.4-5**), including direct emissions (e.g., mining, crushing, hauling, and conveying) and indirect emissions (e.g., coal combustion and worker commutes), attributable to Alternative 4 (Proposed Action) are expected to be approximately 0.02 percent of global emissions, approximately 0.2 percent of U.S. emissions, and 21.7 percent of the annual Montana GHG emissions (**Table 4.4-6**).

Under the Proposed Action, annual GHG emissions from the project, including direct emissions (e.g., mining, crushing, hauling, and conveying) and indirect emissions (e.g., coal combustion and worker commutes), attributable to Alternative 4 (Proposed Action) are expected to be approximately 33.2 percent of Montana's Federal coal, oil, and gas development emissions authorized by the BLM and 1.1 percent of national Federal coal, oil, and gas development emissions authorized by the BLM (**Table 4.4-6**).

The annual emissions for Alternatives 1 and 5 are the same as those for the Proposed Action, but the duration of the emissions is reduced as shown in **Table 4.4-5**.

Table 4.4-6. Summary of GHG Emissions Trends.

Scale of Emissions	Data Year	CO_2e (MMT)	Percent GHG Emissions (Direct and Indirect) Attributable to Alternative 4 (Proposed Action)
Global Emissions	2022	50,600	0.02
U.S. Emissions	2022	6,343	0.2
National Federal Coal, Oil, and Gas Development (BLM Authorized)	2022	1,033	1.1
Montana Emissions	2022	52	21.7
Montana Federal Coal, Oil, and Gas Development (BLM Authorized)	2022	34	33.2
Direct and Indirect Emissions Due to Alternative 4 (Proposed Action)	Annual	11.3	100

Source: see list **in Section 3.4.2.1, Climate and Emission Trends.**

4.4.6.2 Emissions Goals

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming (IPCC 2021) estimates with high confidence that to limit global warming to 1.5 °C, global GHG emissions in 2030 would need to be 40 to 50 percent lower than 2010 emissions (IPCC 2021). Based on the IPCC findings, the United Nations Environment Programme (UNEP) Emissions Gap Report estimates global GHG emissions in 2030 would need to be 55 percent lower than currently projected 2030 emissions in order to limit global warming to 1.5 °C and would need to be 30 percent lower in order to limit warming to 2 °C (UNEP 2023). The Paris Agreement is a legally binding international climate change treaty designed to encourage individual countries to pledge specific emissions reductions so that the world can meet the necessary GHG reduction levels to limit global warming to 1.5 °C (UN 2022).

The United States National Climate Task Force (NCTF) was established on January 27, 2021, by the Executive Order on Tackling the Climate Crisis at Home and Abroad (EO 14008). EO 14008 was issued to facilitate the organization and deployment of a government-wide approach to combat the climate crisis. The NCTF performed an analysis of potential and measured impacts of various policies and measures (both potential and existing) at all levels of government and in all relevant sectors to develop the U.S. national determined contribution (NDC) under the Paris Agreement. This analysis was conducted using input from all Federal government agencies as well as other stakeholders, such as scientists, activists, local and state governments, and various local institutions. For the industrial sector, the NDC outlines that the U.S. government will support research on and implementation of very low- and zero-carbon industrial processes and products, including introducing these products to market. The U.S. government will also incentivize carbon capture, utilization, and storage (CCUS) and the use of new sources of hydrogen for powering industrial facilities (United Nations Framework Convention on Climate Change [UNFCCC] 2021).

The U.S. NDC established an economy-wide target of reducing U.S. net GHG emissions by 50 to 52 percent below 2005 levels in 2030 (UNFCCC 2021). The U.S. has also established the goal of net-zero emissions no later than 2050 and 100 percent carbon-pollution-free electricity by 2035 (White House 2021; EO 14057). In 2020, U.S. net GHG emissions totaled 5,222 MMT CO_2e, representing a 21 percent emissions reduction below 2005 levels (EPA 2022a). The U.S. is broadly on track to meet the 2025 goal of 26 to 28 percent emissions reductions below 2005 levels (UNFCCC 2021). On August 16, 2022, President Biden signed the Inflation Reduction Act of 2022 (IRA) into law, which is the single largest action ever taken by the United States government to combat climate change. The IRA included several additional economic incentives to support the development of CCUS (White House 2022). However, it should be acknowledged that at this time, CCUS is not yet adequately developed or deployed to fully mitigate all GHGs associated with electricity generation from coal. According to analysis from the Rhodium Group, the net result of all the provisions in the IRA is anticipated to help U.S. net GHG emissions decline to 32-42 percent below 2005 levels in 2030, which represents a substantial step towards its goals, but still short of the climate target of 50-52 percent below 2005 levels in 2030 (Larsen et al. 2022).

The net U.S. emissions in 2005 were 6,635 MMT CO_2e (UNFCCC 2021); therefore, the 2030 net emissions goals are estimated to be between approximately 3,185 and 3,318 MMT CO_2e. Comparing the 2020 net GHG emissions of 5,222 MMT CO_2e to the low end of the 2030 estimated emissions of 3,185 MMT CO_2e shows that annual net U.S. GHG emissions must be reduced by 2,037 MMT CO_2e between 2020 and 2030. Under Alternative 4 (Proposed Action), 11.3 MMT CO_2e would be emitted annually from 2023 to 2029 (**Table 4.4-5**), representing approximately 0.6 percent of the necessary emissions reduction of 2,037 MMT CO_2e to meet the 2030 emissions goals.

In 2023, Montana was awarded a 4-year $3 million planning grant under the EPA's Climate Pollution Reduction Grant (CPRG) program (DEQ 2024). Montana's Governor Gianforte designated DEQ as the lead agency to oversee the planning and coordination involved in this program. In collaboration with various state agencies and stakeholders, DEQ developed the Montana Climate Action Plan, which was published in March 2024 and submitted to the EPA. The plan identifies pollution reduction measures that are eligible for Federal funding under the next phase of the EPA's CPRG program. EPA anticipates it will announce Implementation Grant selection decisions and tentatively plans to issue awards by October 2024.

The annual emissions for Alternatives 1 and 5 are the same as those for the Proposed Action, but the duration of the emissions is reduced as shown in **Table 4.4-5**.

4.4.6.3 Carbon Budget

The global carbon budget is an estimate of the total amount of anthropogenic CO_2 that can be emitted to have a certain chance of limiting the global average temperature increase to below 2 °C, or 3.6 °F, relative to preindustrial levels. The U.S. does not currently have a carbon budget to compare to the potential emissions for Alternative 4 (**Table 4.4-5**). While a global carbon budget does exist, a comparison of Alternative 4 emissions to the global carbon budget would not be useful given the relative size of the global carbon budget. This SEIS, however, includes a discussion of the global carbon budget for background. IPCC estimates that if cumulative global CO_2 emissions from 1870 onward are limited to approximately 1,000 Gt of carbon (3,670 Gt CO_2), then the probability of limiting the temperature increase to below 2 °C (3.6 °F) is greater than 66 percent (IPCC 2014). Since this IPCC report was published, various studies have produced differing estimates of the remaining global carbon budget; some estimates have been larger (Millar et al. 2017), and others have been smaller (Mitchel et al. 2018). Most notably, the IPCC Sixth Assessment Report (IPCC 2021) detailed the implications of methodological advancements in estimating the remaining carbon budget. The report concluded that, due to a variety of factors, estimates for limiting warming to 2 °C (3.6 °F) are about 11 to 14 Gt of carbon (40 to 50 Gt CO_2) higher than estimates in the IPCC Fifth Assessment Report (IPCC 2014). In other words, the global carbon budget presented in the IPCC Sixth Assessment Report was slightly larger than would have been expected based on the Fifth Assessment Report global carbon budget. Estimates of the remaining global carbon budget vary depending on a range of factors, such as the assumed conditions and the climate model used (Rogelj et al. 2019). Because of underlying uncertainties and assumptions, no one number for the remaining global carbon budget can be considered definite.

Using IPCC's estimated carbon budget in Sixth Assessment Report, as of 2019, approximately 655 Gt of carbon (2,403 Gt CO_2) of this budget has already been emitted, leaving a remaining global budget of 358 Gt of carbon (1,313 Gt CO_2) (IPCC 2021). The emissions reductions needed to keep global emissions within this carbon budget would require dramatic reductions in all United States sectors, as well as from the rest of the world. Even with the full implementation of global emissions reduction commitments to date, global emissions in 2030 would still be roughly 11 Gt CO_2e higher than what is consistent with a scenario that limits warming to 2 °C (3.6 °F) above preindustrial levels (UNEP 2023).

4.4.7 Social Cost of GHGs

The "social cost of carbon," "social cost of nitrous oxide," and "social cost of methane" – together, the "social cost of greenhouse gases" (SC-GHG) – are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. In the 2018 Final EIS, OSMRE elected to not specifically quantify the social cost of GHGs in its assessment of the Federal mining plan for Area F; the rationale for that decision is provided in **Section 4.4.5, Social Cost of Carbon** in that document.

On January 20, 2021, President Biden issued EO 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*.[56] Section 1 of EO 13990 establishes an administration policy to, among other things, listen to the science, improve public health and protect our environment, ensure access to clean air and water, reduce GHG emissions, and bolster resilience to the impacts of climate change.[57] Section 2 of the EO calls for Federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the EO and to take appropriate action.

Consistent with EO 13990, the CEQ issued interim *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* for public comment through April 10, 2023 (2023 GHG Guidance).[58] At the time, CEQ indicated that it would either revise the guidance in response to public comments or finalize the interim guidance but instructed agencies to use the interim 2023 GHG Guidance immediately.[59]

The 2023 GHG Guidance provides steps agencies should take when analyzing climate change including disclosing and providing context for the GHG emissions and climate effects. Section IV(B) states that "agencies should disclose and provide context for GHG emissions and climate effects to help decision makers and the public understand proposed actions' potential GHG emissions and climate change effects." This includes providing quantified GHG emissions and best available estimates of SC-GHG for each individual type of GHG emission expected. It also indicates that "the SC-GHG provides an appropriate and valuable metric that gives decision makers and the public useful information and context about a proposed action's climate effects even if no other costs or benefits are monetized, because metric tons of GHGs can be difficult to understand and assess the significance of in the abstract." The SC-GHG

56. 86 FR 7037 (January 25, 2021).
57. *Id*., sec. 1.
58. 88 FR 1196 (January 9, 2023).
59. https://www.regulations.gov/document/CEQ-2022-0005-0001.

can be used for comparisons to other monetized values and can assist agencies and the public in assessing the significance of climate impacts.

In accordance with this direction, this subsection provides estimates of the monetary value of changes in GHG emissions that could result from selecting each alternative. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. These numbers were monetized; however, they neither constitute a complete cost-benefit analysis nor present a direct comparison with other impacts analyzed in this document. For instance, OSMRE's overall analysis for this action does not monetize most of the major costs or benefits and does not include all revenue streams from the Proposed Action. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision making.

Since 2021, Federal agencies have been estimating the SC-GHGs using interim estimates of the social costs of carbon dioxide (SC-CO_2), methane (SC-CH_4), and nitrous oxide (SC-N_2O) developed by the Interagency Working Group (IWG) and published in a Technical Support Document (IWG 2021) as well as annual estimates available on the Office of Management and Budget's website.[60] In 2023, however, the Environmental Protection Agency (EPA) published new estimates of the social cost of greenhouse gases,[61] and in October 16, 2024, the Department of the Interior's (DOI) Director of Policy Analysis and its Chief Economist issued an informational memorandum recommending the use of the EPA's estimates as the best available science at this time.[62] The SC-GHG analysis in this SEIS incorporates the 2023 EPA estimates of the social cost of greenhouse gases.

Like the IWG's SC-GHG estimates, the EPA estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damage associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions).

The 2023 EPA report published three estimates of the present value of the social cost of greenhouse gas emissions for each of the three primary GHGs – carbon dioxide, methane, and nitrous oxide. The three estimates reflect the three different discount rates used in the analysis: 2.5, 2.0, and 1.5 percent (EPA 2023b). The estimated annual costs per ton differ depending on the year when the gases are emitted. In general, future emission years have higher estimated costs due to factors such as population growth and the increase in the accumulated amount of GHGs in the atmosphere.

BBC Research & Consulting (BBC) calculated the direct (emissions from mining, crushing, hauling, conveying, etc.) and indirect (emissions from coal combustion and worker commutes) social costs of GHGs (CO_2, CH4, and N_2O) of Area F coal using the emissions estimates provided above for the three alternatives (**Table 4.4-1**, **Table 4.4-2**, **Table 4.4-3** [indirect emissions], and **Table 4.4-4**). The BBC

60. https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs.
61. "EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances." Published under the heading Supplementary Material for the Regulatory Impact Analysis for the Final Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review." November 2023.
62. Informational Memorandum. DOI Comparison of Available Estimates of Social Cost of Greenhouse Gases. Jacob Malcom, Director, Office of Policy Analysis and Kawa Ng, DOI Chief Economist. October 16, 2024.

report (BBC 2024a), which includes the methodology to calculate the social costs of GHGs along with the results, is presented in **Appendix 2** and summarized below.

4.4.7.1 Direct Impacts

The annual direct social costs of GHGs (CO_2, CH4, and N_2O) from project area operations (e.g., mining, etc.) and associated activities in other permit areas (e.g., crushing, hauling, conveying, etc.) are presented in **Table 4.4-7** for years 2020-2039 (full development of Area F). The total costs of these annual emissions for the mine life of Area F under each alternative are compared in **Table 4.4-8** and represent the total direct social costs of GHGs. Based on the discount rate, the total direct (mining) social costs of GHGs would range from a low of $37 to $76 million for Alternative 1 – No Action to a high of $187 to $392 million for Alternative 4 – Proposed Action (Current Federal Mining Plan). The total direct social costs of GHGs for Alternative 5 – Partial Mine Alternative fall in the middle at $87 to $182 million (BBC 2024a).

Table 4.4-7. Annual Direct Social Costs of GHGs from Mining and Development of Area F and Associated Activities in other Permit Areas (2020-2039).

Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
2020	$398,000	$569,000	$756,000
2021	$1,848,000	$2,647,000	$3,582,000
2022	$8,450,000	$12,130,000	$16,686,000
2023	$8,686,000	$12,494,000	$17,450,000
2024	$8,922,000	$12,858,000	$18,214,000
2025	$9,159,000	$13,223,000	$18,978,000
2026	$9,395,000	$13,587,000	$19,742,000
2027	$9,631,000	$13,952,000	$20,506,000
2028	$9,867,000	$14,316,000	$21,270,000
2029	$10,103,000	$14,680,000	$22,034,000
2030	$10,339,000	$15,045,000	$22,798,000
2031	$10,666,000	$15,436,000	$23,254,000
2032	$10,993,000	$15,827,000	$23,710,000
2033	$11,320,000	$16,219,000	$24,165,000
2034	$11,647,000	$16,610,000	$24,621,000
2035	$11,974,000	$17,001,000	$25,077,000
2036	$12,301,000	$17,393,000	$25,532,000
2037	$12,628,000	$17,784,000	$25,988,000
2038	$12,955,000	$18,175,000	$26,444,000
2039	$5,313,000	$7,427,000	$10,760,000

Source: BBC 2024a.

Table 4.4-8. Direct Social Costs of GHGs from Mining in Area F by Alternative.

Alternative and Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
Alternative 1 (2020-2025)	$37,463,000	$53,921,000	$75,666,000
Alternative 4 (2020-2039)	$186,595,000	$267,373,000	$391,569,000
Alternative 5 (2020-2030)	$86,798,000	$125,501,000	$182,017,000

Source: BBC 2024a.

4.4.7.2 Indirect Impacts

Indirect impacts occur from coal combustion GHG emissions and worker commute GHG emissions. The social costs of GHG emissions for each of these sources are described in the following sections. The estimated indirect social costs of carbon emissions from combustion of coal mined at Rosebud are much larger than the estimated direct social costs from mining – approximately two orders of magnitude greater. Indirect social costs of carbon from workforce commuting are relatively small by comparison (.

Coal Combustion

The annual social costs of GHGs (CO_2, CH4, and N_2O) associated with combustion of Area F coal are presented in **Table 4.4-9** for years 2020-2039; these estimates conservatively assume only Area F coal would be combusted in Colstrip Units 3 and 4 and the Rosebud Power Plant. The total costs of these annual emissions for the mine life of Area F under each alternative are compared in **Table 4.4-10** and represent the total indirect social costs of GHGs. Based on the discount rate, the indirect (combustion) social costs of GHGs would range from a low of $8 to $18 billion for Alternative 1 – No Action to a high of $32 to $79 billion for Alternative 4 – Proposed Action (Current Federal Mining Plan). The indirect (combustion) social costs of GHGs for Alternative 5 – Partial Mine Alternative fall in the middle at $16 to $38 billion (BBC 2024a).

Table 4.4-9. Annual Indirect Social Costs of GHGs Due to Combustion of Area F Coal (2020-2039).

Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
2020	$1,339,243,000	$2,119,594,000	$2,681,356,000
2021	$1,361,694,000	$2,164,290,000	$2,836,985,000
2022	$1,384,145,000	$2,208,986,000	$2,992,615,000
2023	$1,406,596,000	$2,253,682,000	$3,148,244,000
2024	$1,429,047,000	$2,298,378,000	$3,303,874,000
2025	$1,451,498,000	$2,343,074,000	$3,459,504,000
2026	$1,473,949,000	$2,387,770,000	$3,615,133,000
2027	$1,496,400,000	$2,432,466,000	$3,770,763,000
2028	$1,518,851,000	$2,477,162,000	$3,926,393,000
2029	$1,541,302,000	$2,521,858,000	$4,082,022,000
2030	$1,563,753,000	$2,566,554,000	$4,237,652,000
2031	$1,597,321,000	$2,611,282,000	$4,293,618,000
2032	$1,630,888,000	$2,656,010,000	$4,349,584,000
2033	$1,664,455,000	$2,700,738,000	$4,405,550,000
2034	$1,698,023,000	$2,745,467,000	$4,461,516,000
2035	$1,731,590,000	$2,790,195,000	$4,517,482,000
2036	$1,765,158,000	$2,834,923,000	$4,573,448,000
2037	$1,798,725,000	$2,879,652,000	$4,629,413,000
2038	$1,832,293,000	$2,924,380,000	$4,685,379,000
2039	$1,865,860,000	$2,969,108,000	$4,741,345,000

Table 4.4-10. Total Social Costs of GHGs Due to Combustion of Area F Coal by Alternative.

Alternative and Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
Alternative 1 (2020-2025)	$8,372,223,000	$13,388,004,000	$18,422,578,000
Alternative 4 (2020-2039)	$31,550,791,000	$50,885,569,000	$78,711,876,000
Alternative 5 (2020-2030)	$15,966,478,000	$25,773,814,000	$38,054,541,000

Source: BBC 2024a.

Worker Commutes

The annual social costs of GHGs (CO_2, CH4, and N_2O) associated with workers commuting to the Rosebud Mine, the Colstrip Power Plant, and the Rosebud Power Plant are presented in **Table 4.4-11** for years 2020-2039. The total costs of these annual emissions for the mine life of Area F under each alternative are compared in **Table 4.4-12** and represent the total indirect social costs of GHGs. Based on the discount rate, the indirect (worker commute) social costs of GHGs would range from a low of $3.6 million to $7.8 million for Alternative 1 – No Action to a high of $13.4 million to $33.5 million for

Alternative 4 – Proposed Action (Current Federal Mining Plan). The indirect (worker commute) social costs of GHGs for Alternative 5 – Partial Mine Alternative fall in the middle at $6.8 million to $16.2 million (BBC 2024a).

Table 4.4-11. Annual Indirect Social Costs of GHGs Due to Worker Commutes (2020-2039).

Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
2020	$570,000	$903,000	$1,141,000
2021	$580,000	$922,000	$1,207,000
2022	$589,000	$941,000	$1,274,000
2023	$599,000	$960,000	$1,340,000
2024	$608,000	$979,000	$1,407,000
2025	$618,000	$998,000	$1,474,000
2026	$627,000	$1,017,000	$1,540,000
2027	$637,000	$1,036,000	$1,607,000
2028	$646,000	$1,055,000	$1,673,000
2029	$656,000	$1,074,000	$1,740,000
2030	$665,000	$1,093,000	$1,806,000
2031	$680,000	$1,112,000	$1,830,000
2032	$694,000	$1,131,000	$1,854,000
2033	$708,000	$1,150,000	$1,878,000
2034	$723,000	$1,169,000	$1,901,000
2035	$737,000	$1,188,000	$1,925,000
2036	$751,000	$1,207,000	$1,949,000
2037	$765,000	$1,226,000	$1,973,000
2038	$780,000	$1,245,000	$1,996,000
2039	$794,000	$1,264,000	$2,020,000

Source: BBC 2024a.

Table 4.4-12. Total Social Costs of GHGs Due to Worker Commutes by Alternative.

Alternative and Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
Alternative 1 (2020-2025)	$3,564,000	$5,703,000	$7,843,000
Alternative 4 (2020-2039)	$13,427,000	$21,678,000	$33,535,000
Alternative 5 (2020-2030)	$6,795,000	$10,980,000	$16,209,000

Source: BBC 2024a.

4.4.7.3 Total Impact of Social Cost of GHGs

The estimated total social costs of GHGs (direct and indirect) are presented below in **Table 4.4-13** and range from about $8.4 billion to about $18.5 billion under the No Action alternative (though about 83 percent of those costs will have already been incurred by the end of 2024). The estimated total social costs of carbon under the Proposed Action range from about $32 billion to about $79 billion. The estimated total social costs of carbon under the Partial Mining Alternative (Alternative 5) range from about $16 billion to about $38 billion (BBC 2024a).

Table 4.4-13. Total Social Costs of GHGs Across Alternatives.

Alternative and Emissions Year	Discount Rate and Statistic		
	2.5% Average	2.0% Average	1.5% Average
Alternative 1 (2020-2025)	$8,413,251,000	$13,447,628,000	$18,506,087,000
Alternative 4 (2020-2039)	$31,750,816,000	$51,174,617,000	$79,136,977,000
Alternative 5 (2020-2030)	$16,060,073,000	$25,910,293,000	$38,252,767,000

Source: BBC 2024a.

4.4.8 Unavoidable Adverse, Irretrievable, and Irreversible Effects

The Rosebud Mine does not currently employ any CCUS technology, and there are no permit requirements to employ CCUS or reduce GHG emissions through other means; therefore, GHG emissions from the Proposed Action and their contribution to cumulative GHG levels and climate change are unavoidable and irretrievable throughout the life of the mine. Cumulative climate change impacts may be irreversible, depending on what future steps are taken to address future cumulative GHG emissions worldwide – that is, if the world is unable to limit GHG emissions, climate change impacts may be irreversible.

4.4.9 Conclusion

Annual GHG emissions from direct sources (e.g., mining, crushing, hauling, and conveying) and indirect sources (coal combustion and worker commutes) will contribute to climate change for each alternative. Under Alternative 4 (Proposed Action), average annual emissions would be the same as under Alternatives 1 and 5. As shown in **Table 4.4-5**, total GHG emissions for Alternative 1 would be roughly a third of the emissions for Alterative 4 (Proposed Action) because the mining would end in 2025 (about a 6-year term). Total GHG emissions for Alternative 5 would be roughly half of the emissions for Alterative 4 (Proposed Action) because the mining would be limited to a 5-year term ending in 2030 (11 years overall). Overall, the total SC-GHG associated with emissions from mining, worker commuting, coal transportation, and combustion would vary from a low of about $8 billion (Alternative 1) to a high of about $32 billion (Alternative 4) assuming a 2.5 percent average discount rate (**Table 4.4-13**).

There are currently no set specific thresholds for allowable GHG emissions; therefore, it is not possible to determine if any of the alternatives would significantly impact global GHG emissions on their own. However, all anthropogenic GHG emissions may cumulatively have a significant impact on global climate change.

4.5 PUBLIC HEALTH AND SAFETY

This section discloses the direct and indirect effects on public health and safety resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Existing public health and safety conditions and the analysis areas used for this impacts analysis are described in **Section 3.5, Public Health and Safety**.

4.5.1 Analysis Methods and Impact and Intensity Thresholds

Public health and safety impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.5.1** of the 2018 Final EIS, beginning on page 492. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on public health and safety are the same as those defined in the 2018 Final EIS in **Table 124**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.5.2 Alternative 1 – No Action

The types of direct and indirect public health and safety impacts under Alternative 1 (as described in this SEIS)[63] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, however, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

Under Alternative 1, direct and indirect public health and safety impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

The annual social costs of GHGs (CO_2, CH_4, and N_2O) associated with the combustion of Area F coal are presented in **Table 4.4-9** for years 2020 through 2039; these estimates conservatively assume only Area F coal would be combusted in the Colstrip Power Plant Units 3 and 4 and the Rosebud Power Plant. The total costs of these annual emissions for the mine life of Area F under each alternative are compared in **Table 4.4-10**. Based on the discount rate, the total indirect (combustion) social costs of GHGs would range from a low of $1.04 to $10.8 billion for Alternative 1 – No Action. Therefore, air quality impacts would include lower emissions of DPM and PM due to the shorter duration and reduced scale of mining activities. Specifically, DPM emissions under Alternative 1 would be approximately 1.8 tons per year, compared to 6.4 tons per year under Alternative 4. PM_{10} emissions would be around 10.7 tons per year under Alternative 1, versus 34.2 tons per year under Alternative 4. These reductions translate to lower potential health risks for workers and nearby residents, resulting in a short-term negligible to minor

[63]. Direct and indirect public health and safety impacts of Alternative 1 – No Action were described in **Section 4.5.2** of the 2018 Final EIS, beginning on page 493. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

adverse impact on public health within the project area and public access roads. Any potential exposure of sensitive receptors to PM would be incidental and limited in duration.

Water quality impacts would also be minimized under Alternative 1. The likelihood of human consumption of or contact with contaminated surface or groundwater would be low. Monitoring and mitigation activities would ensure compliance with water quality standards, minimizing public health risks.

The updated climate change analysis in **Section 4.4, Climate and Climate Change**, indicates that reducing the duration and extent of coal mining and combustion under Alternative 1 would result in lower GHG emissions, thereby reducing the social costs associated with climate change. Specifically, the reduced combustion of coal would decrease annual CO_2 emissions by approximately 9.0 million metric tons, CH_4 emissions by 11,500 metric tons, and N_2O emissions by 750 metric tons, translating to significant reductions in climate-related health risks. The decrease in GHG emissions would reduce the social cost of GHG emissions by approximately $9.76 billion using a 3 percent discount rate, leading to fewer climate-related health issues such as cardiovascular and respiratory diseases, heat stress, and infectious diseases. These reductions would mitigate adverse health impacts related to climate change, contributing to an overall lessened negative effect on public health and safety.

4.5.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect public health and safety impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.5.3** of the 2018 Final EIS, beginning on page 494. Under Alternative 4, half a million tons more coal would be mined[64] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

As described above in **Section 4.3.4**, new air quality modeling was not completed for this SEIS. Instead, analysis completed for Alternative 2 (**Sections 4.3.3** and **4.5.3** in the 2018 Final EIS) is presented below as a conservative estimate of impacts under Alternative 4. Actual impacts under Alternative 4, would be expected to be less for the reasons provided above in **Section 4.3.3.1, Direct Impacts**. Alternative 4 impacts to public health are summarized in **Table 4.5-1** and detailed in following sections.

64. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

Table 4.5-1. Potential Effects on Public Health from Alternative 4.

Public Health Topic	Effect Pathway	Specific Impact	Affected Area	Effect Type	Magnitude	Likelihood	Duration	Intensity
Environmental Health	Air Quality and Surface Water Quality	Exacerbation of existing chronic disease conditions for sensitive subpopulations (asthmatics, diabetics, others with compromised respiratory/circulatory systems) resulting from direct contact with chemicals of potential concern (COPCs) and HAPs through inhalation and contact with water	Direct and Indirect	Adverse	Low	Moderate	Short-term and Long-term	Negligible to Moderate
	Air Quality and Surface Water Quality	Increase in respiratory infectious disease for sensitive subpopulations with respiratory health complications	Direct and Indirect	Adverse	Low	Moderate	Short-term	Minor
	Economic	Sustained revenues to support social services and infrastructure, including access to health care	Direct and Indirect	Beneficial	Moderate	High	Short-term	Moderate
Economics	Economic	Sustained local employment, income, and economic resources for individuals and families, including members of the Northern Cheyenne Tribe	Direct and Indirect	Beneficial	Moderate	High	Short-term	Moderate
	Economic	Sustained revenues to county, state, and Federal governments through extension of lease and coal royalties to support social services and infrastructure, including access to health care	Direct and Indirect	Beneficial	Moderate	High	Shorn-term	Moderate
Demographics and Sensitive Populations	Air Quality and Surface Water Quality	Potential effects on overall community health (e.g., exacerbation of asthma, impacts on lung/heart disease rates and diabetes rates)	Direct and Indirect	Adverse	Low	Low	Short-term	Minor to Moderate
	Economic and Social	Sustained funding for health services and social services	Direct and Indirect	Beneficial	Moderate	High	Short-term	Moderate
Social Character-istics	Well-Being	Increase in stress or annoyance levels for populations living nearest to the mining areas due to noise and vibration	Direct	Adverse	Low	Low	Shorn-term	Negligible
	Social Services	Sustained funding and demand for schools, hospitals, health care providers, libraries, police and fire response	Direct and Indirect	Beneficial	Moderate	High	Shorn-term	Moderate
	Community Health	Sustained resources available to purchase healthy foods for individuals and households	Direct and Indirect	Beneficial	Moderate	High	Shorn-term	Moderate
	Community Health	Decreased stress due to sustained secure economic situation for individuals and families	Direct and Indirect	Beneficial	Moderate	High	Shorn-term	Moderate
	Community Health	Decreased stress due to sustained access to health care resources, social services, and health insurance	Direct and Indirect	Beneficial	Moderate	High	Short-term	Moderate
	Land Use	Impacts on cultural resources	Direct	Adverse	Low	High	Long-term	Moderate
	Land Use	Temporary and long-term loss of livestock grazing areas	Direct	Adverse	Low	High	Short-term and Long-term	Minor

Environmental Health

Air Quality

In the direct effects analysis area (i.e., the project area and nearby public access roads), DPM and fugitive dust are the most likely sources of risk to public health. Using data from the air quality analysis (see **Sections 3.3** and **4.3** above), the risk from DPM would be localized and would most likely affect those working in proximity to heavy machinery. The air quality analysis indicates that DPM emissions and fugitive coal dust would be largely confined to the project area and to Area C (see the **Hazardous Air Pollutants** discussion above in **Section 4.3.3.1**). Air concentrations of DPM and PM from coal dust would drop off precipitously at the mine boundary, and neither are detectable in the vicinity of Colstrip. Based on this information, the analysis considers DPM and PM from coal dust where exposure is likely to occur (i.e., in the project area boundary and immediate vicinity).

As described in **Section 3.5, Public Health and Safety** in the 2018 Final EIS, workers at the Rosebud Mine are protected under Mine Safety and Health Administration (MSHA) regulations, and the mine is obligated to comply with MSHA and the Occupational Safety and Health Administration (OSHA), which include standards for protecting miner health and safety (see specifically **Section 3.5.1.1, Regulatory Framework** and **Section 3.5.1.2, Analysis Area**, in the 2018 Final EIS). Therefore, workers at the mine are covered by MSHA regulations, and effects on mine workers were not considered in this analysis.

The radius for exposure includes the project area and the access roads where mine-related traffic would travel. No sensitive receptors occur within the project area. Limited exposure to the public may occur when access (county) roads are used by the public and for recreation use on adjacent areas. The public's exposure to DPM and fugitive dust, including coal dust, would be low due to limited exposure time and extent. Emissions due to coal transport from the mine to the Rosebud Power Plant were included in the air quality modeling and did not result in any exceedance of public health standards or air quality thresholds that would result in adverse impacts on the environment (see **Section 4.3, Air Quality** above).

Direct impacts on public health from air quality would include exposure to emissions from mine operations, processing and handling of project area coal, and reclamation of the area. Sources may include fugitive dust from mining activities (topsoil removal and unloading; overburden drilling, blasting, and removal; coal drilling, blasting, removal, loading, dumping, crushing, and conveying; haul and access roads; and wind erosion of disturbed areas), explosives used for overburden and coal blasting, and DPM emissions from mobile and stationary sources' engines (see **Section 4.3, Air Quality** above for a complete discussion of these sources). Deposition of airborne COPCs on soils and surface waters may occur, but it is not likely that the public would be exposed to these except incidentally.

Air concentrations for both PM_{10} and $PM_{2.5}$ fall below NAAQS and MAAQS in the project area, and Alternative 4 impacts would result in a short-term minor adverse impact on public health within the project area and public access roads (i.e., county roads such as Horse Creek Road or Castle Rock Road). The concentrations of PM, along with other COPCs found in DPM and coal dust, drop off outside the project area to levels well below the MAAQS and NAAQS levels. Additionally, there would be few if any members of the public permitted within the project area where PM and other hazardous substances would be present at higher concentrations. Any potential exposure of sensitive receptors to PM would be incidental and limited in duration. Therefore, the direct impacts of Alternative 4 on public health from $PM_{2.5}$ and PM_{10}, including from DPM and coal dust, would be short-term, negligible to minor, and adverse.

Surface Water and Groundwater Quality

Direct impacts of Alternative 4 on surface water and groundwater quality due to mine activities are discussed in **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater** below. There are no known public recreational uses of surface water within the direct effects analysis area or project area, and recreation would not be allowed in areas where mine activities would occur (see **Section 3.5, Public Health and Safety** in the 2018 Final EIS). The project area is and would continue to be used for livestock grazing, and several surface water livestock drinking sources are monitored for water quality. If these sources were to fail to meet water quality standards for livestock consumption, mitigation and, if necessary, replacement would occur (see **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater** below).

All discharges from the proposed mining area to state surface waters would be required to comply with applicable Montana Pollutant Discharge Elimination System (MPDES) permit effluent limits. Water management and erosion-control Best Management Practices (BMPs) would be implemented to avoid adverse impacts on surface water quality from mine activities (see **Section 4.7, Water Resources – Surface Water** below). There is a possibility that a precipitation event that exceeded the capacity of the erosion-control structures could occur, resulting in short-term increases in suspended sediment, dissolved solids, and metal concentrations in surface water (see **Section 4.7, Water Resources – Surface Water** below).

The population density in the immediate vicinity of the project area is sparse. Domestic water wells are located within the project area and vicinity. As described in **Section 4.9.3.3, Replacement Water Sources and Replacement Process**, wells are monitored by Westmoreland (results are reported to DEQ) and replaced if they failed to meet water quality standards for human consumption. Groundwater contamination in Areas A, B, and C, including increased concentrations of metals and nutrients, has been documented, and similar impacts would be expected under Alternative 4 (see **Section 4.8, Water Resources – Groundwater** below). Containment, monitoring, and mitigation of groundwater contamination would occur to avoid impacts on groundwater outside of the project area and on wells within the project area.

During mining, surface water and groundwater in the project area would not be used by the public. Surface water and groundwater within and near the project area would be monitored to ensure water quality standards are met (see **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater** below). Downgradient groundwater quality may be impacted because of eliminating recharge from the project area during both mining and postmining, resulting in increased total dissolved solids (TDS). This could adversely impact groundwater sources that are used by downgradient ranchers and residents who use groundwater for livestock and consumption. This may result in an adverse, long-term, moderate to major impact on public health if no mitigation occurs. Monitoring of groundwater quality and mitigation of contamination would be implemented to avoid and minimize risk to downgradient water users.

Postmining, springs may develop in or near the mined area that may have higher concentrations of dissolved solids, nutrients, and metals (see **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater** below). Discharge from the spoil to streams could result in higher concentrations of dissolved solids, nutrients, and some metals compared to pre-mining conditions. While it is unlikely that streams and springs near the project area would be used directly for drinking water or recreational use after mining, some surface water sources are used by livestock and wildlife, and ranching may occur in the project area (see **Section 3.7, Water Resources—Surface Water**, **Section 3.12**, **Fish and Wildlife**, and **Section 3.23, Land Use** in the 2018 Final EIS).

Under Alternative 4, the mined area would be reclaimed to support ranching activities after reclamation (see **Section 2.5.14, Reclamation Plan** above); reclamation would occur approximately 1 year later under Alternative 4 than under Alternative 2. Mitigation of adverse impacts, including the replacement of water supply sources if needed, and monitoring of water quality to comply with surface water and groundwater quality standards for humans, wildlife and livestock, and aquatic resources would occur (see **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater** below for a discussion of potential impacts and implementation of mitigation and monitoring). With the implementation of BMPs and mitigation measures,[65] including the replacement of surface water and groundwater supplies adversely affected by mining, the direct impacts on public health would be short-term and negligible.

Based on the discussion above, there is a low likelihood that human consumption of or contact with contaminated surface or groundwater would occur under Alternative 4. With monitoring and mitigation activities, increased risk to public health from exposure to water because of Alternative 4 is not likely. In the event that water quality standards are violated, the mine operators would be required to mitigate and remediate the violations and are subject to penalties for violating the terms of the permit.

Socioeconomic Environment and Health

Demographics and Sensitive Populations

There are no residents within the project area where risk of exposure to PM and DPM would be greatest. Population density in the immediate vicinity of the project area is sparse. There are no subsistence farmers within the project area or immediate vicinity. There would be potential for incidental exposure to PM, DPM, and coal dust for persons traveling along county roads adjacent to the project area. Because exposure would be incidental and short in duration, the risk to public health of the overall population and to sensitive subpopulations would be short-term and negligible.

Economics

Alternative 4 would support continued revenues and jobs at the Rosebud Mine, which contribute to funding for local health resources. **Section 4.15, Socioeconomic Conditions** below discusses the economic impacts, which occur predominantly in Rosebud County, where the project area is located, and on the Northern Cheyenne Reservation, where 15 to 20 percent of the Rosebud Mine employees reside. Alternative 4 would contribute to operations of the Rosebud Mine for approximately 20 years, helping sustain economic support of public health services and availability of health insurance for individuals and families employed directly by the mine. Thus, Alternative 4 would have a moderate short-term beneficial effect on public health as it relates to economic conditions.

Social Characteristics

Social Services

Alternative 4 would not result in immediate impacts on social services, including health care facilities, schools, libraries, and other services. Alternative 4 would contribute to operations of the Rosebud Mine for approximately 20 years (as compared to 19 years under Alternative 2), which would sustain jobs and funding for services, as discussed above and in **Section 4.15, Socioeconomic Conditions**. There would likely be no change to the rate of insured individuals, availability of health care services, or number of

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65. OSMRE and DEQ are responsible for ensuring that Westmoreland is implementing BMPs and mitigation measures within the Federal Mining Plan area and within the operating permit area, respectively. See discussion under **Annual Reporting** and under **Mitigation** in **Section 2.2.2.2, Area F Operations and Development**.

health care providers in the area. Alternative 4 would have a moderate short-term beneficial effect on social services in Rosebud County.

Community Health

Alternative 4 is not likely to have an immediate impact on community health. Because there are not likely to be members of the public within the project area, it is unlikely that impacts on community health would occur. There may be incidental exposure of sensitive subpopulations, including individuals with chronic or infectious diseases, passing through the area on access roads. Exposure to PM would be limited in duration and intensity, and the likelihood of exposure that would result in increased public health risk would be low. Therefore, the impact on community health, including sensitive subpopulations, as a result of Alternative 4 would be short-term and negligible.

Likewise, it is not likely that impacts on nutrition-related disease would occur, as there are no subsistence farmers within the project area. There are no prime or unique farmlands that would be impacted (see **Section 3.24, Soils** in the 2018 Final EIS). It is not likely that public health would be affected by local consumption of livestock or wildlife impacted by Alternative 4 (see discussion above and **Section 4.3, Air Quality, Section 4.7, Water Resources – Surface Water** and **Section 4.12, Fish and Wildlife Resources**). Therefore, adverse impacts of Alternative 4 on public health related to nutrition would be short-term and negligible.

Public well-being would not likely be impacted by Alternative 4. As discussed in **Section 3.5, Public Health and Safety** of the 2018 Final EIS, poor physical and mental health are compounded by poverty, behavioral risk, and lack of social services (UWPHI 2017). As with Alternative 2 from the 2018 Final EIS, these factors are not likely to be affected by Alternative 4, although the sustained economic benefits, including jobs and revenues, would sustain funding for social services and access to existing physical and mental health care and health insurance for some community members through 2038. Injury may result if trespassers enter the project area, but trespassing is not likely, and any instance would be isolated. As population density near the project area is sparse, it is not likely that residents would be adversely affected by noise and vibrations from mine operations. Therefore, Alternative 4 impacts on community well-being would be beneficial, short-term, and moderate.

Land Use and Cultural Resources

Under Alternative 4, there would be some displacement of historic land use practices because of Alternative 4 (see **Section 4.23, Land Use**). There would be a short-term displacement of livestock and wildlife within the project area where mine activities are taking place. The project area would be reclaimed, and ranching and wildlife habitat would be restored upon mine closure, which would occur approximately 1 year later under Alternative 4 than under Alternatives 2 and 3 from the 2018 Final EIS. Disturbance of cultural resources under Alternative 4 would be resolved through a programmatic agreement with the State Historic Preservation Office (SHPO) (see **Section 4.14, Cultural and Historic Resources**). Tribal consultations with the Northern Cheyenne and Crow Tribes have been initiated to mitigate impacts on culturally significant resources within the direct affects analysis area and to mitigate effects on cultural resources that might affect traditional tribal ways of life (see **Section 6.1.3, Tribal Consultation Process** in the 2018 Final EIS). Recreation opportunities near or on surface water bodies and land within the project area would be lost until reclamation activities are completed, which would result in short-term, minor, and adverse effects on land use as it relates to public health (see **Section 4.18, Recreation**).

Public Safety

Noise

Noise from Alternative 4 activities would include coal and overburden blasting, use of heavy machinery, hauling, excavation, and truck traffic for coal transport and waste disposal, as described in **Section 4.22.3.1**. The nearest noise-sensitive receptors to the project area are seven scattered residences between 2.2 and 8 miles away from the project area boundary, and the city of Colstrip located 12 miles away from the project area. At these distances, no noise impacts are anticipated that would affect sensitive receptors. Mine workers and equipment operators in close proximity to noise sources would be required to wear protective hearing devices in accordance with MSHA regulations.

Solid and Hazardous Waste

Solid and hazardous waste would be contained, stored, transported, and disposed of as described in **Section 4.21, Solid and Hazardous Waste** below. Westmoreland Rosebud would handle all waste as outlined in the Waste Management Program. Workers would be required to wear protective gear and would follow procedures to reduce or eliminate risk from exposure to hazardous waste, in compliance with MSHA. Because regulatory compliance with applicable Federal and state laws would reduce or eliminate the risk of the public being exposed to hazardous waste from project activities, the effects of Alternative 4 on public health would be long-term, negligible, and adverse.

4.5.3.1 Indirect Impacts

Environmental Health

Air Quality

Indirect public health effects from air quality would include those from the Colstrip and Rosebud Power Plants. **Section 4.3, Air Quality** provides a discussion of indirect air quality impacts, which are associated with coal combustion from the Colstrip and Rosebud Power Plants. Predicted air concentrations are expected to remain below NAAQS and MAAQS, and $PM_{2.5}$ and PM_{10} are expected to remain well below the NAAQS at locations impacted by either the project area or Colstrip Power Plant Units 3 and 4 and the Rosebud Power Plant (i.e., indirect impacts). Therefore, Alternative 4 would have a short-term, negligible to minor, adverse effect on public health as it relates to air quality.

The Alternative 2 air quality model from the 2018 Final EIS (here applied to Alternative 4) indicates that DPM would drop off sharply outside of the immediate project area; therefore, risk to the public and sensitive receptors would be low due to limited exposure time and extent. PM is expected to remain below NAAQS and MAAQS thresholds in the indirect impacts analysis area.

Surface Water and Groundwater Quality

Municipal and residential drinking water in the area comes from aquifers and from the Yellowstone River, which would not be affected by the Proposed Action (see **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater**). The most likely exposure pathways from surface water would be through recreational use of surface waters (e.g., wading, swimming, or fishing) or from incidental contact.

The general water quality in the indirect affects analysis area generally meets or exceeds water quality standards, and water quality monitoring data indicate that emissions from the Colstrip and Rosebud

Power Plants would not adversely affect overall surface water quality in the analysis area (see **Section 4.3, Air Quality**, **Section 3.5, Public Health and Safety**, and **Section 3.7, Water Resources – Surface Water**). It is not likely that Alternative 4 would affect mercury concentrations at Castle Rock Lake. The Proposed Action would result in increased concentrations of selenium in the East Fork Armells Creek and nitrogen in Rosebud Creek. Concentrations of other metals and nutrients in other surface waters would not be affected (see **Section 4.7, Water Resources – Surface Water**). Due to the area's sparse population density and low recreational use frequency of these creeks, there is a low likelihood that increased risk to public health would occur from exposure to water during recreation or by incidental skin contact because of the Proposed Action. Selenium and nitrogen concentrations in drinking water sources, including the Yellowstone River, would not be affected, and no increase in public health risk through drinking water consumption would occur because of the Proposed Action.

Based on the discussion above, the likelihood that Alternative 4 would result in impacts on surface water and groundwater that would increase public health risk is low. Indirect effects on public health through impacts on water quality would be long-term and negligible.

Socioeconomic Environment and Health

Demographics and Sensitive Populations

Environmental justice populations within the indirect effects analysis area include a high proportion of American Indians and low-income populations (see **Sections 3.16** and **4.16, Environmental Justice**). The Northern Cheyenne and Crow Indian Reservations are located within the analysis area, and both tribes partake in ranching, hunting, fishing, gathering, and farming. Based on the air quality and water quality discussions (above and in **Section 4.3, Air Quality** and **Section 4.7, Water Resources – Surface Water**), the Proposed Action would not have a disproportionate impact on the environmental health of tribal members as a result of partaking in these activities.

Subpopulations with higher rates of chronic disease, including cancer, respiratory illness, and diabetes, are present within the analysis area. The incidence of asthma in Rosebud County, where the Colstrip and Rosebud Power Plants are located, is higher than the state and regional rates (see **Section 3.5, Public Health and Safety** in the 2018 Final EIS). Air and water quality, as discussed above and in **Section 4.3, Air Quality** and **Section 4.7, Water Resources – Surface Water**, would not likely fall below the regulatory standards for human health (i.e., NAAQS, MAAQS, Montana Surface Water Quality Standards). However, as described in the 2018 Final EIS, sensitive subpopulations in the area may experience adverse effects, including increased risk of infectious disease and exacerbation of chronic disease symptoms from sustained exposure to combustion emissions from project area coal. Therefore, the indirect effects on sensitive subpopulations would be short-term, minor to moderate, and adverse. These effects from Alternative 4, however, would be comparable to effects under Alternative 1, as the power plants would operate at the same level of output under all alternatives; exposure risk would last for 14 years longer under Alternative 4 as compared to Alternative 1 and 9 years longer as compared to Alternative 1.

Economics

Alternative 4 would support continued indirect sources of revenues and jobs within the analysis area, sustaining funding and access to local health resources and funding of public health and social services. **Section 4.18, Socioeconomics** provides a discussion of the indirect economic impacts of the Proposed Action, which are assumed to occur in Rosebud, Treasure, and Big Horn Counties and on the Northern Cheyenne and Crow Indian Reservations. Members of the Northern Cheyenne Tribe hold about 30 percent of indirect jobs created by the Rosebud Mine. Alternative 4 would support production from the

Rosebud Mine through 2039, resulting in sustained indirect economic support of public health services, income, and availability of health insurance through mine-related jobs and revenues. Thus, Alternative 4 would have a beneficial short-term minor effect on public health as it relates to economic conditions.

Social Characteristics

Social Services

Social services, including health care facilities and services, schools, libraries, and other services, would not be impacted as the Colstrip and Rosebud Power Plants and indirect jobs and revenues would remain the same. Alternative 4 w would support production from the Rosebud Mine through 2039, which would extend indirect revenues and funding for social services, as discussed above. This would result in a short-term moderate beneficial impact within the region. There would likely be no change to rates of insured individuals or to the availability of health care services or ratios of providers in the area because of the Proposed Action (see **Section 4.15, Socioeconomic Conditions**).

Community Health

Alternative 4 is not likely to increase chronic or infectious disease, as there is little potential for increases in exposure to air and water pollutants. There may be minor effects on sensitive subpopulations, including those with asthma or compromised respiratory systems, who live or are present near the Colstrip and Rosebud Power Plants. Likewise, it is not likely that indirect impacts on nutrition-related disease would be experienced through consumption of livestock and wildlife (see discussion above, **Section 4.7, Water Resources – Surface Water**, and **Section 4.12, Fish and Wildlife Resources**).

Alternative 4 would not likely adversely affect the well-being of communities within the analysis area. Poor overall physical and mental health are compounded by poverty, behavioral risk, and lack of social services, as discussed in **Section 3.5, Public Health and Safety** (UWPHI 2017). Alternative 4 is not likely to affect quality of life, although the sustained economic benefits and revenues would prolong funding for social services and access to existing physical and mental health care and health insurance. Behavioral risk factors, such as physical inactivity and adult smoking rates, are unlikely to be affected because there would be no major change to the community health environment in the analysis area. Likewise, injury rates and mortality rates within the analysis area would not likely change because of Alternative 4. Sustained economic security for families and individuals who are indirectly employed would maintain existing levels of well-being, including Northern Cheyenne and Crow tribal members, and sensitive subpopulations.

Based on the above discussion, Alternative 4 would have short-term minor to moderate beneficial impacts on community public health in the analysis area.

Land Use

Alternative 4 would not affect land use in the region outside of the project area, nor would it adversely affect culturally significant resources.

Public Safety

Noise

Indirect public health impacts from noise include the operations of the Colstrip Power Plant (Units 3 and 4 after dry-stack conversion) and its associated paste plant, plus the Rosebud Power Plant. These are discussed in detail in **Section 4.22.3.2**. Workers and equipment operators in proximity to noise sources would be required to wear protective hearing devices in accordance with OSHA regulations.

The impact of noise from the Colstrip Power Plant when operating at full capacity for the nearest Colstrip residences to the plant would exceed the EPA's recommended levels (see **Section 4.22**). Therefore, the impact on these residents would be long-term, moderate, and adverse. The noise impact for the Colstrip Power Plant on the seven residences nearest to the project area would be considered less than negligible.

The impact of noise from the Rosebud Power Plant for the nearest residents to the plant would exceed the EPA's recommended levels; therefore, impacts on these residents would be long-term, minor to moderate, and adverse (see **Section 4.22**). The noise impacts at the seven residences nearest to the project area and the city of Colstrip would be considered less than negligible.

Solid and Hazardous Waste

Indirect public health impacts from waste and hazardous materials include exposure to coal combustion residuals (CCR) waste generated at both the Colstrip and Rosebud Power Plants in proportion to the amount of coal burned at the plants, and on groundwater impacts from waste disposal. These are discussed in detail in **Section 4.21.3.2** and **Section 4.8.3.2**. Workers would be required to wear protective gear and would follow procedures to reduce or eliminate risk from exposure to hazardous waste, in compliance with OSHA.

CCR would continue to be disposed of as described in **Sections 3.21.2.4** and **Section 3.21.2.5** of the 2018 Final EIS, and in compliance with the Resource Conservation and Recovery Act and other state and Federal regulations. Because compliance with regulations would reduce the risk of the public being exposed to hazardous waste from the power plants, Alternative 4 would have a less than long-term, negligible, and adverse effect on public health as it relates to waste.

4.5.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect public health and safety impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, however, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, direct and indirect public health and safety impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

As outlined above in **Table 4.3-4,** air quality impacts would include lower emissions of DPM and PM due to the shorter duration and reduced scale of mining activities. Specifically, DPM emissions under Alternative 5 would be approximately 3.6 tons per year, compared to 6.4 tons per year under Alternative 4. PM_{10} emissions would be around 18.2 tons per year under Alternative 5, versus 34.2 tons per year under Alternative 4. These reductions translate to lower potential health risks for workers and nearby residents, resulting in a short-term negligible to minor adverse impact on public health within the project area and public access roads. Any potential exposure of sensitive receptors to PM would be incidental and limited in duration.

Water quality impacts would also be minimized under Alternative 5. Under Alternative 5, disturbance would be limited to the southern portion of the project area, avoiding the Trail Creek, McClure Creek, and Robbie Creek drainages. Additionally, the life of operations for Area F would be 9 years shorter, resulting in a shorter duration of potential water quality impacts that would affect public health and safety. The likelihood of human consumption of or contact with contaminated surface or groundwater would be low. Monitoring and mitigation activities would ensure compliance with water quality standards, minimizing public health risks.

The updated analysis on the social cost of GHGs, in **Section 4.4.5, Comparison Across Alternatives**, demonstrates that the shorter mining and combustion duration under Alternative 5 would lead to a reduction in GHG emissions, thereby lowering the associated social costs of climate change. Specifically, the reduced combustion of coal would decrease annual CO_2 emissions by approximately 3.0 million metric tons, CH_4 emissions by 270 metric tons, and N_2O emissions by 40 metric tons, providing significant reductions in climate-related health risks. The decrease in GHG emissions would reduce the social cost of GHGs by approximately $2.5 billion using a 3 percent discount rate, leading to fewer climate-related health issues such as cardiovascular and respiratory diseases, heat stress, and infectious diseases. Specifically, DPM emissions under Alternative 5 would be approximately 3.6 tons per year, compared to 6.4 tons per year under Alternative 4. PM_{10} emissions would be around 18.2 tons per year under Alternative 5, versus 34.2 tons per year under Alternative 4. Economic benefits from Alternative 5 would be moderate and short-term, while effects on community health and public safety would be negligible to minor.

4.5.5 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible and irretrievable commitments of public health resources because of any of the alternatives.

4.6 GEOLOGY

This section discloses direct and indirect impacts on geology resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine geologic conditions and the analysis areas used for this impacts analysis are described in **Section 3.6, Geology**.

4.6.1 Analysis Methods and Impact and Intensity Thresholds

Geology impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.6.1** of the 2018 Final EIS, beginning on page 505. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on geology are the same as those defined in the 2018 Final EIS in **Table 126**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.6.2 Alternative 1 – No Action

The types of direct and indirect geology impacts under Alternative 1 (as described in this SEIS)[66] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. As with Alternative 4, mining in the project area would result in a long-term major adverse impact on the analysis area geology that would result in impacts on the hydrogeologic system (see discussion of hydrogeologic impacts in **Section 4.8, Water Resources – Groundwater** and **Section 4.24, Soil**). The placement of heterogeneous spoil could preclude future access to the McKay Coal bed. As with Alternative 4, the creation of spoil next to geologically unaltered unmined areas (either outside of the project area or the drainage areas within the indirect effects analysis area) would result in indirect long-term impacts due to the different rates at which these materials would erode.

Under Alternative 1, direct and indirect geology impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.6.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect geology impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.6.3** of the 2018 Final EIS, beginning on page 506. Under Alternative 4, half a million tons more coal would be mined[67] and approximately 28

66. Direct and indirect geology impacts of Alternative 1 – No Action were described in **Section 4.6.2** of the 2018 Final EIS, beginning on page 505. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

67. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.6.3.1 Direct Impacts

Impacts from mining under Alternative 4 would result in the disturbance of 4,288 acres within the proposed direct effects analysis area and the direct removal of an estimated 71.3 million tons of coal over a 20-year period. The mining process would alter the overburden geology in the analysis area. The removal of overburden and the Rosebud Coal and the subsequent replacement of spoil would result in the removal of rock outcrop features and the alteration of the horizontal continuity of the overburden, resulting in a long-term major adverse impact on geologic resources that would last until the spoil is eroded away. As discussed in **Section 4.2, Topography**, rock-outcrop features may be created with DEQ approval from sandstone rock piles and with highwall-reduction techniques to mitigate the loss of sandstone outcrops and cliffs/bluffs. In the short term, manmade features would mimic the habitat-diversity benefits that the sandstone outcrops and cliffs/bluffs currently provide. However, their longevity would be compromised in comparison to the features they are attempting to replicate. Sandstone rock piles would be more easily eroded than the current outcrops they are replacing, and unless the highwall reduction left only competent unaltered sandstone, as opposed to more easily eroded siltstone, mudstone, or claystone, these would also be more easily eroded than the current features they are attempting to replicate.

The spoil would consist of a mixture of geologically distinct vertical layers of sandstone, siltstone, mudstone, and claystone. As a result, the physical characteristics of the overburden as spoil would be altered and would represent a mélange deposit consisting of fragments of the overburden geologic deposits (sandstone, siltstone, mudstone, claystone) and the resulting fine-grained sediment generated due to the destruction of these stones into fragments. In addition, the spoil would contain non-hazardous construction, mining, or agricultural debris allowed by DEQ for disposal in the mine pits. The spoil would consist of a well-graded heterogeneous mixture of lithified and non-lithified material and non-hazardous construction debris of wood, metal, and concrete. The lithified fragments of rock would likely vary in size; vertical distribution would occur with large rock fragments rolling into the bottom of the pit as spoil is backfilled. Alternative 4 would result in a long-term major adverse impact on the analysis area geology that would result in impacts on the hydrogeologic system (see discussion of hydrogeologic impacts in **Section 4.8**, **Water Resources – Groundwater** and **Section 4.24, Soil**). If acid, acid-forming, toxic, toxin-forming, or other deleterious geologic materials are identified as part of implementation of the Spoil Monitoring Plan, they would not be buried as spoil or stored close to streams, negating their impact on hydrogeologic resources. In addition to the geologic impacts related to mining, the placement of heterogeneous spoil could preclude future access to the McKay Coal bed.

4.6.3.2 Indirect Impacts

The creation of spoil next to geologically unaltered unmined areas (either outside of the project area or the drainage areas within the indirect effects analysis area) would result in indirect long-term impacts due to the different rates at which these materials would erode. Differential erosion of the spoil itself would be the preferential erosion of the softer stone fragments and non-lithified sediment relative to the harder stone, metal, and concrete fragments. Differential erosion in the indirect effects analysis area would be the preferential erosion of the spoil relative to areas not mined along the major drainages and the undisturbed areas outside of the analysis area. Long-term differential erosion of these two dissimilar materials over an unknown geologic time would likely result in the topographic inversion of the area where the drainage valleys become buttes over time as the more easily eroded spoil is eroded more quickly than the undisturbed former drainage valleys. This would result in topographic changes unique to the areas where spoil was deposited until the erosion of the spoil material was complete. Because the current rock outcrops and overburden are short-lived occurrences (in that they would be eroded over time regardless of the alternative), there would be long-term minor adverse impacts on the overburden and rock outcrop features with new rock outcrop features created due to differential erosion.

4.6.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect geology impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. As with Alternative 4, mining in the project area would result in a long-term major adverse impact on the analysis area geology that would result in impacts on the hydrogeologic system (see discussion of hydrogeologic impacts in **Section 4.8, Water Resources – Groundwater** and **Section 4.24, Soil**). The placement of heterogeneous spoil could preclude future access to the McKay Coal bed. As with Alternative 4, the creation of spoil next to geologically unaltered unmined areas (either outside of the project area or the drainage areas within the indirect effects analysis area) would result in indirect long-term impacts due to the different rates at which these materials would erode.

Under Alternative 5, direct and indirect geology impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.6.5 Irreversible and Irretrievable Commitment of Resources

Under all action alternatives, removal of the Rosebud Coal and the associated overburden would be an irreversible and irretrievable impact on geologic features and coal reserves. This would represent an irreversible impact on the analysis area geology. After the spoil erodes below the depth of mining, the underlying unaltered rocks below the mined-out former Rosebud Coal would begin to be exposed. Because the geology below the Rosebud Coal would not be altered by any of the action alternatives, impacts related to any of those alternatives would cease after the spoil eroded away.

4.7 WATER RESOURCES – SURFACE WATER

This section discloses the direct and indirect effects on surface water resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. This analysis has been revised to address the deficiencies identified in the 2022 court order (see **Section 1.1, Introduction**). Specifically, this section analyzes the indirect effects of mine expansion on water withdrawals from the Yellowstone River and a reasonable range of alternatives. An updated description of the indirect analysis methods is provided in **Section 4.7.1.1**; surface water effects analysis is provided for three updated alternatives in **Section 4.7.2** (Alternative 1), **Section 4.7.3** (Alternative 4), and **Section 4.7.4** (Alternative 5); and an updated analysis of indirect effects of Alternative 4 mine expansion on water withdrawals from the Yellowstone River is provided in **Section 4.7.3.3**. Pre-mine and existing surface water conditions and the analysis areas used for this impacts analysis are described in **Section 3.7, Water Resources – Surface Water**.

4.7.1 Analysis Methods and Impact and Intensity Thresholds

Surface water impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS; these are described below. As applicable, this environmental consequences section has been updated from the 2018 Final EIS to incorporate information disclosed in the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), which is also referred to as the CHIA in this SEIS, as well as updated monitoring data collected since the data evaluated in the 2018 Final EIS and updated hydrologic information reported in the Annual Hydrology Reports prepared since the 2018 Final EIS. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.7.1.1 Analysis Methods

Direct Effects

Hydrology and water quality data collected by Western Energy (now Westmoreland Rosebud) in the analysis area from mid-2016 through 2023 were used to describe existing conditions, which represents an update of data that were used for the 2018 Final EIS (through mid-2016). The 2016 through 2023 period includes a similar range of climate conditions as described in the 2018 Final EIS, shown to include very wet to very dry conditions and average conditions, as described in **Section 3.7, Water Resources – Surface Water**. The hydrologic and water quality information for the project area may not be representative of typical seasonal or annual conditions and does not represent the variability that occurs over the long term.

Effects on peak stream flows were quantitatively analyzed using U.S. Geological Survey (USGS) regression equations developed for Montana (Parrett and Johnson 2004). Western Energy used the U.S. Department of Agriculture (USDA) Water Erosion Prediction Project (WEPP) and Sediment, Erosion, Discharge by Computer Aided Design (SEDCAD) models to evaluate the impact of mining disturbance on sediment yields in drainages in the analysis area (PAP, Appendix U). The WEPP model was used to estimate average annual sediment yield based on existing vegetation and land use in the direct effects analysis area. Sediment yield from the reclaimed land in the analysis area was modeled using SEDCAD. Other effects were evaluated qualitatively or quantitatively based on data provided by Western Energy in its water quality database, information provided by Western Energy in the Area F PAP and appendices, information collected in an October 2014 field visit to the project area, information provided by DEQ on the Rosebud and Big Sky Mines, and the analysis provided in **Section 4.8, Water Resources – Groundwater**.

Indirect Effects

The indirect effects analysis area includes the Yellowstone River from Cartersville Dam (location chosen to account for indirect effects of water withdrawals by the Colstrip Power Plant and because it is a barrier to fish passage and likely precludes pallid sturgeon above the dam) downstream to the confluence with the Tongue River. The Yellowstone River diversion point for the Colstrip Power Plant's 69 cubic feet per second (cfs) water right is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam. USGS streamflow data for the Yellowstone River and water rights data from the Montana Department of Natural Resources and Conservation (DNRC) were reviewed to determine potential effects of the Colstrip Power Plant's water withdrawals from the Yellowstone River on surface water hydrology (**Section 4.7.3.3**) and surface water rights (**Section 4.9.3.4**) within the indirect effects analysis area.

Water quality data collected by DEQ, the Northern Cheyenne Tribe, and Montana PPL Corporation were reviewed to determine historical and recent (where data are available) mercury, selenium, copper, nitrate+nitrite, and total nitrogen concentrations in Sarpy Creek, Armells Creek (including its tributary East and West Forks), Rosebud Creek (including its tributaries Lame Deer, Miller, Pony, and Spring Creeks), and the Yellowstone River (between the Cartersville Dam and the confluence with the Tongue River). In addition to the water quality data, air quality modeling conducted for this EIS (see **Section 4.3, Air Quality**) was used to evaluate potential effects of atmospheric deposition of mercury, selenium, and copper from the Colstrip and Rosebud Power Plants on stream water quality within the indirect effects analysis area. An analysis of effects on stream water quality from deposition in the indirect effects analysis area was limited to mercury and selenium, for which the most stream water quality data were available in the analysis area, and copper, which was predicted by the air quality modeling to have the greatest deposition rate of all the modeled metals. Other metals were not evaluated because the deposition areas for antimony, arsenic, cadmium, chromium, and lead were predicted to be very small.

Water quality data from PPL Montana LLC's Colstrip Stream Electric Station Administrative Order on Consent Plant Site Report (Hydrometrics 2015) were used to evaluate how the disposal of coal combustion products in ponds, as well as the use of other on-site ponds and ponds near Colstrip, has affected downstream surface water quality.

4.7.1.2 Impact and Intensity Thresholds

The thresholds for assessment of impacts (negligible, minor, moderate, or major) on surface water hydrology and water quality are the same as those defined in the 2018 Final EIS in **Table 127**. Impacts are also defined as short-term, long-term, or both (see **Appendix 1**).

4.7.2 Alternative 1 – No Action

The types of direct and indirect surface water impacts under Alternative 1 (as described in this SEIS)[68] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, impacts would be limited to the southeastern portion of the project area (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine

[68]. Direct and indirect surface water impacts of Alternative 1 – No Action were described in **Section 4.7.2** of the 2018 Final EIS, beginning on page 505. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. Under Alternative 1, direct and indirect surface water impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

As with Alternative 4, the overall impacts on the hydrologic balance in the direct effects analysis area would be long-term, moderate, and adverse, and effects on floodplains would be short-term, minor, and adverse. Spring flows within the project area would be affected by mining, and the effects would range from reduced flow, particularly if the source of the spring water is at least partially from the Rosebud Coal, to complete elimination of the spring if its source is solely from the Rosebud Coal or overburden that would be removed. It is unlikely that springs whose source is either the Rosebud Coal or overburden that is to be mined would redevelop in the postmining period. Overall impacts on spring flows and the beneficial uses of spring water in the analysis area would be long-term and moderate. Removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period that may extend beyond 50 years as described below. Groundwater that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Assuming all runoff from disturbed lands were effectively captured and treated before release to any of the unmined streams in the analysis area, and all discharges at MPDES Permit outfalls met effluent limits, adverse effects on stream water quality should be minimal, and beneficial uses should be protected. Until the spoil is resaturated, remaining Rosebud Coal groundwater would not reach the major drainages. It is not known how much time would be required to resaturate the spoil; due to the nature of the spoil and based on Western Energy's groundwater model, the groundwater table would take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). Presently, in areas reclaimed 40 years ago, the groundwater table in the spoil is still recovering. Stream flow from the upstream areas of the Black Hank Creek tributaries may be reduced or may not flow through the reclaimed area as some or all surface flow may infiltrate into the spoil rather than flowing to the lower portion of the watershed. Black Hank and Donley Creek stream flows in the project area would be reduced and may be eliminated except at locations upstream of the areas to be mined, resulting in a long-term, minor to moderate, and adverse impact. Similarly, the overall impacts of mining activities on surface water quality and associated beneficial uses of streams in the analysis area would be long-term, minor to moderate, and adverse. The water supply of one mapped pond (Pond 4, located adjacent to Black Hank Creek downstream from the mine pits) may be reduced or eliminated during mining due to the impoundment of runoff that is a source of supply to the pond or due to the reduction or elimination of spring flows that are a source of supply to the pond. After mining, the pond would be reestablished, and up to three sediment ponds (located downstream of the proposed mine pits) would be retained until reclamation is complete to provide water supplies for wildlife and livestock; thus, the overall effect on pond water supply in the direct effects analysis area would be short-term, minor to moderate, and adverse. To mitigate the general lack of water in the vicinity of the project area (due to climate and not primarily as a consequence of mining), Westmoreland Rosebud proposes enhancement features within the PMT to capture water when available and use it to enhance habitat for wildlife and livestock, and to establish wetlands. These features would be in the form of small depressions that would store water following runoff events, thereby providing water sources, promoting establishment of wetland species, and diversifying the postmining habitat types within the project area. These small depressions would also help retain sediment within the project area.

Impacts on the direct effects analysis area for Alternative 1 would be similar to impacts for Alternative 4, but since 3,267 fewer acres would be disturbed under Alternative 1 and because the location of mine pits would be limited to the Donley Creek and Black Hank Creek watersheds, the remaining three watersheds (Trail Creek, McClure Creek, and Robbie Creek) in the direct effects analysis area would not be impacted from mine pit activity under Alternative 1. Impacts on the indirect effects analysis area for Alternative 1 would be similar to impacts for Alternative 4, but since the life of operations for Area F and the time period for combustion of project area coal in the Colstrip and Rosebud Power Plants would be 14 fewer years under Alternative 1, there would be a shorter duration of potential impacts related to water withdrawal from the Yellowstone River to supply the Colstrip Power Plant and trace metal deposition onto surface water bodies due to coal combustion at the two power plants.

4.7.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

4.7.3.1 Summary of Impacts

Direct and indirect surface water impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.7.3** of the 2018 Final EIS, beginning on page 509. Under Alternative 4, half a million tons more coal would be mined[69] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

It is anticipated that under Alternative 4 (as for Alternative 2 in the 2018 Final EIS), the greatest impacts on surface waters would be:

- The loss of tributaries and upper McClure Creek within the mining footprint during mining
- The loss of some existing springs and stock ponds within the mine disturbance boundary
- The reduction or elimination of stream flows, spring flows, and water supply to stock ponds where the source of water is from the Rosebud and/or McKay Coal aquifers

Some surface runoff to streams would be captured in sediment ponds and discharged to streams at permitted MPDES outfalls during mining. Westmoreland Rosebud has obtained MPDES Permit coverage (MPDES Permit MT-0031828) for all discharges from the project area to surface waters.

Changes to site hydrology in the direct effects analysis area would continue throughout project area mining and reclamation until sedimentation ponds were removed during the reclamation process and the watershed topography and hydrology were restored to conditions similar to pre-mine conditions. Based on Western Energy's groundwater model, the groundwater table will take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). Presently, in areas reclaimed 40 years ago, the groundwater table in the spoil is still recovering. In addition, it may take hundreds of years for the bedrock (overburden and Rosebud Coal) aquifers to recover to near pre-mining conditions (Nicklin 2017). Other effects would be changes to in-stream and spring-fed pond water quality during mining and to

69. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

stream water quality, which would occur after mining and reclamation was completed due to the discharge of groundwater from the spoil to streams downslope of the mine. Westmoreland Rosebud would be required to meet postmining land use performance standards and protect pre-mine and anticipated beneficial uses of the water.

To mitigate the general lack of water in the vicinity of the project area (due to climate and not primarily as a consequence of mining), Westmoreland Rosebud proposes enhancement features within the PMT to capture water when available and use it to enhance habitat for wildlife and livestock, and to establish wetlands. These features would be in the form of small depressions that would store water following runoff events, thereby providing water sources, promoting establishment of wetland species, and diversifying the postmining habitat types within the project area. These small depressions would also help retain sediment within the project area.

4.7.3.2 Direct Impacts

Surface Water Hydrology Impacts

Springs

Potential effects on the 14 monitored springs in the project area during and after mining are summarized in **Table 4.8-1** in **Section 4.8, Water Resources – Groundwater**. Springs that are not expected to be affected by mining include Springs 1, 4, 5, and 6 (overburden springs located southwest of the analysis area and upgradient of the area to be mined), Spring 7 (within the 74-acre area not approved for mining), Spring 14 (one-half mile downstream from the project area), and Springs 2 and 12 (although they are expected to be affected by nearby road construction). Springs expected to be affected by relocation of the county road and construction of the haul road (see **Section 2.4.3.4, Roads** in the 2018 Final EIS), which would disturb the ground surface near the springs, include Springs 2, 12, and 13 as well as Springs 8 and 11 prior to their expected elimination due to mining activities. The flow of springs near the mining footprint would be reduced or eliminated by mining if their water source is the overburden or Rosebud Coal (which would be removed) or the McKay Coal, in which groundwater drawdown would occur; this includes Spring 13 as well as Spring 8 prior to its expected elimination due to mining activities. Springs 3, 8, 9, 10, and 11 are expected to be eliminated due to mining activities. However, the impact of the removal of the springs on the direct effects analysis area would be reduced as a result of wetland mitigation, reclamation to reestablish the hydrologic balance to the extent possible, and water supply replacement as described in the PAP. Mitigation plans will be developed and implemented for all springs that are impacted by mining-related activities as also described in the PAP. The timing of effects on spring flow would be related to the mining sequence (see PAP, Exhibit A). Spring flows would not be reduced or eliminated until the Rosebud Coal in the vicinity of the spring was mined out. After mining ceased, pre-mine flow conditions would not return to springs whose aquifer sources were removed. If some of the entire spring source is McKay Coal and groundwater drawdown in the McKay Coal reduced the flow during mining, spring flow would recover as the groundwater table recovered. As described in **Section 4.8, Water Resources – Groundwater**, the backfilled spoil would be less capable of transmitting groundwater horizontally than the original overburden; however, it is possible that springs from the backfilled spoil may develop within or downslope of the direct effects analysis area. For example, in Permit Area B of the Rosebud Mine, two small springs have developed in drainage bottoms during reclamation that appear to be a result of preferential subsurface flow paths in the spoil (DEQ 2015d). Overall impacts on spring flows and the beneficial uses of spring water in the analysis area as a result of the Proposed Action would be long-term and moderate.

Streams

Streams located south and west of the direct effects analysis area are upstream of the project area and would not be affected by mining. During mining, perennial and intermittent stream flows in the project area in sections of McClure, Robbie, and Donley Creeks would be reduced and may be eliminated except at locations upstream of the areas to be mined (such as upper Donley Creek). These stream sections are described in **Section 3.7.5.2, Streams in the Direct Effects Analysis Area**. Effects on groundwater contributions to perennial and intermittent stream flow would occur due to reduced water availability from the McKay Coal and/or removing the overburden and/or Rosebud Coal aquifers that are sources of water to these streams via either springs (for which effects are shown in **Table 4.8-1** in **Section 4.8, Water Resources – Groundwater**) or the alluvium. In addition, the direction of groundwater flow in the unmined areas where the Rosebud Coal was not mined would be shifted toward the mine pits rather than to the alluvium in the stream channels. After mining, until the backfilled spoil was resaturated, remaining Rosebud Coal groundwater would not reach the major drainages. As the spoil resaturated, water would begin to flow from the spoil to downslope stream channels. Based on Western Energy's groundwater model, the groundwater table will take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). Presently, in areas reclaimed 40 years ago, the groundwater table in the spoil is still recovering. In addition, it may take hundreds of years for the bedrock (overburden and Rosebud Coal) aquifers to recover to near pre-mining conditions (Nicklin 2017). Groundwater contributions to stream flow from the reclaimed area would eventually return to Robbie and Donley Creeks, but as described in **Section 4.8, Water Resources – Groundwater**, the rate of flow at these locations would be less because there would no longer be discharge from the Rosebud Coal and, due to the nature of the spoil, discharge from the spoil would likely be less than previously occurred from the Rosebud Coal. In addition, the location of groundwater discharge and perennial or intermittent flow in the creeks may change due to the change in water source (from Rosebud Coal to spoil). Once the water table recovered in the McKay Coal, water from the McKay would discharge again to stream channels where it had previously discharged. Growth and propagation of aquatic life may be lost in reaches adjacent to mining that become ephemeral during mining and until water level recovery was complete. The effects of reducing groundwater contributions to stream flow at specific locations would be mitigated through wetland mitigation and reclamation to reestablish the hydrologic balance to the extent possible, as described in the PAP. Effects on groundwater contributions to stream flows and on the overall beneficial uses of perennial and intermittent stream flows in the direct effects analysis area would be long-term, minor to moderate, and adverse.

Much of the flow in the direct effects analysis area streams occurs as a result of runoff from storm events or snowmelt. During mining, the majority of runoff from undisturbed land upstream of the mine would flow through the undisturbed main stream channels (see **Figure 3.7-1** in **Section 3.7, Water Resources – Surface Water**). Tributary drainages would be mined out, and runoff from undisturbed lands upstream of the active pit would be captured in the pit or sediment ponds. Surface runoff from disturbed areas would be impounded in the mine pits or sediment ponds, resulting in reduced ephemeral flows during precipitation or snowmelt runoff events. Based on the expected 19-year mining sequence (see **Section 2.4.3.5, Approximate Mining Sequence**; see also PAP, Exhibit A), the Donley Creek drainage and a small part of the Black Hank Creek drainage would be affected first, then the Robbie Creek drainage, followed by the McClure Creek drainage, and finally the rest of the Black Hank Creek drainage. Estimated mean annual runoff and peak flows for analysis area streams and other ungaged streams in southeast Montana were determined using multiple regression equations developed by the USGS (Parrett and Johnson 2004). Using the regression equations based on basin characteristics, the single most important independent variable is drainage area, and in southeast Montana, the other variable used in the equations is percentage of basin covered by forest (defined in the analysis area as the conifer/sumac and woody draw vegetation communities; see **Section 3.10, Vegetation** and **Figure 45** in the 2018 Final EIS). Other variables considered were precipitation, basin elevation, and channel length and slope. During mining, the watershed areas of McClure, Robbie, Donley, and Black Hank Creeks would be reduced as each watershed was mined; thus, it is expected that runoff to streams would decrease. The Trail Creek watershed is not considered in this analysis because none of the watershed area is approved for mining (a portion of the 74-acre area that is not approved for mining). Using the USGS equations (Parrett and Johnson 2004) to estimate peak flows on these streams, percent flow reductions at full mine development are provided in **Table 4.7-1** (2018 Final EIS **Table 129**). To show the effect of a reduction in watershed area, the calculations assume that the percent forest cover in each basin would not change as a result of mining; however, if the percent forest cover decreased, peak flows would increase, and if the percent forest cover increased, peak flows would decrease. The flows provided in **Table 4.7-1** (2018 Final EIS **Table 129**) are for each stream from the top of each watershed to the downstream, northeastern project area boundary. Before all mine passes were excavated in each watershed, effects on stream flows would be less and would progressively increase to those shown in **Table 4.7-1** (2018 Final EIS **Table 129**). The drainage area and stream flow in Horse Creek would not change because no mining disturbances would occur in that drainage.

Table 4.7-1. Estimated Peak Flows for Streams in the Project Area Before Mining and at Full Mine Development.

Drainage Basin	Watershed Area in the Project Area (acres)	Pre-mining 2-yr Peak Flow (cfs)	2-yr Peak Flow at Full Mine Development (cfs)	Percent Reduction in 2-yr Peak Flow	Pre-mining 10-yr Peak Flow (cfs)	10-yr Peak Flow at Full Mine Development (cfs)	Percent Reduction in 10-yr Peak Flow	Pre-mining 100-yr Peak Flow (cfs)	100-yr Peak Flow during Mining (cfs)	Percent Reduction in 100-yr Peak Flow
McClure Creek[1]	463.1	9	7.6	15	59	51	13	260	231	11
Robbie Creek	2,678.8	29	24	17	158	136	14	591	519	12
Donley Creek	5,440.6	41	38	7	217	204	6	783	742	5
Black Hank Creek	6,344.6	44	42	5	232	220	5	830	792	5

1. Since the publishing of the 2018 Final EIS, 74 acres (approximately 30 acres of which is in the McClure Creek drainage basin) has been removed from the proposed mining area. The analysis shown above reflects corresponding changes to the affected drainage basin (less affected area than reflected in the 2018 Final EIS) resulting in slightly higher peak flows during mining and slightly lower corresponding peak flow reductions in the McClure Creek drainage basin, as compared to data reflected in the 2018 Final EIS.
Source for peak flow calculations: http://wy-mt.water.usgs.gov/freq?page_type=gen_stats_1.

Within each analysis area watershed, when all of the mine passes were being or had been mined, and until the watersheds were fully restored, estimated 2-year, 10-year, and 100-year peak flows would be reduced by up to 15 percent in McClure Creek, up to 17 percent in Robbie Creek, and less than 10 percent in Donley and Black Hank Creeks. In addition, disturbed area runoff would be controlled by a network of roadside ditches, sediment-control ponds, and sediment traps. Surface runoff from disturbed areas would be impounded in the mine pits and/or sediment-control structures in accordance with the Hydrologic Control Plan shown on **Figure 4.7-1** (2018 Final EIS **Figure 107**). The detention and controlled release of surface runoff would result in additionally reduced peak flows to the West Armells Creek drainage. Some of the water stored in the sediment ponds or mine pits would be used (such as for dust control), some would evaporate, and some would infiltrate to the subsurface; this is water that would be lost as surface or subsurface flow in the stream channels. Loss of runoff water due to storage of runoff in the sediment ponds or mine pits, evaporation, or infiltration could affect the local hydrologic balance (EPA 2001). The volume, timing, and frequency of ephemeral flows in direct effects analysis area streams and West Fork Armells Creek would change. The effect of reduced peak flows may be changes to stream morphology and reduced surface and subsurface (via the alluvium) recharge to the streams below the analysis area, including the West Fork Armells Creek. Reduced peak flows may result in less sediment transport, channel narrowing, and less water storage within channel banks and floodplains. It may be difficult to separate these effects from the effects of variability in runoff-producing storm events.

During mining, water would be discharged when needed from sedimentation ponds to McClure, Robbie, Donley, and Black Hank Creeks via MPDES outfalls. The sedimentation ponds would be designed to retain up to the volume of runoff produced by the theoretical 10-year 24-hour storm event, so runoff from larger events would discharge to the main channels (PAP, Appendix O). Discharge may also occur when the ponds needed to be drained to comply with the minimum 24-hour retention capacity requirement per ARM 17.24.639(2). Stored water would be removed by using a non-clogging dewatering device or conduit approved by DEQ. Discharges to mine area streams would replace some of the storm water runoff, but the volume, timing, and frequency of such discharges would not be the same as would occur naturally, so effects on channel morphology would not be offset by discharges at the MPDES outfalls (**Figure 2.24**).

As the mine site is reclaimed (see **Section 2.4.4, Reclamation Plan** and **Figure 2.25** for the proposed timing of reclamation), the PMT, drainage areas, and geomorphic characteristics would be designed to be similar to pre-mine topography (given the constraints of earthmoving equipment, costs, other ongoing reclamation, and the volume of spoil available to fill the pits and restore the site topography) (PAP, Appendix J, Tables J-1 and J-2). As a result, peak flows would return to near pre-mine peak flows (PAP, Appendix J, Tables J-3 to J-5). The Montana Surface and Underground Mine Reclamation Act (MSUMRA) requires that drainage basins be restored during reclamation to the original stream function. To the extent possible during reclamation, smooth transitions would be constructed between undisturbed and reclaimed land to reestablish surface drainage patterns. The disturbed tributary drainages and stream channels would be reconstructed to the approximate original drainage configurations, with channel geometry similar to pre-mine conditions; however, there would be small differences in watershed areas and shapes postmining that would slightly alter runoff within the watersheds (see **Section 2.4.4.5, Postmining Topography and Drainage Basin Design** and **Figure 2.26**). The disturbed stream channels within the project area formerly governed by geologic structure and the inherent variability of different strata would no longer exist. Geologic structure within the stream channels would not be disturbed upstream and downstream of the project area. Spoil in the designed postmining drainages would be covered by several feet of topsoil and vegetated. The reclaimed drainages would be designed to minimize erosion and protect the hydrologic balance.

Although stream flows may be restored to conditions similar to pre-mine stream flows, stream flow from the upstream areas of the tributaries may be reduced or may not flow through the reclaimed area because the vertical percolation rate in the spoil would be greater than in the overburden (see **Section 4.8, Water Resources – Groundwater**). Some or all surface flow may infiltrate into the spoil rather than flowing to the lower portion of the watershed, as has been observed at the Big Sky Mine during reclamation (DEQ 2015e). Whether surface flow across the spoil was reduced or totally infiltrated would be dependent on topography; where fairly flat, there may be no flow after reclamation. In addition, baseflow in the streams from groundwater discharge to the stream channels would not begin until after groundwater levels recovered more than 50 years to possibly hundreds of years after mining, and discharges to streams may occur at different locations than occurred before mining. Based on Western Energy's groundwater model, the groundwater table will take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). Presently, in areas reclaimed 40 years ago, the groundwater table in the spoil is still recovering. In addition, it may take hundreds of years for the bedrock (overburden and Rosebud Coal) aquifers to recover to near pre-mining conditions (Nicklin 2017). The overall impacts from the Proposed Action on ephemeral stream flows in the direct effects analysis area would be adverse and minor in the short term, to negligible in the long term.

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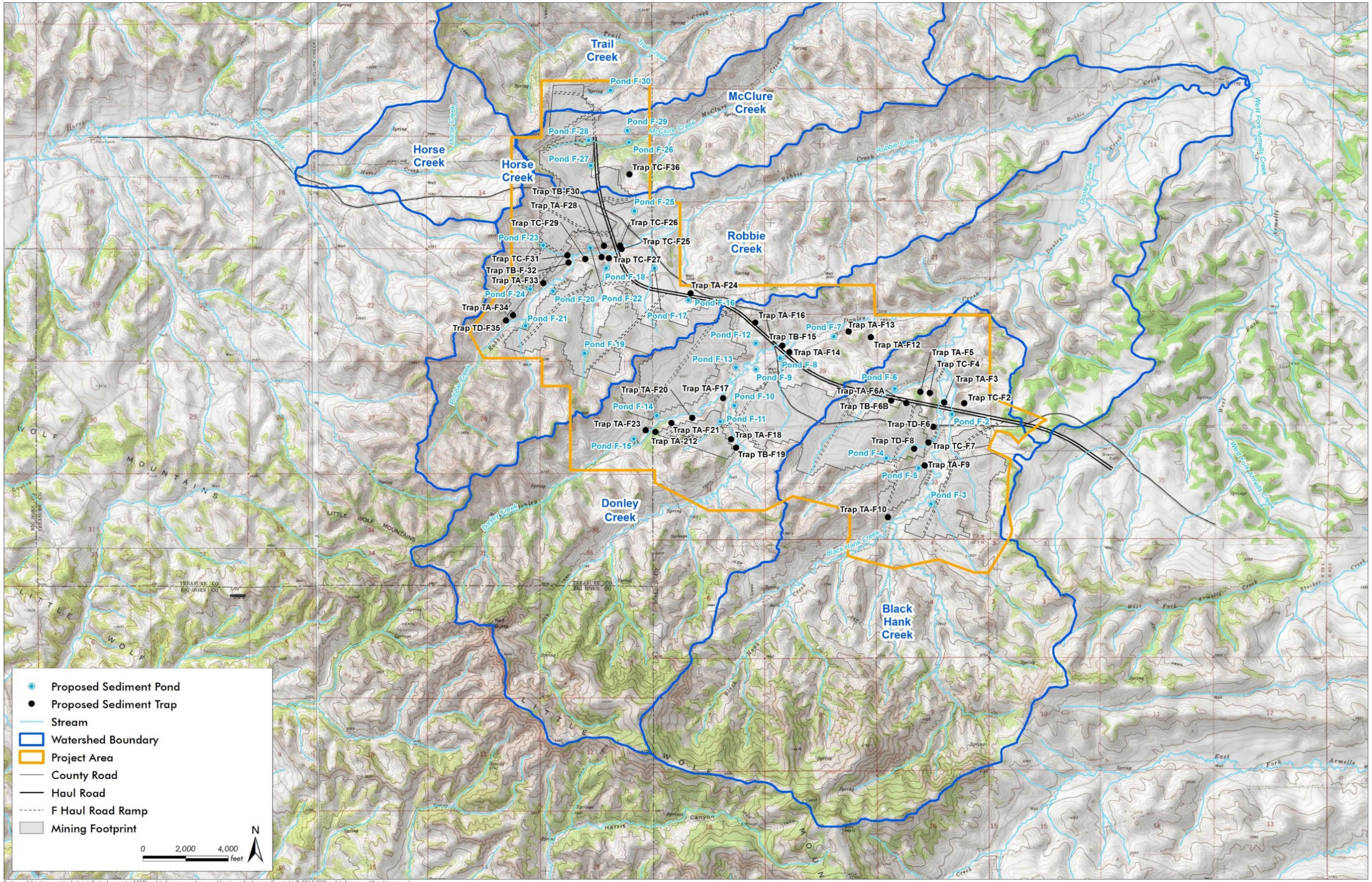

Figure 4.7-1. Proposed Project Area Mining Footprint, Haul Roads, and Sediment Ponds and Traps (2018 Final EIS Figure 107).

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Ponds

None of the seven monitored man-made livestock ponds would be removed during mining. Other ponds in the analysis area are not mapped, but if they are within the mining footprint, they would be eliminated. The water supply of two ponds (Pond 4, located adjacent to Black Hank Creek, and Pond 8, located adjacent to McClure Creek, both downstream from the mine pits) may be reduced or eliminated during mining due to the impoundment of runoff that is a source of supply to the ponds or due to the reduction or elimination of spring flows that are a source of supply to the ponds. After mining, the two ponds would be reestablished, and up to ten sediment ponds (located downstream of the proposed mine pits) would be retained until reclamation is complete to provide water supplies for wildlife and livestock; thus, the overall effect on pond water supply in the direct effects analysis area would be short-term, minor to moderate, and adverse. As discussed in **Section 4.9, Water Resources – Water Rights**, if a pond with a water right for stock watering were to become unusable, a suitable replacement source would be provided by Westmoreland Rosebud. To mitigate the general lack of water in the vicinity of the project area (due to climate and not primarily as a consequence of mining), Westmoreland Rosebud proposes enhancement features within the PMT to capture water when available and use it to enhance habitat for wildlife and livestock, and to establish wetlands. These features would be in the form of small depressions that would store water following runoff events, thereby providing water sources, promoting establishment of wetland species, and diversifying the postmining habitat types within the project area. These small depressions would also help retain sediment within the project area.

Hydrologic Balance

Mining would affect the hydrologic balance within and downstream of the project area in the following ways:

- Mining through tributaries, which would affect stream and alluvial flows
- Altering the topography, which would affect stream and alluvial flows
- Storing runoff, which would affect stream and alluvial flows and alter surface water storage
- Decreasing or eliminating spring flows, which would affect stream and alluvial flows
- Eliminating some stock ponds, which would reduce surface water storage
- Storing water in sediment ponds and discharging water from MPDES outfalls, which would affect stream and alluvial flows and recharge to groundwater
- Disturbing the soil surface and removing vegetation, which would affect the interception, infiltration, evaporation, sublimation, and transpiration of water at the land surface
- Removing the Rosebud Coal aquifer, which would change groundwater storage
- Removing the overburden and replacing it with spoil, which would permanently change the vertical percolation rate (**Section 4.8, Water Resources – Groundwater** states that the vertical percolation would be greater in the spoil than in the overburden) and change groundwater storage

After mining, the watershed topography and hydrology would be restored to reestablish to the extent possible the hydrologic balance in the analysis area (see **Section 2.4.4, Reclamation Plan** and **Section 2.4.5, Protection of the Hydrologic Balance**). This reclamation would be phased (see **Section 2.4.4, Reclamation Plan** and **Figure 2.25** for the proposed timing of reclamation), with spoil backfilled into the pit after each subsequent mine pass and grading and stabilization of the spoil occurring within four spoil ridges of the active mining pass. During the final phases of spoil grading, surface drainages would be reconstructed to the approved approximate PMT, which would approximate original drainage configurations. A tributary system would be designed and constructed to restore the pre-mine incised drainages. The postmining channels and floodplains would be designed to mimic the pre-mine channels' response to rainfall events by providing channel geometry (length, slope, longitudinal profile, cross-section, and bedform) to create velocities, depths, flow areas, and other hydraulic properties similar to pre-mine properties for the same discharge events. New ponds may be constructed, and surface water flow and quality would be monitored to determine if surface water quantity and quality without treatment had stabilized to its previous undisturbed state and achieved postmining land use performance standards for livestock and wildlife use in and downstream of the project area. Effects on the hydrologic balance would vary depending on location within the direct effects analysis area. At locations where the overburden and Rosebud Coal were removed, groundwater storage would be permanently changed. At the most downstream end of the analysis area at the West Fork Armells Creek, any changes to the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in the West Fork Armells Creek basin, including the dynamic relationships among precipitation, runoff, evaporation, and changes in groundwater and surface water storage, would be restored during reclamation.

Based on Western Energy's groundwater model, the groundwater table will take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). Presently, in areas reclaimed 40 years ago, the groundwater table in the spoil is still recovering. In addition, it may take hundreds of years for the bedrock (overburden and Rosebud Coal) aquifers to recover to near pre-mining conditions (Nicklin 2017). It would not be possible to completely restore the pre-mine hydrologic balance in the direct effects analysis area after mining due to the removal and replacement of the Rosebud Coal and overburden with spoil. Westmoreland Rosebud would be required to meet postmining land use performance standards and protect pre-mine and anticipated beneficial uses of the water; thus, the overall impacts on the hydrologic balance in the direct effects analysis area would be long-term, moderate, and adverse.

Floodplains

The 100-year floodplains on Trail, McClure, Robbie, Donley, and Black Hank Creeks in the analysis area, which are about 300 feet wide, would not be mined and would remain intact. Haul roads would largely be located outside of the 100-year floodplains, but where they crossed streams, culverts would be installed that were designed for the 10-year, 24-hour storm event (see **Figure 2.23**). Structural BMPs, described in **Chapter 2**, would be used to control sediment movement and erosion, and stabilize the haul roads within the 100-year floodplains. The only other mine facilities that may be installed in the floodplains would be sediment ponds or traps. The disturbance area of the sediment ponds or traps to project area streams would be very small compared to the area of the 100-year floodplains in the analysis area. Flooding would continue to occur due to large storms, such as the 5-inch precipitation event in late May 2013 that resulted in a flow estimated to be 400 cfs at SW-90 on Donley Creek. Runoff from storms greater than the 10-year, 24-hour event would flow over any haul roads located in the floodplains, and some would flow through the culverts. It is possible that damage to the floodplain and an increased hazard to life could occur temporarily if a very large storm event damaged or washed out the haul road within one or more of the creek floodplains. It is not expected that other mine structures or mine activities would damage the floodplains or cause an increased hazard to life downstream of the project area. Effects on floodplains would be short-term, minor, and adverse.

Surface Water Quality Impacts

Surface water quality data for Areas A, B, C, D, and E were evaluated for changes in water quality that may have occurred prior to mining and during or after mining. For the most part, there were inadequate pre-mine data to make such a comparison. In addition, changes in laboratory detection limits since the 1970s and early 1980s (pre-mining), as well as natural water quality variability, made it difficult to analyze changes in stream, spring, and pond water quality due to mining. Another variable for stream water quality was the suspended solids concentration, which is variable during runoff events and can affect metal concentrations in streams. The only documented difference in water quality occurred in Pond 917 in Area D, where nitrate+nitrite and selenium concentrations were sometimes higher during and after mining than when measured before mining began in Area D.

Springs

The water quality of overburden springs located southwest of the project area and upgradient of the area to be mined such as Springs 1, 4, 5, and 6 would not be affected by mining. The water quality of springs whose source is the McKay Coal (such as Spring 13) would not be affected by mining. Rosebud Coal springs and springs within the mined area (such as Springs 3, 8, 9, 10, and 11) would be eliminated. The water quality of the spoil would generally be poor (as described in **Section 4.8, Water Resources – Groundwater**), so any springs that developed in or below the mined area from spoil groundwater would likely have higher dissolved solids, sulfate, and possibly nutrient and metal concentrations. Springs 8, 11, and 13 would be affected by construction of the haul road, which would disturb the ground surface near the springs; the effects would be short-term and minor.

Streams

Runoff from disturbed lands would be intercepted and treated by the implementation of sediment-control measures. Sedimentation ponds would be designed for total containment of runoff from the 10-year, 24-hour precipitation event plus storage of 3 years of sediment yield from disturbed areas in the mine area. Locations of sedimentation ponds and associated ditches are shown on **Figure 4.7-1** (2018 Final EIS **Figure 107**; see also **Section 3.7, Water Resources – Surface Water**). During mining, runoff from undisturbed land above the pit would be intercepted by the pit or by temporary impoundments or traps in the drainages above the pit. Very large runoff events would be intercepted by the pit. A system of ditches and traps proposed for the perimeter haul road is shown in the Approximate Hydrologic Control Plan (PAP, Exhibit D) and discussed in **Section 2.4.5.2, Surface Water Management and Sediment Control Measures**. Ditches along the haul road would direct runoff to either sedimentation ponds or sediment traps. In areas where the haul road crossed the ephemeral drainages, runoff from the road embankment would be collected by sediment traps. Ditches would roughly parallel the access roads to intercept runoff from disturbed lands. This containment system should prevent any sediment or untreated runoff from leaving the project area. All discharges from the proposed mining areas to state surface waters would be required to comply with applicable MPDES Permit effluent limits.

Westmoreland Rosebud would also use other sediment-control measures for roads and other disturbed areas as described in **Section 2.4.5.2, Surface Water Management and Sediment Control Measures** in the 2018 Final EIS. Erosion control BMPs listed by DEQ in the MPDES Permit for the project area would be required. Sediment and erosion control structures would remain in place after mining for as long as needed until all disturbed areas were fully reclaimed. Structural BMPs that have been proposed for use in the project area by Westmoreland Rosebud are outlined in **Section 2.4.5.2, Surface Water Management and Sediment Control Measures** in the 2018 Final EIS.

Assuming all runoff from disturbed lands were effectively captured and treated before release to any of the unmined streams in the analysis area, and all discharges at MPDES Permit outfalls met effluent limits, adverse effects on stream water quality should be minimal, and beneficial uses should be protected.

If a precipitation event occurred that was greater than the culverts, sediment ponds, ditches, and other erosion-control structures were designed for, they would not be capable of routing, holding, and/or treating sediment-laden runoff and may themselves cause erosion to roads, upland disturbed and undisturbed areas, and channels and floodplains in and downslope of the analysis area. Some storm water runoff would be captured in the mine pits, but other runoff from disturbed areas may reach streams and ponds in the unmined areas, temporarily increasing suspended sediment, dissolved solids, and total metal concentrations in streams and ponds.

During mining, the quality of storm water flow from undisturbed areas in the project area would be the same as before mining commenced if no untreated storm water runoff was released from the disturbed areas. The quality of water where it flows perennially and intermittently in sections of Trail, McClure, Robbie, and Donley Creeks, if and when such flows from the coal beds remained, would be similar to the existing quality of the Rosebud and/or McKay Coal water (see tables in **Section 4.8, Water Resources – Groundwater**).

As discussed in **Section 4.8, Water Resources – Groundwater**, after backfilling and once the spoil resaturated, groundwater may discharge from the spoil to alluvium along the major drainages, and some of the alluvial water could discharge to streams where the groundwater table intersects the stream bottom. It is not known where such discharges would occur downstream of the analysis area, and the quantity of such discharges is not known. Discharge from the spoil to streams could result in changes in water quality in the drainages compared to pre-mining conditions. Postmining, discharge to the streams would be from spoil with water quality that, compared to stream water quality, has higher dissolved solids, nutrient, and some metal concentrations. As discussed in **Section 4.8, Water Resources – Groundwater**, the quality of spoil groundwater in other areas mined by Western Energy is highly variable, so it is difficult to predict to what extent discharge from the spoil in the analysis area would affect surface water quality, and if changes in water quality due to discharge from the spoil would be separable from natural water quality variability. In addition, an evaluation of several decades of spoil water quality data from Permit Areas A and B of the Rosebud Mine shows that in a number of wells, concentrations of the following parameters have increased over time: TDS, sulfate, carbonate alkalinity, total alkalinity, chloride, dissolved iron, and dissolved manganese. After nearly 40 years of monitoring, there is no clear indication that TDS concentrations in the spoil have reached equilibrium or have shown decreases. Possible adverse effects of discharges from spoil on the water quality of downslope streams may increase over time. It is not known how long it would take for the quality of water in spoil to eventually improve as soluble salts and metals are flushed from the system. Based on spoil water quality presented in **Section 4.8, Water Resources – Groundwater**, TDS, sulfate, alkalinity, calcium, sodium, nitrate+nitrite, magnesium, and manganese concentrations in streams below the spoil may increase and exceed nitrate+nitrite and total nitrogen standards as well as and recommended limits for the other parameters for livestock, other ruminants, and aquatic life when and where groundwater discharge is the major or only source of water to streams. As stated in **Section 3.7, Water Resources – Surface Water**, cattle and wildlife can adapt to higher TDS concentrations, but there may be chronic adverse health effects. If surface water became unusable for its specified postmining beneficial use due to water quality changes, a suitable replacement source would be provided. The overall impacts of the Proposed Action on surface water quality and associated beneficial uses of streams in the analysis area would be long-term, minor to moderate, and adverse.

Ponds

During mining, for ponds whose water supply was reduced due to the impoundment of runoff (such as Pond 4), the quality of the pond water may improve due to the reduction in sediment-laden runoff entering the pond and reduced total metals associated with the suspended solids in the water. For any ponds whose water supply was reduced during mining due to the reduction or elimination of spring flows that are a supply source, the water quality of the pond would change. The water quality of all of the ponds may degrade due to a reduction in inflows, which would increase parameter concentrations in any water remaining in the ponds. The overall effects on water quality and associated beneficial uses of ponds in the analysis area would be long-term and moderate. Postmining ponds would be supplied water from storm water runoff, so the water quality of the ponds would be similar to that of existing ponds whose source of water is only storm runoff.

Sediment Yield

Input parameters for the WEPP model to predict existing sediment yield in the analysis area included pre-mine topography and drainage basin boundaries, Natural Resources Conservation Service soil survey data, a rangeland grass system with sagebrush vegetative cover, and precipitation data from the Colstrip meteorological station (PAP, Appendix U). Running the model for a 20-year period resulted in a pre-mine average annual sediment yield for the analysis area ranging from 0 to 0.871 ton/acre/year, with an average of 0.142 ton/acre/year. Input parameters for the SEDCAD model included estimated PMT and drainage basin boundaries, an assumed 80 percent ground cover after reclamation, postmining soils that would be similar to pre-mine soils, a loam or silt loam soil texture, an erodibility factor with a soil of moderate infiltration rate and runoff potential, and a 10-year 24-hour storm event of 2.45 inches (PAP, Appendix U). The model-predicated postmining average annual sediment yield ranged from 0.001 to 0.18 ton/acre/year for the postmining drainage basins in the analysis area. The postmining sediment yields would be less than or equal to pre-mine sediment yields in the majority of drainages within the Robbie Creek, Donley Creek, and Black Hank Creek watersheds, and greater than pre-mine sediment yields in some of the drainages within the Robbie Creek, Donley Creek, and Black Hank Creek watersheds. In basin area RCT-7, located in lower Robbie Creek within the project area, pre-mine sediment yield was predicted to be 0 ton/acre/year for the 131-acre basin area; postmining sediment yield after disturbance of 82.8 acres was estimated to be 0.046 ton/acre/year, with a yield of 9.4 tons of sediment from a 10-year 24-hour storm event. The largest ton/acre/year sediment yield increase and largest 10-year 24-hour storm yield were predicted to occur in basin area BHCT-6, located in Black Hank Creek within the project area. The predicted increase in BHCT-6 is from 0.021 ton/acre/year to 0.145 ton/acre/year after disturbance of 344.2 acres, with a yield of 121.9 tons of sediment from a 10-year 24-hour storm event. The largest ton/acre/year sediment yield decrease is predicted to occur in RCT-2, located in the upper Robbie Creek watershed; the yield is predicted to decrease from 0.598 ton/acre/year to 0.034 ton/acre/year. Changes in sediment yield indistinguishable from those caused by fluctuations in natural processes would not have measurable effects on streams. Increases or decreases in sediment yield in some of the basins may have localized measurable effects on stream morphology and water quality. Large increases or decreases in sediment yields, such as those predicted for RCT-2 and BHCT-6, may result in measurable effects on stream morphology, stream water quality, and aquatic habitat in parts of the watersheds in the direct effects analysis area. Although a few localized watersheds may show increases in sediment yield, the overall effect of the Proposed Action is to reduce sediment yields within the analysis area from an estimated 0.142 ton/acre/year to 0.058 ton/acre/year. The reduction would be due to less steep slopes in the PMT than in the pre-mine topography. The overall impact on surface water quality due to changes in sediment yield in the analysis area would be long-term and moderate.

Other Impacts on Surface Water Quality

If not adequately suppressed, dust from mining activities could reach surface water bodies in the analysis area. The dust would add sediment and other pollutants such as metals to surface water. Westmoreland Rosebud would use a surfactant to suppress fugitive dust on haul roads that could enter surface waters in and near the analysis area and may degrade water quality. Effects on surface water quality due to dust from mining activities would be short-term, negligible to minor, and adverse.

4.7.3.3 Indirect Impacts

Surface Water Hydrology

The indirect effects analysis area includes the Yellowstone River from Cartersville Dam downstream to the confluence with the Tongue River; this location was chosen to account for indirect effects of water withdrawals by the Colstrip Power Plant and because the dam is a barrier to fish passage and likely precludes pallid sturgeon above the dam. The Yellowstone River diversion point for the Colstrip Power Plant's 69 cfs water right is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam.

Based on average annual flow data for the Forsythe gage (**Table 3.7-6**), the diversion associated with the Colstrip Power Plant currently withdraws an average of 0.7 percent of the estimated Yellowstone River flows, with a slightly higher (1.0) and lower (0.4) proportion of the total flow withdrawn in dry and wet years, respectively. Even in dry years, mean annual flows in the Yellowstone River near the diversion point were almost 16,000 cfs, whereas the diversion removed approximately 69 cfs. The other metrics demonstrated similar patterns. The proportional impact of the water withdrawals on peak flows was 0.1 to 0.2 percent (**Table 3.7-6**). In February, typically the month in which the Yellowstone River has the lowest flows on average, the water withdrawals would result in a 1.0 to 1.8 percent decrease in flows depending on the year type. As also noted in the analysis of peak flows, the impact of the diverted water in June, the wettest month on average, would be a decrease in streamflow of 0.3 percent or less. When the single individual day with the lowest flow within the period of record from 2000 through 2023 was analyzed (2,019 cfs on August 30, 2001), the water withdrawal accounted for 3 percent of the estimated total flow in the Yellowstone River, upstream of the diversion point.

To view the water withdrawal amount from a different perspective, daily flow fluctuations at the Forsythe gage averaged 541 cfs and ranged from 0 to 27,000 cfs. The maximum fluctuation occurred in mid-June 2022 during the record-breaking flooding event that year; a similar fluctuation near that magnitude occurred in May 2011. Out of these data, 73 percent of the day-to-day fluctuations were greater than the diversion amount of approximately 69 cfs. The amount of water diverted to supply the Colstrip Power Plant is insignificant in comparison to daily fluctuations that occur in the Yellowstone River in the vicinity of the diversion. The proportion of flow diverted for the Colstrip Power Plant is further muted as the drainage area increases and tributaries continue to contribute water to the Yellowstone River.

Based on these analyses, streamflow in the Yellowstone River is minimally impacted by the water withdrawals for the Colstrip Power Plant, with each flow metric in average, dry, or wet years decreasing by less than 2 percent (OSMRE 2024). The amount of water diverted cannot be differentiated from the natural variability in flow observed from day to day based on data from 2000 to 2023 (**Table 3.7-6**).

The narrative that follows summarizes potential indirect effects from project area mining activities on Yellowstone River surface water hydrology. As described in **Section 4.7.3.2, Direct Impacts, Surface Water Hydrology Impacts, Streams**, perennial and intermittent stream flows in sections of West Fork Armells Creek tributaries (McClure, Robbie, and Donley Creeks) would be reduced and may be eliminated due to anticipated effects of project area mining activities that would reduce groundwater contributions to stream base flows, resulting in direct effects on analysis area streams that would be long-term, minor to moderate, and adverse. Project area mining activities would also reduce ephemeral stream flows in West Fork Armells Creek tributaries (McClure, Robbie, Donley, and Black Hank Creeks) during precipitation or snowmelt runoff events due to the capture of on-site and upstream surface water runoff in mine pits or sediment ponds, resulting in direct effects on analysis area streams that would be adverse and minor in the short term, to negligible in the long term. The combination of these effects on perennial, intermittent, and ephemeral stream flows in the direct effects analysis area would, in turn, affect surface water flow in receiving streams that encompass a portion of the indirect effects analysis area including Armells Creek and the Yellowstone River from Cartersville Dam (approximately 6 miles downstream of the Armells Creek confluence) to the confluence with the Tongue River.

Potential indirect effects from the conditions described above on surface water hydrology of the Yellowstone River can be quantified by comparing estimated project-induced streamflow reductions in Armells Creek with historical surface water flow in the Yellowstone River. The Armells Creek watershed encompasses approximately 370 square miles, and the portion of the Armells Creek watershed that is within and upstream of the Area F mine disturbance area (including the upper portions of the McClure, Robbie, Donley, and Black Hank Creek watersheds) encompasses approximately 22 square miles (6 percent of the Armells Creek watershed). Assuming project area mining activities would eliminate all perennial, intermittent, and ephemeral streamflow that originates from the 22-square-mile area, flow reductions in Armells Creek can be conservatively approximated as 6 percent of the stream's total flow. Historical records of USGS streamflow measurements (1977 to 1995) reflect average daily flow rates in Armells Creek (near the confluence with the Yellowstone River) ranging between 0 and 1,100 cfs (averaging 5 cfs). Potential reductions in Armells Creek streamflow can therefore be approximated as 6 percent of those values, ranging between 0 and 66 cfs (averaging 0.3 cfs). Historical records of USGS streamflow measurements (1977 to 1995) reflect average daily flow rates in the Yellowstone River (near Forsythe) ranging between 1,400 and 97,000 cfs (averaging 10,500 cfs). Dividing each of the approximated daily Armells Creek streamflow rate reductions over the 18-year period of record by each of the corresponding historical daily flow rates in the Yellowstone River results in potential Yellowstone River flow rate reductions that range between 0 and 0.3 percent (average 0.003 percent). Therefore, indirect effects from project area mining activities on Yellowstone River surface water hydrology would be negligible.

Surface Water Quality

As described in **Section 1.2.2.1, Colstrip Power Plant** and in **Chapter 5, Cumulative Impacts**, the Rosebud Mine provided an annual average of 9.9 million tons of coal over the previous decade to the Colstrip Power Plant, for combustion in Units 1, 2, 3, and 4 (with the closure of Units 1 and 2, the average is expected to be around 6 million tons for the next decade). Coal mined in the project area would be burned in Units 3 and 4 only, along with coal from other active permit areas of the Rosebud Mine. The Rosebud Power Plant, located 6 miles north of the city of Colstrip, would also combust project area coal. As described in **Section 1.2.2.2, Rosebud Power Plant**, the Rosebud Mine provides 300,000 tons of coal annually to the Rosebud Power Plant. The project area would provide 30 to 50 percent of the mine's total waste coal delivery to the Rosebud Power Plant, with other permit areas of the mine providing the remainder. There are no reports of spills or seepage from storage or disposal of combustion residuals at the Rosebud Power Plant that have affected surface water quality.

At the Colstrip Power Plant, numerous lined ponds are used for various purposes, including disposal of coal combustion products, evaporation of wastewater, and storm water runoff (Hydrometrics 2015). The ponds were designed and constructed to minimize seepage losses; however, over the period of operations, seepage from various ponds has occurred, resulting in measurable impacts on groundwater beneath the plant site and on nearby surface water in the East Fork Armells Creek. Spills to the East Fork Armells Creek from Colstrip Power Plant pipelines have also occurred. The power plant operator has collected and continues to collect numerous surface water samples from the creek starting just west of the power plant to about 3 miles north of the power plant. The water quality of the East Fork Armells Creek near the Colstrip Power Plant has been impacted by plant operations but has improved, likely due to capture of contaminated groundwater, better water management, and BMPs implemented at the power plant (Hydrometrics 2015).

The area of deposition of coal combustion emissions in soil and surface water around the two power plants is described in **Section 4.3, Air Quality** (see also **Section 3.7.1.2, Analysis Area** in the 2018 Final EIS).

In the past 10 years, mercury concentrations measured in the streams in the indirect effects analysis area (part of the Sarpy Creek, Armells Creek, Rosebud Creek, and Yellowstone River watersheds) have been below the water quality standard (and only four results have been above laboratory detection limits); this indicates that mercury deposition from the Colstrip and Rosebud Power Plants, and even from all atmospheric mercury sources, does not adversely affect the water quality of these streams. Although Castle Rock Lake in Colstrip has a fish consumption advisory related to mercury, there are no water quality data for the lake, so it is not known if atmospheric deposition from the Colstrip and Rosebud Power Plants has adversely affected the water quality of the lake. However, because mercury concentrations in the East Fork Armells Creek (located about one-half mile from Castle Rock Lake) were all below the water quality standard and below laboratory detection limits (for all but one sampling event), mercury deposition from the Colstrip and Rosebud Power Plants does not adversely affect the creek, and it seems unlikely that the power plants' mercury deposition has or would adversely affect Castle Rock Lake.

In the past 10 years, selenium concentrations measured in the streams in the indirect effects analysis area have been below the water quality standard, indicating that selenium deposition from the two power plants does not adversely affect the water quality of analysis area streams.

In the past 10 years, copper concentrations measured in the streams in the indirect effects analysis area have been below the water quality standard, except for one exceedance in East Fork Armells Creek in 2015 at 0.032 mg/L (slightly above the water quality standard of 0.031 mg/L). This indicates that copper deposition from the two power plants has very little potential adverse effect on the water quality of analysis area streams. If project area coal is burned at the Colstrip and Rosebud Power Plants, it is expected that there would be no effect on stream water quality, except possibly for copper in East Fork Armells Creek. Effects on East Fork Armells Creek would be long-term, negligible to moderate, and adverse.

Within the indirect effects analysis area, Sarpy Creek, East Fork Armells Creek, and the Yellowstone River are listed by DEQ as impaired for nitrate+nitrite, with sources listed by DEQ as non-irrigated crop production (Sarpy Creek), unknown (East Fork Armells Creek), and natural sources (Yellowstone River). When sampled in the past 10 years, nitrate+nitrite concentrations in Rosebud Creek, Armells Creek (including East and West Fork), and the Yellowstone River have been well below the standard, indicating that nitrogen deposition from all atmospheric nitrogen sources does not adversely affect the water quality of these streams with regard to nitrate and nitrite.

Within the indirect effects analysis area, Sarpy Creek and East Fork Armells Creek are listed by DEQ as impaired for total nitrogen, with sources listed by DEQ as grazing in riparian or shoreline zones (Sarpy Creek) and transfer of water from an outside watershed (East Fork Armells Creek). In the past 10 years, most total nitrogen concentrations in analysis area streams have also been well below the total nitrogen July through September standard of 1.3 mg/L, except for 11 exceedances between 2017 and 2022 of the standard in Armells Creek (one exceedance in 2017 downstream of the East and West Fork confluence) and in East Fork Armells Creek (10 exceedances between 2017 and 2022 at multiple locations). The average total nitrogen concentration in Armells Creek and East Fork Armells Creek during the summer months when the nitrogen standard applies was 2.2 mg/L between 2017 and 2022. It is possible that atmospheric deposition is a source of nitrogen to Armells Creek and East Fork Armells Creek, but it is likely that agriculture is also a source of nitrogen to the creeks. Because total nitrogen surface water concentrations in the indirect effects analysis area are nearly all low, it appears that nitrogen deposition does not affect the water quality of analysis area streams, except possibly Armells Creek and East Fork Armells Creek. The air quality modeling completed for this EIS shows that at East Fork Armells Creek in Colstrip, the nitrogen deposition from the Colstrip and Rosebud Power Plants is 6 percent of all nitrogen deposition at that location from all atmospheric sources, and at Rosebud Creek east of Colstrip it is 6.8 percent (the prevailing wind direction is more consistently to the east). At Sarpy Creek west of the Rosebud Mine, the nitrogen deposition from the Colstrip and Rosebud Power Plants is 3.5 percent of all nitrogen deposition at that location from all atmospheric sources. Because atmospheric nitrogen deposition from the Colstrip and Rosebud Power Plants is less than 10 percent of all atmospheric deposition sources to these streams, it is likely that nitrogen deposition from the two power plants does not and would not adversely affect the water quality of the indirect effects analysis area streams.

The alkalinity of indirect effects analysis area streams has nearly always been greater than 100 mg/L, and often has been several hundred mg/L when measured in recent years. Alkalinity refers to the capability of water to neutralize acid and is an expression of the buffering capacity of a surface water body. Due to the high alkalinity of the analysis area streams, a result of alkaline soils in the analysis area, any acid rain deposition from the Colstrip and Rosebud Power Plants or from any other acid rain source would not change the pH of the streams appreciably. For example, at a site named AR-10PBR in the East Fork Armells Creek located within the city of Colstrip, the pH has remained essentially unchanged, with very little fluctuation, at 8.0 standard units between 2000 and 2016 (EPA 2017h).

Metal and nitrogen data collected between 2017 and 2019 from the Yellowstone River in Treasure, Rosebud, and Custer Counties show very low mercury, selenium, copper, and nitrogen concentrations in the river that are well below water quality standards. The depositional effects of coal combustion emissions from the Colstrip and Rosebud Power Plants on the Yellowstone River are not expected to be measurable for the following reasons:

- A comparison of the monthly flow contribution of Sarpy Creek, Armells Creek, and Rosebud Creek to the monthly flows in the Yellowstone River using USGS gage periods of record shows that they contribute from 0.1 percent (July) to 1.0 percent (March) of the total flow of the Yellowstone River at the Forsyth gage. Any deposition effects from the Colstrip and Rosebud Power Plants on the water quality of the three tributaries are not likely to be detectable in the Yellowstone River due to dilution.
- The air quality modeling completed for this EIS shows that at a location halfway between the Colstrip and Rosebud Power Plants (about 3 miles north of Colstrip), the mercury deposition from the two power plants is less than 3 percent of all mercury deposition at that location from all atmospheric sources. At the Yellowstone River about 25 miles north of Colstrip, the effects of mercury deposition from the two power plants would not be expected to be measurable compared to worldwide atmospheric deposition sources to the Yellowstone River.
- The air quality modeling completed for this EIS shows that at the confluence of Armells Creek and the Yellowstone River, the nitrogen deposition from the two power plants is 1.4 percent of all nitrogen deposition at that location from all atmospheric sources, and at the confluence of Rosebud Creek and the Yellowstone River, it is 1 percent. The effects of nitrogen deposition from the two power plants would not be expected to be measurable compared to worldwide atmospheric deposition sources to the Yellowstone River.

The indirect effects analysis area includes East Fork Armells Creek to account for potential indirect effects of Westmoreland Rosebud’s two coal processing facilities (crushers) and one coal conveyance system in Rosebud Mine Areas A and C. Westmoreland Rosebud holds two active permits issued by DEQ for Area A (permit C1986003A) and Area C (permit C1985003C). After coal is processed in the crushers, crushed coal is delivered via an existing covered conveyor-belt system that roughly parallels East Fork Armells Creek to the Colstrip Power Plant from the Area C crusher (4.2 miles) and from the Area A crusher (2.7 miles). The two coal processing facilities each encompass approximately 20 acres of land that contains crushers, coal stockpile areas, and related support infrastructure adjacent to East Fork Armells Creek. MPDES Permit MT-0023965 (Modification 2) regulates discharges of surface water drainage from both coal processing facilities through provisions for effluent limits, monitoring requirements, and other special conditions for discharges from two outfalls (Area A Outfall 016A and Area C Outfall 043) to East Fork Armells Creek. There have been no effluent limitation exceedances associated with the two outfalls since 2007 (EPA 2024i). Due to the physical covering of the coal conveyance system, the limited geographical extent of the two coal processing facilities, and the lack of recent effluent limitation exceedances associated with the two outfalls, adverse effects from related operations on East Fork Armells Creek surface water quality are expected to be insignificant.

4.7.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect surface water impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, disturbance would be limited to the southern portion of the project area (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. Under Alternative 5, direct and indirect surface water impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

As with Alternative 4, the overall impacts on the hydrologic balance in the direct effects analysis area would be long-term, moderate, and adverse, and effects on floodplains would be short-term, minor, and adverse. Spring flows within the project area would be affected by mining, and the effects would range from reduced flow, particularly if the source of the spring water is at least partially from the Rosebud Coal, to complete elimination of the spring if its source is solely from the Rosebud Coal or overburden that would be removed. It is unlikely that springs whose source is either the Rosebud Coal or overburden that is to be mined would redevelop in the postmining period. Overall impacts on spring flows and the beneficial uses of spring water in the analysis area would be long-term and moderate. Removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period. Groundwater that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Assuming all runoff from disturbed lands were effectively captured and treated before release to any of the unmined streams in the analysis area, and all discharges at MPDES Permit outfalls met effluent limits, adverse effects on stream water quality should be minimal, and beneficial uses should be protected. Until the spoil is resaturated, remaining Rosebud Coal groundwater would not reach the major drainages. It is not known how much time would be required to resaturate the spoil, but the process is expected to require more than 50 years due to the nature of the spoil. Stream flow from the upstream areas of the Black Hank Creek tributaries may be reduced or may not flow through the reclaimed area as some or all surface flow may infiltrate into the spoil rather than flowing to the lower portion of the watershed. Black Hank and Donley Creek stream flows in the project area would be reduced and may be eliminated except at locations upstream of the areas to be mined, resulting in a long-term, minor to moderate, and adverse impact. Similarly, the overall impacts of mining activities on surface water quality and associated beneficial uses of streams in the analysis area would be long-term, minor to moderate, and adverse. The water supply of one mapped pond (Pond 4, located adjacent to Black Hank Creek downstream from the mine pits) may be reduced or eliminated during mining due to the impoundment of runoff that is a source of supply to the pond or due to the reduction or elimination of spring flows that are a source of supply to the pond. After mining, the pond would be reestablished, and up to three sediment ponds (located downstream of the proposed mine pits) would be retained until reclamation is complete to provide water supplies for wildlife and livestock; thus, the overall effect on pond water supply in the direct effects analysis area would be short-term, minor to moderate, and adverse. To mitigate the general lack of water in the vicinity of the project area (due to climate and not primarily as a consequence of mining), Westmoreland Rosebud proposes enhancement features within the PMT to capture water when available and use it to enhance habitat for wildlife and livestock, and to establish wetlands. These features would be in the form of small depressions that would store water following runoff events, thereby providing water sources, promoting establishment of wetland species, and diversifying the postmining habitat types within the project area. These small depressions would also help retain sediment within the project area.

Impacts on the direct effects analysis area for Alternative 5 would be similar to impacts for Alternative 4, but since 1,793 fewer acres would be disturbed under Alternative 5 and because the location of mine pits would be limited to the Donley Creek and Black Hank Creek watersheds, the remaining three watersheds (Trail Creek, McClure Creek, and Robbie Creek) in the direct effects analysis area would not be impacted from mine pit activity under Alternative 5. Impacts on the indirect effects analysis area for Alternative 5 would be similar to impacts for Alternative 4, but because the life of operations for Area F and the time period for combustion of project area coal in the Colstrip and Rosebud Power Plants would be 9 fewer years under Alternative 5, there would be a shorter duration of potential impacts related to water withdrawal from the Yellowstone River to supply the Colstrip Power Plant and trace metal deposition onto surface water bodies due to coal combustion at the two power plants.

4.7.5 Irreversible and Irretrievable Commitment of Resources

The following would be irreversible and irretrievable commitments of surface water resources:

- The loss of water to the springs in the project area whose source of water supply was the Rosebud Coal, which likely would result in the loss of these springs and associated wetlands
- Springs, ponds, and associated wetlands within the project area disturbance boundary that would be removed during mining
- Reduced stream flow in the reclaimed stream channels because the permeability of the spoil material is higher than that of the undisturbed native material
- Changes in stream flow due to changes in postmining channel morphology
- Water quality effects on streams downslope of the spoil where the groundwater table intersects the stream bottom

The loss of wetlands in the project area and the hydrologic conditions that support the wetlands is discussed in **Section 4.11, Wetlands and Riparian Zones**. New springs may appear along project area drainages after the spoil is resaturated postmining. However, based on Western Energy's groundwater model, the groundwater table will take more than 50 years after site reclamation to be reestablished (PAP, Appendix O). In addition, it may take hundreds of years for the bedrock (overburden and Rosebud Coal) aquifers to recover (Nicklin 2017). After mining, some ponds may be constructed to provide water supplies for wildlife and livestock. Because the hydrologic balance in the project area would be restored to the extent possible, there would be no other irreversible or irretrievable commitment of resources.

4.8 WATER RESOURCES – GROUNDWATER

This section discloses the direct and indirect effects on groundwater resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine and existing groundwater conditions and the analysis areas used for this impacts analysis are described in **Section 3.8, Water Resources – Groundwater**.

4.8.1 Analysis Methods and Impact and Intensity Thresholds

Groundwater impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.8.1** of the 2018 Final EIS, beginning on page 527. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on groundwater are the same as those defined in the 2018 Final EIS in **Table 130**. Although none of the changed groundwater conditions substantially alter the impact analysis presented in the 2018 Final EIS, this environmental consequences section has been updated from the 2018 Final EIS to incorporate the groundwater impact assessments disclosed in the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), updated monitoring data collected since the data evaluated in the 2018 Final EIS, and updated hydrologic information reported in the Annual Hydrology Reports prepared since the 2018 Final EIS. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.8.2 Alternative 1 – No Action

The types of direct and indirect groundwater impacts under Alternative 1 (as described in this SEIS)[70] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, disturbance would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. Under Alternative 1, direct and indirect groundwater impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

As with Alternative 4, removal and stockpiling of overburden during the Alternative 1 mining period would permanently remove any saturated zones within the overburden, and removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period. Groundwater that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Groundwater levels in the Rosebud Coal would decline as the coal is dewatered and removed. Drawdown created by removal of the coal would extend out from the mined areas as more of the coal is dewatered and removed. Until the spoil is resaturated, remaining Rosebud Coal groundwater would not reach the major drainages. It is not known how much time would be required to resaturate the

[70]. Direct and indirect groundwater impacts of Alternative 1 – No Action were described in **Section 4.8.2** of the 2018 Final EIS, beginning on page 527. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

spoil, but the process is expected to require more than 50 years due to the nature of the spoil. Spring flows within the project area would be affected by mining. The effects would range from reduced flow, particularly if the source of the spring water is at least partially from the Rosebud Coal, to complete elimination of the spring if its source is solely from the Rosebud Coal or overburden that would be removed. It is unlikely that springs whose source is either the Rosebud Coal or overburden that is to be mined would redevelop in the postmining period. As with Alternative 4, if any private wells were to become unusable due to mining under Alternative 1, Westmoreland Rosebud would be required to replace the well; thus, impacts on private wells in the analysis area from drawdown would be long-term, negligible to moderate, and adverse. Under Alternative 1, as with Alternative 4, the primary change to groundwater quality would result from removing the Rosebud Coal and replacing the coal with overburden as spoil. The effects on groundwater quality in the analysis area are likely to be long-term, moderate, and adverse.

Within the Trail Creek, McClure Creek, and Robbie Creek drainages (where mining would not occur), direct impacts under Alternative 1 would be limited to water quantity impacts from drawdown related to mining occurring to the east. Water quantity impacts would progressively decrease further northwest of Donley Creek. The maximum drawdown at the end of mining would not be as deep as that predicted for Alternative 4 (about 90 feet) since mining would not extend as far south as the mining pits under Alternative 4 and the predicted 5-foot drawdown for the Rosebud and McKay Coals hydrostratigraphic units would not extend as far upgradient to the south as predicted for Alternative 4 (about 1.5 miles). Groundwater quality impacts within the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated. In addition to the springs listed in **Table 4.8-1** as not being impacted, Springs 3, 10, 11, 13, and 14 would also not be impacted under Alternative 1.

Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4. With the exception of accidental spills, which cannot be predicted, burning of Area F coal at the Colstrip Power Plant under any of the alternatives would not likely result in any indirect impacts on groundwater because of the recent operational changes at the plant (see Alternative 4 discussion below in **Section 4.8.3**). Similarly, combustion of Area F coal in the Rosebud Power Plant would not likely result in any indirect impacts on groundwater under any of the alternatives (see Alternative 4 discussion below in **Section 4.8.3**).

4.8.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect groundwater impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.8.3** of the 2018 Final EIS, beginning on page 528. Under Alternative 4, half a million tons more coal would be mined[71] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

[71]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

4.8.3.1 Direct Impacts

Open pit coal mining directly removes the overburden to remove/mine the Rosebud Coal seam. Following removal, each pit is successively backfilled with the broken spoil (overburden) material removed from the previous mining cut. With the overburden and Rosebud Coal containing groundwater, water level/quantity and water quality within the project area are directly impacted, and indirect groundwater impacts occur from operations related to water storage associated with the Colstrip Power Plant and water usage at the Rosebud Power Plant. The following direct impacts related to groundwater quantity and quality were taken from the 2018 Final EIS and the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b). As applicable, the discussions have been updated based on recent monitoring results and impacts currently observed from Area F mining, which started in 2020 in the Black Hank Creek drainage and progressed into the Donley Creek drainage in 2022. As of 2023, Area F wells that have been abandoned as a result of mining include WD-194, WM-199, and WR-238 (WET 2024).

Groundwater Quantity

As described in **Section 3.8.2, Site Hydrogeology** in the 2018 Final EIS, most of the Tongue River Member sedimentary units in the project area are saturated. However, due to the low overall hydraulic conductivity, few of the units are capable of producing water to a well or transmitting water any great distance. Groundwater in the more continuous and permeable bedrock units such as the Rosebud Coal flows from the upland areas southwest of the project area to the northeast, which is also the trend of the major drainages. Saturated zones in bedrock that overlie the coal (overburden) are typically perched on low-permeability layers and are typically discontinuous. The Rosebud Coal crops out within the project area (see **Figure 38** in **Section 3.8, Water Resources – Groundwater** in the 2018 Final EIS), and at the outcrops, partially saturated conditions are typical. This outcrop line represents the northeastern-most extent of the Rosebud Coal within the project area. Rosebud Coal groundwater currently discharges from the northeastern edge of the coal at the surface as springs or in the subsurface as underflow and ultimately ends up in the alluvium of the major drainages. Removal of the coal and the eventual replacement of the coal by spoil would have long-term, moderate, adverse effects on groundwater quantity in the analysis area.

Mining Period

Removal and stockpiling of overburden would permanently remove any saturated zones within the overburden. This would result in a more homogeneous mixture of sedimentary lithologies such as shale, siltstone, and sandstone that would be temporarily stockpiled and/or returned to the mined areas as spoil. It is unlikely that significant quantities of groundwater would flow into the mine pits from the overburden walls because of the low overall hydraulic conductivity and the discontinuous nature of the saturated zones in the overburden. Due to the characteristics of the overburden, it is likely that groundwater drawdown in the overburden would extend only a short distance from the pits being mined.

Removal of the Rosebud Coal would likely result in low to moderate groundwater inflow to the pits, some of which would be pumped from the pits into storage ponds. Some of the inflowing groundwater would evaporate from the walls of the pit due to low inflow rates. The mine pits would intercept groundwater that would otherwise have discharged to alluvium in the major drainages, reducing the bedrock contribution to the stream baseflow to near zero within the permit boundary, except in areas where the streams may be receiving groundwater from the McKay Coal, which would not be mined. For those reaches of streams where there is intermittent or perennial flow, the relative contributions to baseflow and alluvial groundwater flow from existing bedrock groundwater sources in the project area are unknown. However, removing the Rosebud Coal adjacent to the major drainages would likely result in lower groundwater levels in the alluvium and reduced baseflow in intermittent and perennial reaches of the streams. Many of the mapped wetlands (see **Section 3.11, Wetlands and Riparian Zones**), which typically require a perennial or intermittent source of water, are located just downstream of Rosebud Coal outcrops or subcrops within the major drainages. Their location suggests that the Rosebud Coal is the primary contributor of groundwater to these wetlands and drainages. Groundwater in unmined Rosebud Coal beneath the unmined drainages would not continue to discharge water to the major drainages because groundwater is likely to flow toward the pits on the flanks of the drainages, rather than flow to the northeast, as it currently does (see **Section 4.7.3.2, Direct Impacts, Streams** for how this impacts surface water). The hydraulic gradient in the unmined Rosebud Coal would change as a result of mining, causing the groundwater flow direction to change toward the pits. Because Westmoreland Rosebud would be required to replace any water supply where reduced bedrock inflow or drawdown precluded the beneficial use, the impacts from reduced bedrock inflow and drawdown on the quantity of alluvial groundwater would be long term, minor to moderate, and adverse.

Groundwater levels in the Rosebud Coal would decline as the coal is dewatered and removed. Drawdown created by removal of the coal would extend out from the mined areas as more of the coal is dewatered and removed. The maximum depth of drawdown would be limited by the depth of the coal, which increases to the southwest. The groundwater model described in the 2018 Final EIS for Alternative 2 (here applied to Alternative 4) indicated that the maximum drawdown at the end of mining (Year 2034) would be about 90 feet in the southeast portion of the project area, corresponding to the deeper mine pit areas (PAP, Appendix O); a similar drawdown is assumed for Alternative 4. Drawdown does not occur to the north and east of the mine pits in Area F, because mining extends to near the coal crop. To the south and west, the amount of drawdown decreases rapidly with distance from the mine pits, generally to less than 20 feet of drawdown 1,000 feet away. Drawdown is typically less than 10 feet one-half mile from the pits, and less than 5 feet one mile away. The Alternative 2 groundwater model also indicated that where the interburden between the Rosebud Coal and the McKay Coal is relatively thin, approximately 40 feet or less, dewatering and removal of the Rosebud Coal would induce drawdown in the McKay Coal into the pits. This drawdown in the McKay Coal would extend upgradient and cross-gradient of the mine pits, resulting in long-term moderate adverse effects. Results reported in the 2023 Annual Hydrology Report (WET 2024) corroborate this modeled impact. Water level declines over 2 feet were observed in well WM-192 located upgradient of mining near the southern Area F permit boundary, with water levels before October 2020 reflective of baseline conditions and recent declines likely influenced by Area F mining activities north of the well. At WD-193, located west of active mining in Area F, water level decreases near 2 feet were recently observed.

Under Alternative 4 (as for Alternative 2) groundwater levels at the end of mining would decrease upgradient to the southwest to a maximum drawdown of about 5 feet at a distance of about 1.5 miles in each of the two coals based on modeling completed for Alternative 2. Groundwater drawdown in the Rosebud and McKay Coals outside the Area F boundary to the south would reduce groundwater levels in private wells screened in one or both of the coal units. It is not known if water level decreases of between 5 and 10 feet in private wells in this area as a result of mining would impair the owner's ability to produce water because it would depend on the characteristics of the individual wells such as depth, depth to water, pump location, and specific capacity. Springs in the upgradient areas would not likely be impacted by groundwater drawdown due to mining. It is unlikely that their source of water is one of the two coals because of the depth to the coal. Limited alluvium in the drainages in the upgradient areas is also not likely to be hydraulically connected to the coals (PAP, Appendix O).

Spring flows within the project area would be affected by mining. The effects would range from reduced flow, particularly if the source of the spring water is at least partially from the Rosebud Coal, to complete elimination of the spring if its source is solely from the Rosebud Coal or overburden that would be removed. This would include subsurface flow from the Rosebud Coal to alluvium and/or overburden. The timing of effects on spring flow would be related to the mining sequence. Spring flows would not be reduced or eliminated until the Rosebud Coal in the vicinity of the spring was mined out. **Table 4.8-1** provides a summary of which springs are likely to be impacted by mining under Alternative 4.

Table 4.8-1. Alternative 4 Impacts on Identified Springs in the Analysis Area.

Spring	Groundwater Source	Likely to Be Impacted	Potential Impact during Mining	Potential Impact Postmining
1	Overburden	No	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
2	Unknown (possibly overburden)	No	Impact not likely, downgradient and outside of Area F mining	Impact not likely, downgradient and outside of Area F mining
3	Overburden	Yes	Spring removed during mining	Spring removed during mining
4	Overburden	No	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
5	Overburden	No	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
6	Overburden	No	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
7	Rosebud Coal	No	Impact not likely, located within 74-acre area not approved for mining	Impact not likely, outside of the area approved for mining
8	Rosebud and possibly clinker	Yes	Source of water removed by mining	Source of water removed by mining
9	Overburden	Yes	Spring removed during mining	Spring not likely to reestablish at this location
10	Overburden and possibly Rosebud Coal	Yes	Spring removed during mining	Spring removed during mining
11	Rosebud/clinker and possibly overburden	Yes	Although not located within the proposed mine cuts, water levels in the Rosebud Coal would decline as the coal is dewatered and removed	Flow may be temporarily reduced by mining
12	Unknown	No	Not likely to be impacted except by road construction	Not likely to be impacted except by road construction
13	McKay Coal	Yes	Flow may be temporarily reduced by mining and may be affected by road construction	Flow may be temporarily reduced by mining and may be affected by road construction
14	Sub-McKay and possibly alluvial groundwater	Yes/No	Not likely if sourced from Sub-McKay but potential impact if sourced from alluvium	Not likely if sourced from Sub-McKay but potential impact if sourced from alluvium

Source: PAP, Appendix J, Attachment B-J. Springs 7 and 11 updated based on exclusion of 74-acre area not approved for mining. Additional updates made based on Area F CHIA (DEQ 2019b).

Areas of clinker would not be disturbed except for those scoria pits where clinker would be mined for use as road material. As described in **Section 3.8.2.2, Groundwater Conditions** in the 2018 Final EIS, clinker deposits are typically areas with high infiltration rates and provide significant recharge to the subsurface. Water entering the clinker may discharge to drainages as springs or slowly discharge to lower-permeability units such as overburden, and possibly the Rosebud Coal. Because they would be left unmined, clinker areas would continue to provide recharge to the subsurface and/or springs.

Postmining Period

The postmining effects on groundwater quantity would include the following:

- Removal of the Rosebud Coal aquifer within Area F
- Change in hydrologic characteristics of the overburden as it becomes spoil
- Elimination of overburden and Rosebud Coal springs within the mined areas
- Long-term (greater than 50 years) groundwater drawdown in the Rosebud and McKay Coals upgradient of Area F

Removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period. Groundwater that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Until the spoil is resaturated, Rosebud Coal groundwater would not reach the major drainages. It is not known how much time would be required to resaturate the spoil, but the process is expected to require more than 50 years due to the nature of the spoil (as discussed below). Existing groundwater level data collected during the last 40 years from spoils monitoring wells indicate that water levels have not yet reached equilibrium in previously mined areas. Other long-term effects on groundwater quality are described below.

The overburden consists of a mixture of lithologies in a layered sequence. Removal, temporary stockpiling, and replacement of overburden would tend to homogenize the various lithologies, eliminating the higher-hydraulic-conductivity sandstone layers in the overburden. The result would be to mix fine-grained and coarse-grained material, leading to overall lower horizontal hydraulic conductivity. Due to the increased porosity or void spaces created by the broken overburden material that forms the spoil, vertical hydraulic conductivity and storage coefficient for spoil is expected to be somewhat greater than that of the Rosebud Coal it replaced. According to the PAP, Appendix O, the spoil would be more isotropic than the undisturbed overburden, which is defined as having equal hydraulic conductivity in all directions. As a result, the vertical percolation rate would be greater than in the overburden (PAP, Appendix O), but the spoil would be less capable of transmitting groundwater horizontally in the uppermost part of the unit than the original overburden due to the lack of any substantial stratigraphy. As a result, it is unlikely that springs would redevelop at locations similar to those of existing springs. Therefore, it is unlikely that springs whose source is either the Rosebud Coal or overburden that is to be mined would redevelop in the postmining period. The Rosebud Coal would be removed, and the nature of the overburden would be permanently changed due to removal, temporary stockpiling, and/or direct replacement as spoil during mining.

Assuming at least part of the resaturation process is due to vertical recharge from precipitation, groundwater would likely percolate vertically until reaching a saturated zone. Groundwater in the developing saturated zone would likely move downgradient to the north. It is not known if any shallow perched zones would develop due to heterogeneities in the spoils or if springs would develop if any perched zones intersected the surface. The pre-mining perennial or intermittent reaches of creeks may change, or the creeks may no longer flow in these reaches. It is not known if discharge from the McKay Coal would be sufficient to maintain baseflow at the pre-mining locations.

Forty-four spoil wells are active in the Rosebud Mine. Many wells show some level of recovery, but others remain dry or have insufficient water for sampling (DEQ 2019b). Aquifer tests in spoil wells indicate that spoil has the ability to recharge and the flow system to recover. Eleven tests of mine spoil hydraulic conductivity in the Colstrip mines were completed using a bailer recovery method (Van Voast et al. 1977). The values generated were in the same general range as those for undisturbed coal seams (DEQ 2019b). Eight spoil wells at the Rosebud Mine were tested and found to have transmissivity ranges from 3.75 to 395 square feet per day (WECo 1984). This implies that spoil, upon resaturation, has the ability to conduct groundwater similar to the Rosebud Coal prior to mining and will not restrict postmining groundwater flow.

The Alternative 2 groundwater model indicated that residual drawdown in the Rosebud and McKay Coals upgradient of Area F would require more than 50 years to recover to pre-mine conditions under Alternative 2 (PAP, Appendix O); a similar recovery period is anticipated for Alternative 4. The simulation for 50 years postmining indicated that residual drawdown upgradient of the Area F boundary would be less than 10 feet in the Rosebud Coal and less than 5 feet in the McKay Coal (PAP, Appendix O). It is not known whether residual drawdown of 10 feet or less would impact private well owners' ability to produce water from one or both of the two coals, because it would depend on the characteristics of the individual wells such as well depth, depth to water, pump location, and specific capacity of the well. If any private wells were to become unusable, Westmoreland Rosebud would be required to replace the well; thus, impacts on private wells in the analysis area from drawdown would be long-term, negligible to moderate, and adverse. Westmoreland Rosebud has identified the Sub-McKay sandstones as the most likely suitable groundwater source for any private wells that require replacement.

Groundwater Quality

The primary change to groundwater quality would result from removing the Rosebud Coal and replacing the coal with overburden as spoil. The effects on groundwater quality in the analysis area are likely to be long-term, moderate, and adverse. Currently, groundwater quality in the Rosebud Coal ranges from Class I to Class III but is typically better than that of other water-bearing units in the project area, while groundwater in the overburden is considered to have the poorest quality of any of the saturated units (see **Section 3.8.5, Groundwater Quality**).

Removing, stockpiling, and returning the overburden material to the pits as spoil would mix and homogenize all of the overburden lithologies, exposing fresh mineral surfaces to water during the resaturation process. As a result, soluble salts would dissolve into groundwater, increasing TDS concentrations in groundwater. Van Voast and Reiten (1988) reported that TDS concentrations in spoil groundwater were between 50 and 200 percent higher than TDS concentrations in undisturbed aquifers at the Decker mine site in southeastern Montana. Site-specific water quality data indicate that the TDS concentrations in spoil from Westmoreland Rosebud's mined areas A, B, and C had TDS concentrations that were between 70 and 200 percent higher than in the overburden. Geochemical conditions simulated in the laboratory with bench-scale column-leach and paste-extract leaching tests using overburden materials suggest that the dissolved-solids concentrations in the backfill water reach a maximum during initial saturation and then decrease to an equilibrium level after one or more pore volumes of water pass through the backfill (Van Voast and Reiten 1988). The increased TDS concentrations are due to increases in the concentration of all major ions, but primarily calcium, magnesium, sodium, and sulfate (Van Voast and Reiten 1988).

Due to the variability of the overburden mineralogy and the somewhat random nature of spoil backfilling, the quality of spoil groundwater in other areas mined by Westmoreland Rosebud has been variable. Consequently, some areas have shown rapid increases in TDS concentrations during approximately 45 years of data collection, while other areas show only small increases in TDS concentrations through the same period. In addition to the major ions, this also appears to be true for other constituents such as nitrate, iron, and manganese. Most data for spoil groundwater collected from other Westmoreland Rosebud mine sites have low nitrate concentrations, but there are a few locations with nitrate concentrations that equaled or exceeded the standard (WS-100, WS-107, and WS-157). The water quality of the spoil in Areas A, B, and C when monitored between 1978 and 2023 had exceedances in arsenic, cadmium, lead, nitrate, and zinc groundwater standards (**Table 4.8-2**). The pre-mining groundwater quality of the Rosebud Coal in the project area (see **Section 3.8, Water Resources – Groundwater** and **Table 29** in **Appendix 3 – Water Quality Tables**) did not show any exceedances of arsenic, cadmium, lead, and nitrate standards, with the exception of one lead standard exceedance. It would be expected that the project area spoil would have similar spatial and temporal variability in groundwater quality.

After nearly 45 years of groundwater sampling, there is no clear indication that TDS concentrations in the spoil have reached equilibrium or have shown decreases. According to the PAP, Appendix O, TDS concentrations in the spoil should reach equilibrium after one or two pore volumes of water pass through the spoil, based on bench-scale testing. However, Van Voast and Reiten (1988) noted that this concept is valid only where there is no vertical recharge. Pre-mining water level data from the project area indicate that vertical recharge does occur in some areas (see **Section 3.8.3, Conceptual Hydrogeological Model** in the 2018 Final EIS). Also, Van Voast and Reiten (1988) state that vertical recharge to the spoil may occur where the spoil contains large quantities of sand. In arid environments where the potential evaporation rate exceeds the annual precipitation, it is not uncommon for there to be net vertical recharge to groundwater under certain conditions, such as unusually wet periods. Therefore, one or two pore volumes of groundwater in the project area may not be sufficient to reach equilibrium with respect to water quality of the spoil. Based on the spoil water quality from Areas A, B, and C, it will require more than 45 years postmining to reach equilibrium in project area spoil, which constitutes an irreversible commitment of resources where the Rosebud Coal is replaced by mine spoil (see **Section 4.8.5, Irreversible and Irretrievable Commitment of Resources**).

Once the spoil has been resaturated and groundwater has moved toward the various drainages, groundwater may again discharge to alluvium along the major drainages. Impacts on alluvial groundwater are likely to occur when mining close to the alluvium. Impacts on groundwater could occur due to storage of water in sediment ponds near alluvium and from MPDES discharges to the streams. Recharge from the spoil to the alluvium would result in changes in alluvial groundwater quality in the drainages compared to pre-mining conditions. The current alluvial groundwater quality is variable, but TDS concentrations are generally lower than overburden concentrations and higher than Rosebud Coal TDS concentrations. Postmining, discharge to the alluvium would be from spoil containing generally poor-quality groundwater. It is not known how much time would be required for the quality of water in the spoil to improve as the soluble salts and metals are flushed from the system.

Similar to the overburden, water quality impacts may occur where spoil groundwater flows into the undisturbed Rosebud Coal after mining. However, the proximity of the coal crop and direction of groundwater flow limits the areas where this condition can occur. The unmined Rosebud Coal beneath the major drainages will likely see increases in TDS and other water quality parameters after mining, but these areas are all within the permit boundary.

As a result of mining, it is possible that downgradient alluvial groundwater quality near the mine pits could change as a result of eliminating the recharge from the Rosebud Coal. Without recharge from the Rosebud Coal, the TDS concentrations in the alluvial groundwater could increase initially to look more like that of the overburden TDS. Postmining, after the spoil was saturated to a level that would result in discharge to the major drainages, TDS concentrations in the alluvium would likely increase. Water quality impacts on alluvial groundwater from MPDES discharges are expected to be minimal. The MPDES Permit stipulates effluent limits that are protective of the water quality of the surface water in the creeks. Because the alluvial groundwater typically contains higher parameter concentrations than surface water, limits that are protective of surface water will also be protective of groundwater.

Table 4.8-2. Water Quality of Spoil Groundwater in Areas A, B, and C.

Parameter	Number of Samples	Number of Detections	Minimum	25th Percentile	Median	75th Percentile	Maximum	Human Health Water Quality Standard
Acidity (mg/L)	280	63	1.0	1.0	1.0	1.0	306	NS
Aluminum, diss (mg/L)	339	250	0.004	0.05075	0.1	0.1035	18.7	NS
Ammonia (mg/L)	192	189	0.0073	0.333	0.551	1.01	22.9	NS
Arsenic, diss (mg/L)	250	190	0.000035	0.000598	0.00263	0.00449	**0.02**	0.01
Bicarbonate Alkalinity (mg/L)	355	355	41.0	517	620	804	1,648	NS
Boron, diss (mg/L)	279	276	0.0257	0.286	0.39	0.5	1.2	NS
Cadmium, diss (mg/L)	350	130	0.000005	0.0000811	0.000132	0.001	**0.02**	0.005
Calcium, diss (mg/L)	192	192	133	264	347	451	640	NS
Carbonate Alkalinity (mg/L)	314	117	0.52	1.0	1.0	1.0	25	NS
Chloride (mg/L)	355	355	4.0	20	25	36	200	NS
Chromium, diss (mg/L)	8	3	0.01	0.0175	0.02	0.02	0.09	0.1
Copper, diss (mg/L)	297	158	0.000018	0.000837	0.003	0.01	0.274	1.3
Fluoride (mg/L)	356	303	0.004	0.1	0.18	0.2225	2.0	4
Hydroxide Alkalinity (mg/L)	201	1	1.0	1.0	1.0	1.0	5.0	NS
Iron, diss (mg/L)	355	304	0.000688	0.05	0.13	0.715	34	NS
Laboratory Conductivity (µS/cm)	355	355	864	2,940	3,520	4,295	8,420	NS
Laboratory pH (s.u.)	356	356	4.9	7.0	7.6	7.9	8.4	NS
Lead, diss (mg/L)	348	142	0.0000023	0.0001	0.000395	0.01	**0.08**	0.015
Magnesium, diss (mg/L)	192	192	206	306	340	428	720	NS
Manganese, diss (mg/L)	338	335	0.005	0.418	0.825	1.8	7.3	NS
Nickel, diss (mg/L)	203	160	0.0005	0.00183	0.00407	0.00845	0.061	0.1
Nitrate+Nitrite (mg/L)	342	168	0.003	0.0066	0.035	0.13	**38.5**	10
Ortho Phosphate (mg/L)	109	98	0.01	0.02	0.04	0.21	13.2	NS
Total Phosphate (mg/L)	51	49	0.01	0.0245	0.07	0.43	14.0	NS
Potassium, diss (mg/L)	192	189	9.05	12.5	15.0	17.0	22.2	NS
Selenium, diss (mg/L)	279	98	0.000094	0.0002085	0.0005	0.005	0.026	0.05
Sodium, diss (mg/L)	192	192	78.1	137	164	266	751	NS
Sulfate (mg/L)	355	355	368	1,450	1,970	2,470	5,440	NS
Total Alkalinity (mg/L)	356	356	34	480	568	781	1,350	NS
TDS (mg/L)	352	352	860	2,775	3,545	4,428	8,750	NS
Total Hardness (mg/L)	354	354	519	1,800	2,120	2,690	5,407	NS
Vanadium, diss (mg/L)	279	141	0.00002	0.0008015	0.00125	0.1	1.0	NS
Zinc, diss (mg/L)	355	233	0.000855	0.00682	0.0151	0.05	**2.61**	2

Groundwater data collected from 1978 to 2023. For less-than-detection-limit concentrations, detection limits are used to calculate percentile concentrations. Concentrations in bold exceed Montana numeric groundwater quality standards.
NS = no numeric standard or recommended concentration; µS/cm = micro Siemens per centimeter; s.u. = standard units.

Depending on the level of increase in TDS and sulfate concentrations above pre-mine concentrations, downstream groundwater users may be adversely affected. Most, if not all, alluvial groundwater users downstream of Area F use groundwater for stock watering, and it is possible that in some areas adjacent to the spoil, the water may become too degraded for livestock use due to possible increases in nitrate, calcium, magnesium, manganese, sodium, sulfate, or TDS concentrations to above recommended water quality limits for livestock (see **Table 3.7-5**, **Section 3.7, Water Resources – Surface Water**). If this were to occur, a suitable replacement source would be provided; thus, the impacts on alluvial groundwater use in the analysis area would be long-term, minor to moderate, and adverse.

It is unlikely that groundwater quality in upgradient areas would be affected by mining because the regional flow direction is toward the mined areas. Upgradient alluvium is isolated from mining-related drawdown by the overburden and receives recharge from the overburden, surface water flows, and direct precipitation.

4.8.3.2 Indirect Impacts

As described in **Section 1.2.2.1, Colstrip Power Plant** and in **Chapter 5, Cumulative Impacts**, the Rosebud Mine is the exclusive source of coal to the Colstrip Power Plant for combustion in Units 3 and 4. The Colstrip Power Plant uses a closed-loop process (with respect to water) to minimize impacts on local surface and groundwater. All water used by the Colstrip Power Plant is imported via pipeline from the Yellowstone River (see Section **3.7.6.2, Water Quality in the Indirect Effects Analysis Area**). Local surface and groundwater are not used at the plant. Numerous lined ponds are used to store combustion residuals and storm water runoff. The ponds were designed to minimize seepage losses and were constructed with either synthetic liners or compacted clay liners (Hydrometrics 2015). However, over the period of operation, seepage from various ponds has occurred, resulting in measurable impacts on groundwater beneath the plant site. A site characterization investigation indicated that the clay-lined ponds were responsible for almost all of the seepage (Hydrometrics 2015). The synthetic-lined ponds contributed insignificant amounts of seepage. As a result of the impacts on groundwater and related litigation, DEQ and PPL Montana (now Talen Energy) entered into an Administrative Order of Consent on August 3, 2012, to characterize the extent of the impacts and remediate the plant site area groundwater (see **Section 1.2.2.1, Colstrip Power Plant**).

The characterization process resulted in the installation of monitoring wells, groundwater capture wells, trenches, leachate collection systems between and below pond liners, and in-dam toe and chimney drains on the plant site. The extent of the groundwater impact beneath the plant site has been determined, and groundwater capture has been in operation for a number of years. Ponds contributing to the groundwater impact typically have elevated TDS, specific conductance, sulfate, boron, and chloride concentrations. Elevated concentrations of these constituents have been identified in groundwater beneath and downgradient from various ponds. Impacted groundwater is limited to the Colstrip Power Plant site. The Revised Cleanup Criteria and Risk Assessment Report (Marietta Canty, LLC and Neptune and Company, LLC 2017) revised the constituents of interest/constituents of concern list to include boron, sulfate, cobalt, lithium, molybdenum, selenium, and manganese.

The groundwater impacts at the Colstrip Power Plant have been characterized, and groundwater impacts are currently being remediated via capture wells, preventing off-site migration. As a result of seepage from ponds to groundwater, the Colstrip Power Plant has modified its operations to use ponds with clay liners for only storm water runoff. CCR is currently being stored in synthetically lined ponds.

With the exception of accidental spills, which cannot be predicted, burning of Area F coal at the Colstrip Power Plant would not likely result in any indirect impacts on groundwater because of the recent operational changes at the plant. Plant operations were modified due to past seepage losses and the resulting groundwater impacts. Existing groundwater impacts are currently being remediated.

The Rosebud Power Plant, located 6 miles north of the city of Colstrip, also operates on Rosebud Mine coal, including Area F coal. There have been no reported impacts on local groundwater or ongoing groundwater issues related to the Rosebud Power Plant. The source of water for the Rosebud Power Plant is groundwater from deep wells; these wells likely would continue to be the source for the Rosebud Power Plant. As discussed in **Section 4.9, Water Resources – Water Rights**, the Rosebud Power Plant was required by DNRC to demonstrate that there was adequate water to supply its demand when it applied for a Beneficial Use Permit. Given that the water source for the Rosebud Power Plant has been approved and is unlikely to change, it is unlikely that there would be any impacts on regional groundwater levels as a result of burning Area F coal. The Rosebud Power Plant would not receive substantial amounts of coal from Area F, and without any existing groundwater issues, mining in Area F would not likely result in any indirect impacts on groundwater.

4.8.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect groundwater impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, disturbance would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. Under Alternative 5, direct and indirect groundwater impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

As with Alternative 4, removal and stockpiling of overburden during the Alternative 5 mining period would permanently remove any saturated zones within the overburden, and removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period. Groundwater that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Groundwater levels in the Rosebud Coal would decline as the coal is dewatered and removed. Drawdown created by removal of the coal would extend out from the mined areas as more of the coal is dewatered and removed. Until the spoil is resaturated, remaining Rosebud Coal groundwater would not reach the major drainages. It is not known how much time would be required to resaturate the spoil, but the process is expected to require more than 50 years due to the nature of the spoil. Spring flows within the project area would be affected by mining. The effects would range from reduced flow, particularly if the source of the spring water is at least partially from the Rosebud Coal, to complete elimination of the spring if its source is solely from the Rosebud Coal or overburden that would be removed. It is unlikely that springs whose source is either the Rosebud Coal or overburden that is to be mined would redevelop in the postmining period. As with Alternative 4, if any private wells were to become unusable due to mining under Alternative 5, Westmoreland Rosebud would be required to replace the well; thus, impacts on private wells in the analysis area from drawdown would be long-term, negligible to moderate, and adverse. Under Alternative 5, as with Alternative 4, the primary change to groundwater quality would result from removing the Rosebud Coal and replacing the coal with overburden as spoil. The effects on groundwater quality in the analysis area are likely to be long-term, moderate, and adverse.

Within the Trail Creek, McClure Creek, and Robbie Creek drainages (where mining would not occur), direct impacts under Alternative 5 would be limited to water quantity impacts from drawdown related to mining occurring to the east. Water quantity impacts would progressively decrease further northwest of Donley Creek. The maximum drawdown at the end of mining would not be as deep as that predicted for Alternative 4 (about 90 feet) since mining would not extend as far south as the mining pits under Alternative 4 and the predicted 5-foot drawdown for the Rosebud and McKay Coals hydrostratigraphic units would not extend as far upgradient to the south as predicted for Alternative 4 (about 1.5 miles). Under Alternative 5, the predicted maximum and 5-foot drawdown would be greater than under Alternative 1 due to the increased disturbance of 1,474 acres, mine life increase of 5 years, and coal production of 20 million tons.

Groundwater quality impacts within the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated. In addition to the springs listed in **Table 4.8-1** as not being impacted, similar to Alternative 1, Springs 3, 10, 11, 13, and 14 would also not be impacted under Alternative 5.

Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4. With the exception of accidental spills, which cannot be predicted, burning of Area F coal at the Colstrip Power Plant under any of the alternatives would not likely result in any indirect impacts on groundwater because of the recent operational changes at the plant (see Alternative 4 discussion above in **Section 4.8.3**). Similarly, combustion of Area F coal in the Rosebud Power Plant would not likely result in any indirect impacts on groundwater under any of the alternatives (see Alternative 4 discussion above in **Section 4.8.3**).

4.8.5 Irreversible and Irretrievable Commitment of Resources

The Rosebud Coal aquifer within the mine pit footprint would be irreversibly and irretrievably lost due to mining. The coal would be replaced with spoil, which would likely have different hydrologic characteristics and water quality.

Groundwater springs removed due to mining would be irreversibly and irretrievably lost. It is possible that after the spoil resaturates, new springs may appear along the various drainages. Groundwater quality in the saturated zones that would develop in the spoil would require an undetermined but significant amount of time to reach equilibrium and begin to improve. As defined under NEPA, this would be an irreversible commitment of resources, which cannot be reversed except over extremely long periods.

4.9 WATER RESOURCES – WATER RIGHTS

This section discloses the direct and indirect effects on water rights (surface and groundwater) resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine water rights and the analysis areas used for this impacts analysis are described in **Section 3.9, Water Resources – Water Rights**. This environmental consequences section has been updated from the 2018 Final EIS to incorporate the surface and groundwater impact assessments disclosed in the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), updated monitoring data collected since the data evaluated in the 2018 Final EIS, and updated hydrologic information reported in the Annual Hydrology Reports prepared since the 2018 Final EIS. For spring and groundwater rights, the 2018 Final EIS limited the water rights analysis to those water rights listed by DNRC. This water rights assessment has been broadened to summarize and incorporate by reference the private wells groundwater information center (GWIC) IDs, which are administrated by the Montana Bureau of Mines and Geology and were disclosed in the CHIA (DEQ 2019b).

4.9.1 Analysis Methods and Impact and Intensity Thresholds

Water rights impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.9.1** of the 2018 Final EIS, beginning on page 540. The analysis area for direct and cumulative impacts on surface waters was increased for this SEIS to include a portion of the Yellowstone River (see **Section 3.7, Water Resources – Surface Water**). As a result, the analysis area for indirect effects on surface water rights was also increased as described in **Section 3.9**. For purposes of assessing springs, impacts on springs are defined by their source, which is groundwater. Therefore, the analysis area for direct impacts for springs is the same as that defined for groundwater (see **Section 3.8, Water Resources – Groundwater**). The thresholds for assessment of water rights impacts (negligible, minor, moderate, or major) are the same as those defined in the 2018 Final EIS in **Table 133**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.9.2 Alternative 1 – No Action

The types of direct and indirect water rights impacts under Alternative 1 (as described in this SEIS)[72] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct impacts would be limited to the southeastern portion of the project area (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

Under Alternative 1, direct and indirect water rights impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than

[72]. Direct and indirect water rights impacts of Alternative 1 – No Action were described in **Section 4.9.2** of the 2018 Final EIS, beginning on page 541. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

Similar to Alternative 5, mining under Alternative 1 would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Therefore, surface water rights located in the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated to be impacted under Alternative 1. As compared to Alternative 4, this would result in four fewer surface water rights potentially impacted from mining: two on Trail Creek (42KJ 183497 00 and 42KJ 183501 00), one on McClure Creek (42KJ 8211 00), and one on Robbie Creek (42KJ 183532 00). All of these water rights are for stock watering directly from the source or from a ditch system.

Similar to Alternative 5, mining under Alternative 1 would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). Therefore, groundwater rights located in the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated to be impacted under Alternative 1. As compared to Alternative 4, this would result in three fewer groundwater rights destroyed from mining (DNRC ID 42KJ438900, 42KJ44622, and GWIC ID 14199), four fewer groundwater rights potentially impacted due to drawdown (DNR ID 42KJ18335200, 42KJ16279800, 42KJ2839400, and 42KJ16285000), and five fewer springs physically disturbed (Springs 3, 10, 11, 13, and 14).

4.9.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect water rights impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.9.3** of the 2018 Final EIS, beginning on page 541. Under Alternative 4, half a million tons more coal would be mined[73] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.9.3.1 Direct Impacts (Active Mining)

Spring Water Rights

There are 16 spring rights used for stock watering located in the direct effects analysis area on unnamed tributaries of Trail, McClure, Robbie, Donley, and Black Hank Creeks (**Figure 3.7-1**; **Table 4.8-1**). **Table 4.9-1** has been updated based on the CHIA (DEQ 2019b); this revised table better resolves uncertainties regarding water rights and incorporates updated information disclosed in **Table 4.8-1**. **Table 4.9-1** incorporates additional springs identified by the CHIA (Table 8-2 of DEQ 2019b) as being located within the groundwater analysis area. See Figure 8-2 of the CHIA for spring water rights locations. Based on the CHIA (DEQ 2019b), Springs 2, 5, 8, 9, 12, and 14 do not have associated water rights. Eleven of the spring water rights listed in **Table 4.9-1** would be physically disturbed due to mining, their water source would be removed, or their flow rate would be reduced until after mining. The 74-acre area where mining

73. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

would be prohibited under Alternative 4 would likely result in two spring rights not being impacted (as compared to Alternative 2).

Table 4.9-1. Spring Water Rights in the Direct Effects Analysis Area.

Identification Number (Monitored Spring #)	Water Source	Potential Impact during Active Mining	Potential Impact Postmining
DNRC 42KJ 108383 00	Overburden	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
DNRC 42KJ 162857 00 (Spring 1)	Overburden	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
DNRC 42KJ 162860 00	Overburden	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
DNRC 42KJ 44616 00	Overburden	Impact not likely, located upgradient of 74-acre area not approved for mining	Impact not likely, outside of the area approved for mining
DNRC 42KJ 44613 00 (Spring 7)	Rosebud Coal	Impact not likely, located within 74-acre area not approved for mining	Impact not likely, outside of the area approved for mining
DNRC 42KJ 108396 00	Rosebud Coal	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 108673 00 (may be Spring 11)	Alluvium/interburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 108394 00 (may be Spring 10)	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 108393 00	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 108395 00	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 183350 00 (Spring 3)	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
42JK 183353 00 (Spring 13)	Alluvium/interburden	Flow may be temporarily reduced by mining and may be affected by road construction	Flow may be temporarily reduced by mining and may be affected by road construction
DNRC 42KJ 18492 00	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
DNRC 42KJ 183510 00	Alluvium, overburden, and/or Rosebud Coal	Near mine pits and disturbance, loss of flow during mining likely	Increase in TDS likely due to spoil water after mining
GWIC 1055 (Spring 4)	Overburden	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
DNRC 42KJ 162853 00 (Spring 6)	Overburden	No impact on overburden, upgradient of Area F mining	No impact on overburden, upgradient of Area F mining
42KJ 183508 00	Overburden	Physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return
42KJ 108264 00	Overburden	May be physically disturbed by Area F mining, loss of flow during mining likely	Water source removed, may not return

If a spring water right were to become unusable for its specified purpose due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud, so the impact would be moderate and short-term. Possible replacement water sources are discussed in **Section 4.9.3.3, Replacement Water Sources**. If a spring water right were impacted by mining but still contained sufficient water of adequate quality to meet beneficial use needs, the intensity of the impact would be negligible to minor and short-term.

Surface Water Rights

Because streams located south and west of the analysis area would not be affected by mining, surface water rights located south and west of the project area would not be affected by mining. During mining, runoff from disturbed areas would be detained and contained in mining pits and/or sediment-control structures, resulting in a loss of water downstream. Although the main creek channels would not be mined, tributaries to the creeks in the project area would be mined, temporarily reducing stream flows. Impounded water would be discharged at times, after sediment settling treatment, from the sediment ponds to all of the creeks in the project area, changing the timing of water availability to downstream surface water users. Some of the impounded water would be used for dust control or would evaporate or infiltrate. In addition, removal of the Rosebud aquifer that is a source of water to some sections of McClure, Robbie, and Donley Creeks, plus the reduction of water availability from the McKay Coal, would reduce baseflow in and downstream of the project area until the groundwater table recovered after many decades. Effects on stream flow are described in greater detail in **Section 4.7, Water Resources – Surface Water**. Direct surface water diversions downstream of the project area include seven water rights: two on Trail Creek (42KJ 183497 00 and 42KJ 183501 00), one on McClure Creek (42KJ 8211 00), one on Robbie Creek (42KJ 183532 00), two on Donley Creek (42KJ 177102 00 and 42KJ 183513 00), and one on Black Hank Creek (42KJ 183512 00). All of these water rights are for stock watering directly from the source or from a ditch system. The 74-acre area removed from mining under Alternative 4, as compared to Alternative 2, could result in one surface water right being impacted less due to this reduction in mining. Due to the irregular nature of stream flow in Trail, Donley, Robbie, McClure, and Black Hank Creeks, it is not possible to quantify the effect on water rights on these creeks. If a surface water right were to become unusable for its specified purpose due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud; thus, the impact would be moderate and short-term. Possible replacement water sources are discussed in **Section 4.9.3.3, Replacement Water Sources**. If a surface water right were impacted by mining, but changes in flow or water quality were small enough that the flow and/or water quality were still adequate to meet beneficial use needs, the intensity of the impact would be negligible to minor and short-term.

There are surface water rights on the West Fork Armells Creek, but because the mine disturbance area is small (less than 5 percent) relative to the overall watershed area of the creek, it is expected that effects on these water rights would not be measurable except when flows from a large, localized storm event at the project area are detained during mining. The intensity of the impact on any surface water rights on the West Fork Armells Creek as a result of mining would be expected to be short-term and negligible.

Some of the surface water rights are for on-stream reservoirs used for stock watering. Stock ponds located within the disturbed area in the project area would be lost due to mining. Other ponds located near the disturbance area, both within and near the project area, may lose some or all of their water supply due to:

- Reductions in stream flow as a result of impounding water during mining
- Reductions in stream flow due to the loss of mined sections of the watersheds
- Reductions or elimination in groundwater discharge from the Rosebud and McKay aquifers to perennial or intermittent stream reaches

As discussed in **Section 4.7, Water Resources – Surface Water**, the water quality of the stock ponds may be degraded as a result of mining. If a stock pond were to become unusable due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud; thus, the impact would be moderate and short-term. If a pond were impacted by mining but still contained sufficient water of adequate quality for stock watering, the intensity of the impact would be short-term and negligible to minor.

Groundwater Rights

Groundwater wells located within the 4,288-acre Alternative 4 disturbance area would be removed as a result of mining; in comparison, Alternative 2 would impact groundwater wells in a smaller disturbance area (4,260 acres). The 74-acre area removed from mining under Alternative 4 as compared to Alternative 2 would likely result in one groundwater right (GWIC ID 705195 – stock well with no DNRC water ID number) not being impacted due to this reduction in mining. The full list of groundwater rights impacted by Alternative 4 is listed in Table 8-3 and shown on Figure 8-3 of the CHIA (DEQ 2019b). Six groundwater rights (DNRC IDs 42KJ438900, 42KJ4651900, 42KJ10840000, 42KJ4462200, and 42KJ18350900 and GWIC ID 14199) are likely to be destroyed under Alternative 4 mining.

Westmoreland Rosebud's Alternative 2 groundwater model (PAP, Appendix I-B) estimated that the maximum drawdown in the Rosebud aquifer at the end of mining would be 90 feet and in the McKay aquifer would be 10 feet (see **Section 3.8, Water Resources – Groundwater**); similar drawdown would be expected under Alternative 4. For wells not removed by mining, depending on the well location, the groundwater level under Alternative 4 could be drawn down in the Rosebud aquifer from a few feet up to 90 feet as a result of mining, and in the McKay aquifer by up to 10 feet based on modeling for Alternative 2. The Alternative 2 groundwater model also showed that groundwater levels in water wells located outside of and within 1 mile to the south or west of Area F would be drawn down by 5 to 20 feet in the Rosebud aquifer and up to 5 feet in the McKay aquifer; similar drawdown would be expected under Alternative 4. Table 8-3 of the CHIA (DEQ 2019b) details the likely drawdown possible for each groundwater right assuming well completion depth; however, information is often lacking for accurate determinations to be made. It is not known what water level decreases in private wells would impair the owner's ability to produce water; production would depend on the characteristics of the individual wells such as depth, depth to water, pump location, and specific capacity. In general, wells would not be affected by mining if they are located outside the model-predicted drawdown area (i.e., groundwater analysis area). If a well were to become inadequate or unusable for its specified purpose due to drawdown in the well or change in water quality, it would be replaced by Westmoreland Rosebud, or a suitable replacement water source would be provided; thus, the impact would be moderate and short-term. Possible replacement water sources are discussed in **Section 4.9.3.3, Replacement Water Sources**. If a groundwater right were impacted by mining but still contained sufficient water of adequate quality to meet beneficial use needs, the intensity of the impact would be short-term and negligible to minor.

4.9.3.2 Direct Impacts (Postmining)

Spring Water Rights

Postmining effects on spring water rights are described in **Table 4.9-1**. The water table would recover in the McKay Coal after mining, so the flow of any spring from the McKay Coal would return to near pre-mine conditions many decades after mine closure. Increases in TDS are likely due to spoil water after mining for any Rosebud or overburden spring that returns. If a spring water right were unusable for its specified purpose due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud; thus, the impact would be moderate and short-term. If a spring water right were impacted by mining but still contained sufficient water of adequate quality to meet beneficial use needs, the intensity of the impact would be short-term and negligible to minor.

Surface Water Rights

After mining, when the site was reclaimed and the hydrologic balance restored in accordance with MSUMRA requirements for Phase IV bond release (ARM 17.24.1116(6)(d); see also **Section 1.6.4, Bond Release** in the 2018 Final EIS), effects on surface water rights would diminish and may, after many decades, return to near pre-mine conditions. Direct surface water diversions downstream of the project area include seven water rights: two on Trail Creek (42KJ 183497 00 and 42KJ 183501 00), one on McClure Creek (42KJ 8211 00), one on Robbie Creek (42KJ 183532 00), two on Donley Creek (42KJ 177102 00 and 42KJ 183513 00), and one on Black Hank Creek (42KJ 183512 00). All of these water rights are for stock watering directly from the source or from a ditch system. If these surface water rights were to become unusable for their specified purpose due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud; thus, the impact would be moderate and short-term. If these surface water rights were impacted by mining either during or after mining, but changes in flow or water quality were small enough that the flow and/or water quality were still adequate to meet beneficial use needs, the intensity of the impact would be short-term and negligible to minor.

Stock ponds with water rights located near the disturbed area within the analysis area whose source of supply was runoff would return to near pre-mine conditions after reclamation was completed and the hydrologic balance restored to the extent possible. The ponds would fill when precipitation events resulting in stream flow and direct runoff to the ponds occurred. For stock ponds located near the disturbed area whose source of supply was at least in part spring flows, there would not be a return to pre-mine conditions. Stock ponds for livestock and wildlife watering in the project area would be reestablished or mitigated by Westmoreland Rosebud during postmining reclamation. If a stock pond were to become unusable either during or after mining due to flow or water quality changes, a suitable replacement source would be provided by Westmoreland Rosebud; thus, the impact would be moderate and short-term. If a pond were impacted during or after mining but still contained sufficient water of adequate quality for stock watering, the intensity of the impact would be short-term and negligible to minor.

Groundwater Rights

The Alternative 2 groundwater model showed that 50 years after the end of mining, there would still be residual drawdown in the coal aquifers outside of the mined area (PAP, Appendix I-B); a similar drawdown timeframe is expected for Alternative 4. It is predicted that groundwater levels would return to pre-mine conditions in the McKay Coal many decades after mine closure. Groundwater levels in the Rosebud Coal upgradient of the Area F boundary would return to pre-mine conditions many decades after mine closure. If a well were to become inadequate or unusable for its specified purpose due to drawdown in the well or change in water quality, it would be replaced by Westmoreland Rosebud, or a suitable replacement water source would be provided; thus, the impact would be moderate and short-term. If a groundwater right were impacted by mining but still contained sufficient water of adequate quality to meet beneficial use needs, the intensity of the impact would be short-term and negligible to minor.

4.9.3.3 Replacement Water Sources and Replacement Process

Possible sources of replacement water for stock and domestic groundwater, spring, and surface water rights would likely be groundwater pumped from the unmined areas of the Rosebud Coal aquifer west and south of the project area, the McKay Coal aquifer, or the Sub-McKay aquifer. The most likely source may be the Sub-McKay aquifer because it generally yields more water than the coal aquifers. The water quality of these aquifers is comparable to the existing quality of the streams, springs, and wells in and near the project area, so it is unlikely that beneficial uses of the existing water rights would be impaired. All of these aquifers would produce water if developed. MSUMRA requires the applicant to provide “a description of alternative water supplies, not to be disturbed by mining that could be developed to replace water supply diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses." Approximate yields in Sub-McKay wells range from 3.5 to 35 gpm (PAP, Appendix O), which should be sufficient for stock and domestic water use. Power would need to be provided to the pumps in any wells installed for replacement water. Water could also be delivered by truck or pipeline from other areas, which may be a viable alternative for domestic water rights but may be cost prohibitive for stock watering. Stock ponds would be constructed in the project area during reclamation.

The replacement of water sources may implicate the jurisdiction of both DEQ and DNRC. MSUMRA requires Westmoreland Rosebud to identify the probable need for and hydrologic availability of water supplies that could be used to replace any water supply interrupted, diminished, or otherwise adversely impacted by mining activities (Section 82-4-222(1)(m), Montana Code Annotated [MCA]; ARM 17.24.648; ARM 17.24.304(1)(f)(iii)). Westmoreland Rosebud's obligation to provide replacement water is unconditional (Section 82-4-253(3)(d), MCA). To the extent that such provision of replacement water implicates the Montana Water Use Act, Westmoreland Rosebud would also need to fully comply with that law and any associated DNRC rules. *Id*. DEQ has neither the authority nor the expertise to determine, on an advisory basis or otherwise, water rights issues. See Section 85-2-311, MCA; *Confederated Salish & Kootenai Tribes v. Clinch*, 2007 MT 63, P35, 336 Mont. 302, 318 (2007); see also *Confederated Salish & Kootenai Tribes v. Clinch*, 1999 MT 342, P14-P15, 297 Mont. 448, 453-454 (19990; *Peabody Coal Co. v. OSMRE*, 123 IBLA 195; 1992 IBLA LEXIS 55, 123 IBLA 195; and 1992 IBLA LEXIS 55 at [2]. The process for replacing a water right impacted by mining is described in **Section 3.9.1.1** of the 2018 Final EIS.

4.9.3.4 Indirect Impacts

The indirect effects analysis area includes the Yellowstone River from Cartersville Dam downstream to the confluence with the Tongue River; this analysis area was chosen to account for indirect effects of water withdrawals by the Colstrip Power Plant and because the Cartersville Dam is a barrier to fish passage and likely precludes pallid sturgeon above the dam. The Yellowstone River diversion point for the Colstrip Power Plant's 69 cfs water right is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam. As described in **Section 4.7.3.3, Indirect Impacts** for surface water hydrology, the 69 cfs diversion potential of the Colstrip Power Plant represents a small fraction of average daily flow in the Yellowstone River within the indirect effects analysis area (less than 0.1 percent at maximum recorded flow to 5 percent at minimum recorded flow), indicating that corresponding diversions would not adversely affect the river's surface water hydrology. There are approximately 100 active surface water rights on the Yellowstone River within the indirect effects analysis area with a maximum diversion potential of approximately 1,400 cfs. Most of those water rights are dedicated exclusively to irrigation purposes, including the largest three of those water rights (425 cfs, 144 cfs, and 109 cfs). The Colstrip Power Plant's 69 cfs municipal and industrial water right on the Yellowstone River represents a small fraction (5 percent) of the maximum diversion potential from the river within the indirect effects analysis area, and when considered in combination with its non-adverse effect on surface water hydrology, diversions associated with the water right would not adversely affect other water rights within the indirect effects analysis area.

Coal currently mined by Westmoreland Rosebud at the Rosebud Mine is used by two coal-fired power plants (the Rosebud and Colstrip Power Plants) to generate electricity. Project area coal would be used at these same power plants, thus contributing to their annual emissions. The source of water supply to the Colstrip Power Plant is water piped from the Yellowstone River (see Section **3.7.6.2, Water Quality in the Indirect Effects Analysis Area**). There would be no indirect impacts from the Colstrip Power Plant on water levels in wells, spring flows, or stream flows that would affect any water rights in the indirect impacts analysis area.

The source of water to the Rosebud Power Plant is deep groundwater wells. There are other deep groundwater wells near the Rosebud Power Plant wells, but for the power plant to have obtained a Beneficial Water Use Permit from DNRC to pump water from their wells required proof that water was physically and legally available at the proposed point of diversion in the amount requested. In addition, senior water rights cannot be impaired. There may be indirect impacts from the Rosebud Power Plant on water levels in nearby wells due to pumping water for the power plant, but adequate water would still be available for the other nearby groundwater rights. There have been no reported impacts on local groundwater or ongoing groundwater issues related to the Rosebud Power Plant, so there would be no indirect impacts on the water quality of groundwater rights in the analysis area. There would be no indirect impacts on spring flows or stream flows that would affect analysis area spring or surface water rights.

Impacts on groundwater quality due to the disposal of CCR at the Colstrip Power Plant are described in **Section 4.8, Water Resources – Groundwater** and are limited to the Colstrip Power Plant site. There would be no impacts on groundwater quality except on the Colstrip Power Plant site (Hydrometrics 2015). There are no groundwater wells on the Colstrip Power Plant site except for a very deep well owned by the electric power companies and City of Colstrip, as well as capture wells for site remediation, so there would be no indirect impacts on groundwater rights due to the disposal of CCR. Pumping from the on-site wells would not impair nearby senior water rights. There may be indirect impacts from the Colstrip Power Plant on water levels in nearby wells due to pumping groundwater on the power plant site, but adequate water would still be available for the other nearby groundwater rights. Therefore, there would be no indirect impacts on groundwater rights due to pumping groundwater on the Colstrip Power Plant property.

Based on the described effects on surface water quality of atmospheric deposition from the two power plants described in **Section 4.7, Water Resources – Surface Water**, it is not expected that there would be any effects on surface water rights in the analysis area. It is not expected that atmospheric deposition from the two power plants would affect groundwater quality, so there would be no effects on groundwater rights in the analysis area.

4.9.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect water rights impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, disturbance would be limited to the southern portion of the project area (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, direct and indirect water rights impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

Similar to Alternative 1, mining under Alternative 5 would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages. Therefore, surface water rights located in the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated to be impacted under Alternative 5. As compared to Alternative 4, this would result in four fewer surface water rights potentially impacted from mining: two on Trail Creek (42KJ 183497 00 and 42KJ 183501 00), one on McClure Creek (42KJ 8211 00), and one on Robbie Creek (42KJ 183532 00). All of these water rights are for stock watering directly from the source or from a ditch system.

Mining under Alternative 5 would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). Therefore, groundwater rights located in the Trail Creek, McClure Creek, and Robbie Creek drainages would not be anticipated to be impacted under Alternative 5. As compared to Alternative 4, this would result in three fewer groundwater rights destroyed from mining (DNRC IDs 42KJ438900 and 42KJ44622 and GWIC ID 14199), one fewer groundwater right potentially impacted due to drawdown (DNR ID 42KJ18335200), and five fewer springs physically disturbed (Springs 3, 10, 11, 13, and 14).

4.9.5 Irreversible and Irretrievable Commitment of Resources

Assuming that any adversely affected water rights would be replaced with an adequate water supply, no irreversible or irretrievable commitment of resources would occur. If there was not an adequate water supply to replace all adversely affected water rights, then the loss of some water rights would be an irreversible and irretrievable commitment of resources.

4.10 VEGETATION

This section discloses the direct and indirect effects on vegetation resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine vegetation conditions and the analysis areas used for this impacts analysis are described in **Section 3.10, Vegetation**.

4.10.1 Analysis Methods and Impact and Intensity Thresholds

Vegetation impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.10.1** of the 2018 Final EIS, beginning on page 547. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on vegetation are the same as those defined in the 2018 Final EIS **Table 135**). Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.10.2 Alternative 1 – No Action

The types of direct and indirect vegetation impacts under Alternative 1 (as described in this SEIS)[74] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area, which would result in a short-term, moderate, adverse effect on vegetation. Over a 6-year mine life, approximately 17.1 million tons of coal would be mined from Federal and private coal leases in the project area. As with Alternative 4, areas that require vegetation clearing and removal under Alternative 1 would be subject to an overall loss of biodiversity and a short-term loss of productivity during the active mining period. Reclamation would reestablish plant communities, but biodiversity would be reduced and species composition would not be the same. As with Alternative 4, mining dewatering activities could lower the regional water table, which would adversely impact adjacent vegetation communities, especially wetland and riparian areas.

Under Alternative 1, direct and indirect vegetation impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres (and associated vegetation) would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.10.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect vegetation impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.10.3** of the 2018 Final EIS,

74. Direct and indirect vegetation impacts of Alternative 1 – No Action were described in **Section 4.10.2** of the 2018 Final EIS, beginning on page 547. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

beginning on page 548. Under Alternative 4, half a million tons more coal would be mined[75] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation (including revegetation) of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.10.3.1 Direct Impacts

Alternative 4 would result in the removal and loss of vegetation communities on up to 4,288 acres in the direct effects analysis area during mining operations in the project area, which would result in a short-term, moderate, adverse effect on vegetation. The upland grassland community would be most affected, with up to 1,538 acres disturbed, followed by agricultural land and pastureland with a total of 985 acres impacted. When the various shrub grassland communities are combined, they make up the third-largest vegetation community impacted, with a disturbance of 918 acres. **Table 4.10-1** lists the acreages of disturbance for each vegetation type in the direct effects analysis area and the proposed postmining revegetation target acres for each type. The vegetation types are categorized by the communities proposed for revegetation. The vegetation types listed in **Table 4.10-1** match those used by Westmoreland Rosebud in the PAP and the approved permit. These terms are similar to but differ from the terms used in the Cedar Creek Associates, Inc. 2014 report (PAP, Appendix E) as described in the affected environment discussion in **Section 3.10, Vegetation** in the 2018 Final EIS.

As shown in **Table 4.10-1**, Alternative 4 would disturb up to 4,288 acres (instead of 4,260 acres in Alternative 2) in a 6,773-acre permit area (instead of 6,746 acres under Alternative 2), and the habitat types have roughly the same distribution. As described in the 2018 Final EIS for Alternative 2, areas that require vegetation clearing and removal under Alternative 4 would be subject to an overall loss of biodiversity and a short-term loss of productivity in the direct effects analysis area during the active mining period. Reclamation would reestablish plant communities, but biodiversity would be reduced and species composition would not be the same After reclamation of mine disturbances, shrublands and grasslands can take many years to reestablish a community with a diversity of plants similar to but less than the original plant community. As discussed in **Section 4.24, Soil**, Alternative 4 (like Alternative 2) would impact soil structure by altering ecological processes (e.g., propagule pressure, nutrient cycling, competition, interference) and adversely affect soil/plant interaction due to decreased soil water-holding capacity, loss of aeration and pore space, and increased bulk density. Soil compaction, loss of soil structure, loss of organic matter due to mixing and storage, and loss of microorganisms due to prolonged storage of soil could lower postmining vegetation vigor and diversity for an extended period.

Upon completion of mining in the project area, disturbed areas would be reclaimed and revegetated. Westmoreland Rosebud's reclamation requirement is to establish a postmining environment comparable to existing conditions. The approved reclamation plan includes areas designated for various shrublands and grasslands. Shrublands would likely take longer to restore to pre-mine conditions, while grasslands would recover more quickly following reclamation. Westmoreland Rosebud would revegetate the existing pasturelands with grasslands to reflect landowner preference for more grazing land. Overall, reclamation under Alternative 4 would reestablish plant species that would have the same seasonal growth characteristics as the original vegetation, be capable of self-regeneration and plant succession, be

75. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

compatible with the plant and animal species of the area, and meet the requirements of applicable seed, poisonous and noxious plant, and introduced species laws and regulations.

Success of reclamation would be measured through monitoring as described in the revegetation monitoring plan and revegetation success criteria (see 2018 Final EIS). Although the seed mixes for revegetation would be dominated by native species, it is likely over the long term that reclaimed areas would have fewer native species than pre-mine vegetation communities.

Table 4.10-1. Vegetation Impacts and Proposed Revegetation Acreages.

Vegetation Type	Acres in Project Area	Acres Disturbed	Postmining Revegetation Target Acres
Lowland			
Grassland	0.4	0.4	0
Deciduous tree/shrub	61	19	22
Upland			
Grassland	2,383	1,538	2,006
Shrub grasslands			
• Big sagebrush	443	285	253
• Silver sagebrush	643	327	429
• Skunkbush sumac	394	223	240
• Deciduous tree/shrub	159	83	145
Mixed shrub	184	82	101
Conifer	1,373	672	734
Other			
Pastureland	537	516	0
Agricultural fields	513	469	318
Ranch yards/county roads	41	32	3
Sandstone features			
• Cliff	2	2	0
• Sandstone rock	4	4	6
Scoria pit	5	5	0
Ponds	1	0	0
Wet meadow	5	2	3
Total (Alternative 2)	**6,746**[1]	**4,260**	**4,260**
Total (Alternative 4)	**6,773**[2]	**4,288**	**4,288**

[1.] Based on Table 313-1 from Western Energy's PAP. Please note this number actually equals 6,748 due to rounding to the nearest whole number.
[2.] See **Section 2.2.2.2, Area F Operations** for a discussion of how the approved operating permit has evolved from Alternative 2 – Proposed Action analyzed in the 2018 Final EIS.

In addition to ground-disturbing activities, mining dewatering activities could lower the regional water table, which would adversely impact adjacent vegetation communities, especially wetland and riparian areas. As discussed in **Section 4.11, Wetlands and Riparian Zones**, a majority of the wetlands in the project area could be impacted from mining, including a reduction in groundwater and surface water support. Although sections of these drainages would not be directly impacted by mining activities, the reduction in surface and groundwater could cause changes to the vegetation communities along the drainages. Forty-six acres of riparian habitat occur along drainages that would have reduced flow due to mining activities. Changes to hydrology could cause these riparian areas to shift to grassland/upland communities. Loss of hydrology to wetland and riparian areas often leads to an increase in noxious and nonnative species along drainages. Although hydrology would be returned during reclamation, it could take decades before the wetland/riparian communities return to pre-mine conditions.

Adverse effects on surrounding vegetation could also occur from increased dust in the project area from mining activities. Increased dust that settles on vegetation can block photosynthesis and growth (Wijayratne et al. 2009). These impacts would be localized, and dust-control measures (see **Section 4.3, Air Quality**) would reduce the short-term negligible effects from dust.

Alternative 4 may result in new or expanded populations of noxious weeds by disturbing 4,288 acres of land (as compared to 4,260 acres under Alternative 2) that could become potential paths for dispersal of weed seeds. Existing weed populations could disperse to newly disturbed areas and other areas via vehicular traffic or soil transport. An increase in abundance and distribution of noxious weeds has the potential to displace native species and reduce vegetation diversity. The noxious weed control plan would prevent any large populations of noxious weeds from establishing within the project area. With the implementation of the noxious weed control plan, reclamation plan, and BMPs, Alternative 4 would have a short-term, minor, adverse impact on surrounding vegetation. Overall, Alternative 4 would have a short-term, moderate, adverse effect on vegetation. The Alternative 4 impact would be slightly greater than that of Alternative 2 due to the removal of 4,288 acres (instead of 4,260 acres) of vegetation for mining activities in the direct effects analysis area; however, these areas would be reclaimed following mining. Some long-term, minor, adverse effects on vegetation would occur due to decreased vegetation vigor or diversity and due to the potential for changes to vegetation communities from the reduced amount of surface and groundwater in the area.

4.10.3.2 Indirect Impacts

Deposition modeling results (see **Section 4.3, Air Quality**) indicate that the operation of the Colstrip and Rosebud Power Plants during the 20-year mining operations period in the project area would not result in adverse impacts on plants (see **Section 4.3.3.2, Indirect Impacts of Coal Combustion**). **Table 4.10-2** (**Table 137** in the 2018 Final EIS) provides a summary of background concentrations for the trace metals analyzed plus deposition in the indirect effects analysis area, compared to the ecological screening values for plants. For all trace metals except mercury and selenium, deposition of 1 percent of background concentrations would not be reached from combustion of project area coal over the 20-year operations period, and mercury deposition inside the analysis area would be less than the ecological soil screening level (Eco-SSL) for plants. Although the combined background levels and expected deposition for selenium exceed the Eco-SSL for plants, the expected deposition is only 6.1 percent of the Eco-SSL. Additional detail is provided in **Section 4.10.3.2** of the 2018 Final EIS. As such, there would be no indirect effects on vegetation from deposition of trace metals.

Table 4.10-2. Trace Metal Background, Potential Soil Impact Distance, and Ecological Screening Values for Plants.

Analyte	Background 95 Percent UCL	Total Deposition over 19-year Operations Period[1]	Total Expected Concentration (Background + Total Deposition)	Ecological Screening Values for Plants[2]	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Plant Ecological Screening Values[2]	Does Deposition plus Background Exceed the Plant Ecological Screening Values?	Potential Adverse Indirect Impacts on Plants
	mg/kg, DW	**mg/kg, DW**	**mg/kg, DW**	**mg/kg, DW**	**Percent**	**Percent**	**(Yes/No)**	**(Yes/No)**
Antimony	0.9	0.00504	0.90504	NA	0.56	NA	No	No
Arsenic	10.9	0.00694	10.90694	18	0.06	0.04	No	No
Cadmium	0.3	0.00189	0.30189	32	0.63	0.01	No	No
Chromium	50.5	0.01765	50.51765	NA	0.03	NA	No	No
Copper	17.8	0.08133	17.88133	70	0.46	0.12	No	No
Lead	19.1	0.00757	19.10757	120	0.04	0.01	No	No
Selenium	0.56	0.03153	0.59153	0.52	5.60	6.10	Yes	No
Mercury	0.023	0.00085	0.02385	0.3	3.70	0.28	No	No

NA = Not available. Insufficient data to derive Eco-SSLs; DW = Dry weight; UCL = Upper Confidence Limit.

1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by the EPA (2005).

2. **Section 4.10.1.1, Analysis Methods** in the 2018 Final EIS describes the hierarchy of plant ecological screening values.

4.10.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect vegetation impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area, which would result in a short-term, moderate, adverse effect on vegetation. Over an 11-year mine life, approximately 37.1 million tons of coal would be mined from Federal and private coal leases in the project area. As with Alternative 4, areas that require vegetation clearing and removal under Alternative 5 would be subject to an overall loss of biodiversity and a short-term loss of productivity during the active mining period. Reclamation would reestablish plant communities, but biodiversity would be reduced and species composition would not be the same. As with Alternative 4, mining dewatering activities could lower the regional water table, which would adversely impact adjacent vegetation communities, especially wetland and riparian areas.

Under Alternative 5, direct and indirect vegetation impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres (and associated vegetation) would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.10.5 Irreversible and Irretrievable Commitment of Resources

All action alternatives would disturb vegetation communities dominated by native species, the effects of which would be subsequently mitigated by revegetation. Revegetated areas would eventually return to pre-disturbance productivity, but vegetation diversity would be lower than existing conditions. The loss of some native plant species in all alternatives would be an irreversible resource commitment. The irreversible and irretrievable commitment of resources under Alternative 4 would be slightly greater than under Alternative 1 or 5 due to additional acres of disturbance.

4.11 WETLANDS AND RIPARIAN ZONES

This section discloses the direct and indirect effects on wetlands and riparian zones resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Existing wetland conditions and the analysis areas used for this impacts analysis are described in **Section 3.11, Wetlands and Riparian Zones**.

4.11.1 Analysis Methods and Impact and Intensity Thresholds

Wetland impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.11.1** of the 2018 Final EIS, beginning on page 554. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on wetlands are the same as those defined in the 2018 Final EIS in **Table 135**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.11.2 Alternative 1 – No Action

No direct wetland impacts are anticipated to occur under Alternative 1 because mining and disturbance would be limited to the southern portion of the project area (east of Donley Creek): no mining would occur in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. As with Alternative 4, indirect wetland impacts under Alternative 1 would be negligible.

Under Alternative 1, direct and indirect wetland impacts (if any) would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.11.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect wetland impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.11.3** of the 2018 Final EIS, beginning on page 555. Under Alternative 4, half a million tons more coal would be mined[76] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation (including revegetation) of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described

[76]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.11.3.1 Direct Impacts

Riparian Zones

Alternative 4 would have a short-term and long-term moderate adverse impact on riparian zones because the riparian habitat along the drainages in the analysis area would likely be impacted by changes to surface and groundwater. Although sections of these drainages would not be directly impacted by mining activities, the reduction in surface and groundwater flow from springs could cause changes to the vegetation communities along the drainages. Approximately 46 acres of riparian habitat (Woody Draw community as described in **Section 3.10, Vegetation** in the 2018 Final EIS) occur along drainages that would have reduced flow due to mining activities. Changes to hydrology could cause these riparian areas to shift to grassland/upland communities. Loss of hydrology to wetland and riparian areas often leads to an increase in noxious and nonnative species along drainages. Although hydrology would be returned during reclamation, it could take decades before the wetland/riparian communities return to pre-mine conditions.

Wetlands

Wetlands in the direct effects analysis area are described in **Section 3.11.2.1, Location and Classification of Wetlands in the Direct Effects Analysis Area** in the 2018 Final EIS. Because mining would be prohibited in approximately 74 acres of Federal coal in the Trail Creek drainage, impacts on wetlands[77] under Alternative 4 would be less than those described for Alternative 2 in the 2018 Final EIS. Under Alternative 4, approximately 7.19 acres of palustrine persistent emergent saturated wetlands would be directly impacted by mining activities in the analysis area (as compared to 8.38 acres under Alternative 2); see **Table 4.11-1** below. Of these, 3.41 acres of wetlands would experience short-term impacts, and 3.78 acres of wetlands would experience long-term impacts (as compared to 3.41 acres of short-term wetland impacts and 4.97 acres of long-term wetland impacts under Alternative 2). Based on the mining sequence in the currently approved Area F operating permit (**Section 2.2.5, General Sequence of Operations**), a majority of these direct impacts would occur 10 years or more after mining begins. The wetlands would be impacted by surface mining, construction of the haul road, installation of utility structures, or changes to surface and groundwater hydrology due to mining activities. Overall, Alternative 4 would have a short-term and long-term moderate adverse impact on wetlands.

[77]. Wetland B, within the Trail Creek drainage, would no longer be affected due to the prohibition of mining approximately 74 acres of Federal coal, reducing direct impacts by 1.19 acres.

Table 4.11-1. Alternative 4 Wetland Impacts.

Wetland Identification	Direct Short-Term Impact (acres)	Direct Long-Term Impact (acres)
A	0	0
B	0	0
C	0	0.80
D	1.64	0
E	1.23	0
F	0	2.38
F028	0	0.60
F049	0	0
F058	0	0
F061	0	0
F081	0.54	0
Total Impacts	**3.41**	**3.78**

Below is a summary of how each wetland (shown on **Figure 4.11-1**) would be impacted under Alternative 4:

- Wetland A (1.22 acres) – No impact.
- Wetland B (1.19 acres) – No impact.
- Wetland C (0.80 acre) – Approximately 0.61 acre of Wetland C would be impacted by ground-disturbing activities from mining. In addition, Wetland C is supported by Spring 10, which would not reestablish after mining is completed (see **Section 4.8, Water Resources – Groundwater**). Therefore, there would be a long-term moderate adverse impact on all 0.80 acre of Wetland C.
- Wetland D (1.64 acres) – Approximately 0.04 acre of Wetland D would be impacted by ground-disturbing activities. In addition, Wetland D is supported by Spring 13, which may be temporarily impacted by mining or road construction (see **Section 4.8, Water Resources – Groundwater**). Therefore, there would be a short-term minor adverse impact on all 1.64 acres of Wetland D.
- Wetland E (1.23 acres) – This wetland is supported by Spring 12, which may experience limited impacts from road construction. Therefore, there may be a short-term minor adverse impact on all 1.23 acres of Wetland E.
- Wetland F (2.38 acres) – This wetland is supported by overburden Spring 9, which would be impacted by mining and is not likely to reestablish at the same location after mining. Therefore, there would be a long-term moderate adverse impact on all 2.38 acres of Wetland F.
- Wetland F028 (0.60 acre) – This wetland is supported by Spring 11, which would be impacted during mining and is not expected to return postmining (see **Section 4.8, Water Resources – Groundwater**). Therefore, there would be a long-term moderate adverse impact on all 0.60 acre of Wetland F028.
- Wetland F049 (0.46 acre) – No impact.
- Wetland F058 (2.01 acres) – No impact.
- Wetland F061 (0.13 acre) – This wetland is along Donley Creek, where reduced flow to the alluvium is most likely; however, the primary source of water supporting this wetland is surface water (see **Section 4.7, Water Resources – Surface Water**). Therefore, there would be a negligible impact on Wetland F061.
- Wetland F081 (0.54 acre) – This wetland is supported by Spring 2, which may experience limited impacts from road construction. Therefore, there may be a short-term minor adverse impact on all 0.54 acre of Wetland F081.

The project would not require any Clean Water Act Section 404 permits because all of the wetlands identified in the project area were determined to be non-jurisdictional. MSUMRA (ARM 17.24.751) requires wetlands to be restored. The watershed topography and hydrology would be reclaimed to reestablish the hydrologic balance to the extent possible in and near the project area; however, as discussed above and in **Section 4.8, Water Resources – Groundwater**, the baseflow in the streams from groundwater discharge to the stream channels would not begin until after groundwater levels recovered many decades after mining, and discharges to streams may occur at different locations than where they occurred before mining. Pre-mine flow conditions would not return to springs whose aquifer sources were removed. There would be no impact on those springs supported by aquifers that were not impacted by mining, and they would remain fully functional. New wetlands may appear along drainages in the analysis area postmining after the spoil resaturates. After mining, some ponds may be constructed to provide water supplies for wetlands. Reclamation of wetlands on-site would achieve the same functions and values of pre-mining conditions but may not do so for a considerable amount of time. The mitigation of wetlands would provide replacement of the functions and values lost.

As discussed in **Section 2.4.8.5, Wetland Mitigation Plan**, in the 2018 Final EIS, Westmoreland Rosebud developed a wetland mitigation plan for Alternative 2 to mitigate for the loss of wetland functions and values from the proposed project; the same plan would be applied to Alternative 4.

4.11.3.2 Indirect Impacts

Indirect impacts on wetlands and riparian zones associated with Alternative 4 would result from air emissions due to the combustion of coal from the project area in the Rosebud Power Plant and in Units 3 and 4 of the Colstrip Power Plant. Alternative 4 indirect impacts would be similar to those described in **Section 4.10, Vegetation**. For all trace metals except mercury and selenium, deposition of 1 percent of background concentrations would not be reached from combustion of project area coal over the 20-year operations period, and mercury deposition inside the analysis area would be less than the Eco-SSL for plants. Although the combined background levels and expected deposition for selenium exceed the Eco-SSL for plants, the expected deposition is only 5.3 percent of the Eco-SSL. In addition, the mercury and selenium concentrations measured in the streams in the indirect effects analysis area have been below water-quality standards, with the exception of East Fork Armells Creek as described in **Section 4.7, Water Resources – Surface Water**. Indirect effects on wetlands and riparian zones from Colstrip and Rosebud Power Plant emissions likely would be negligible for one or more of the following reasons: (1) the deposition of trace metals around the power plant would not reach 1 percent of the background soil concentrations, (2) deposition would be significantly less than the Eco-SSLs for plants, or (3) deposition would only be a small percentage of the total concentrations (for selenium).

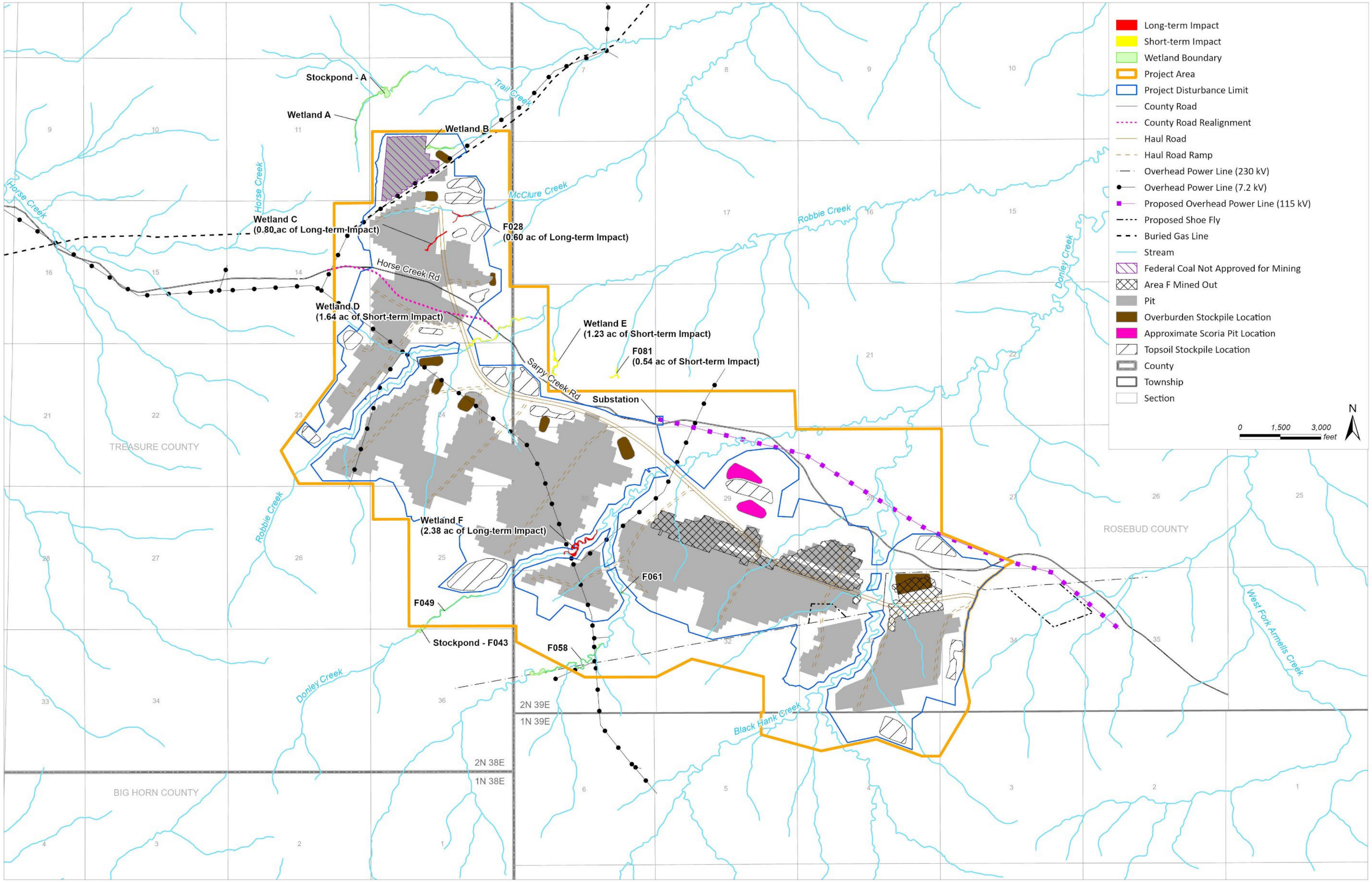

Figure 4.11-1. Alternative 4 Wetland Impacts

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4.11.4 Alternative 5 – Partial Mining Alternative

No direct wetland impacts are anticipated to occur under Alternative 5 because mining and disturbance would be limited to the southern portion of the project area (east of Donley Creek); no mining would occur in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. As with Alternative 4, indirect wetland impacts under Alternative 1 would be negligible.

Under Alternative 5, direct and indirect wetland impacts (if any) would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.11.5 Irreversible and Irretrievable Commitment of Resources

The following would be irreversible and irretrievable commitments of wetlands under Alternative 4:

- The loss of wetlands in the analysis area whose source of water supply would be permanently affected by mining activities.
- Wetlands within the disturbance area (4,288 acres under Alternative 4) would be removed during mining or other related disturbance.

The loss of surface water and groundwater hydrology in the analysis area are discussed in **Section 4.7, Water Resources – Surface Water** and **Section 4.8, Water Resources – Groundwater**.

4.12 FISH AND WILDLIFE RESOURCES

This section discloses the direct and indirect effects on fish and wildlife resources resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine fish and wildlife conditions and the analysis areas used for this impacts analysis are described in **Section 3.12, Fish and Wildlife Resources**.

4.12.1 Analysis Methods and Impact and Intensity Thresholds

Fish and wildlife impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.12.1** of the 2018 Final EIS, beginning on page 563. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on fish and wildlife are the same as those defined in the 2018 Final EIS in **Table 140**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.12.2 Alternative 1 – No Action

The types of direct and indirect fish and wildlife impacts under Alternative 1 (as described in this SEIS)[78] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct disturbance-related impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area. Alternative 1, as with Alternative 4, would likely result in minor to moderate, short- and long-term, adverse effects on fish and wildlife species due to displacement and habitat disturbance.

Over a 6-year mine life, approximately 17.1 million tons of coal would be mined from Federal and private coal leases in the project area. Under Alternative 1, as with Alternative 4, the indirect effects on wildlife from Colstrip and Rosebud Power Plant emissions are expected to be negligible (for metals not exceeding the ecological screening values) to minor (for those metals exceeding the ecological screening values) over the long term.

Under Alternative 1, direct and indirect wildlife impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.12.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect fish and wildlife impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.12.3** of the 2018 Final

[78] Direct and indirect impacts of Alternative 1 – No Action on fish and wildlife resources were described in **Section 4.12.2** of the 2018 Final EIS, beginning on page 564. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

EIS, beginning on page 564. Under Alternative 4, half a million tons more coal would be mined[79] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation (including revegetation) of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.12.3.1 Direct Impacts

As with Alternative 2, potential adverse effects from Alternative 4 include loss of habitat due to surface disturbances that remove vegetation, direct mortality of or injury to wildlife, and behavioral shifts such as a change in movement or displacement to other areas due to increased human activity and noise from blasting and mining operations.

Wildlife species are closely tied to habitat and the plant communities that characterize these specific habitats. Thus, effects on wildlife are generally related to impacts on the plant communities as described in **Section 4.10, Vegetation** and **Section 4.11, Wetlands and Riparian Zones**. Under Alternative 4, 4,288 acres would be disturbed. Reclamation of impacts on vegetation communities (at a 1:1 ratio based on acreage) would eventually offset some adverse wildlife impacts, although species composition and maturity of certain communities may take years, which may result in long-term adverse impacts or shifts in species composition. Mortality or injury to wildlife may occur from habitat removal (especially for less mobile species including ground-nesting birds, small mammals, reptiles, and amphibians) and collisions with mine-related vehicles. Restricted movement of less mobile species due to barriers such as construction fences, pits, and stockpiles is also possible during active mining. Animals that are displaced may move to less suitable habitat or suitable habitat occupied by predators or competitors, which could result in lower survival and reproduction rates.

Reclamation following mining would restore vegetation communities, but vegetation species composition and structure would take time to establish and mature. For example, reclaimed conifer areas may initially see an influx of early successional communities before a coniferous or deciduous overstory develops (Buehler and Percy 2012). Wildlife favoring early successional stages of plant growth would be the first to move into a reclaimed area. As vegetation matures, reclaimed mined areas would support a greater diversity of wildlife.

Because mining would be conducted in phases, surface disturbance and vegetation removal would occur incrementally over 20 years. Initial stages of reclamation (grading, application of soil, and seeding) of disturbed lands would begin approximately 2 years after the removal of coal and would occur in phases throughout the life of the mine until all disturbed lands are revegetated (see **Section 2.4.4, Reclamation Plan** in the 2018 Final EIS). Land in the project area that has been reclaimed and successfully revegetated, along with unmined land, would provide habitat for wildlife during mine operations.

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[79]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

Mammals

Small Mammals

Alternative 4 would result in moderate, short-term and possible long-term, adverse effects on small mammals. Direct losses of small mammals due to habitat loss would occur since mobility of small animals is limited and many use burrows for shelter. It is possible that localized small-mammal populations (mice, voles, shrews, and lagomorphs) would decline during land clearing. Some small mammals may be displaced to adjacent land, which could lead to increased competition.

Long-term effects would depend on how quickly different habitat types establish following reclamation. Grasslands would mature more quickly than woodland and shrub grassland habitat. Reclaimed areas would first be revegetated with early successional species providing habitat for grassland-associated species. Habitat for small mammals adapted to woodland habitats would take longer to recover. Many small mammals (lagomorphs and rodents) would be able to quickly recolonize areas due to high reproductive rates. These species tend to adapt to reclaimed areas fairly quickly. Generalist species such as deer mice and cottontail rabbits would establish more quickly than species with specialized habitat requirements.

Bats

Bat roosting habitat in the analysis area consists of structures (e.g., bridges and buildings), rock outcrops, and trees. Mining activities could remove potential roosting habitat or deter bats from roosting.

Due to surface disturbances and vegetation removal, mining in the project area would impact a variety of habitats used by bats. Vegetation removal would reduce available habitat for roosting and foraging. Common wide-ranging species such as big brown bat and long-eared myotis would be impacted by vegetation removal in all habitat types. Fringed myotis and pallid bat would be impacted by the loss of shrublands. Impacts would be greatest for forest-dwelling species such as hoary bat, Townsend’s big-eared bat, and silver-eared bat due to the longer recovery time for reclaimed forest habitats.

Bat foraging behavior would possibly be affected by increased human presence and mine-related noise, because such effects may cause bats to avoid suitable foraging habitat. Studies conducted in the direct effects analysis area have determined that most bats were detected foraging near water or riparian areas. Because riparian areas would not be impacted by mining activities, bats would continue to forage in these areas. However, removal of roosting habitat could result in an overall lower number of bats.

Other effects on local bat populations would likely occur over the long term due to potential changes in habitat over time. Generalist species would likely recover more quickly due to adaptation to different habitats. Effects on forest- and shrub-dwelling species such as the hoary bat, pallid bat, and Townsend’s big-eared bat would last longer and could result in a decline in these species in the analysis area. However, these localized effects would not likely affect bat populations outside of the analysis area. Alternative 4 would likely result in moderate, short- and long-term, adverse effects on bat species.

Carnivores

The effects on small carnivores from Alternative 4 are expected to be minor and short-term due to relatively high reproductive rates and ability to adapt to human presence. Smaller carnivores such as skunk, raccoon, and weasel may decline in the analysis area due to habitat loss from mine-related surface disturbance. Small carnivores may respond to such disturbance by moving to other nearby habitat. Displacement could result in lower production or survival of local populations in the analysis area depending on the level of competition in other nearby habitats and abundance of food sources. Most large carnivore sightings in the project area have been incidental. Because larger carnivores are somewhat nomadic in nature and pass through areas while foraging, effects are expected to be minor, short-term, and adverse due to mining operations. Larger carnivores including coyote, black bear, and mountain lion are mobile and would avoid active mine areas. Predatory species would likely return following reclamation and recolonization by prey species.

Big Game Animals

Mule Deer, Elk, and Pronghorn

Direct effects on large game from mining in the project area under Alternative 4 would include loss of habitat due to mine-related surface disturbances and vegetation removal. Over the life of the mine, about 4,288 acres of grassland, shrub grassland, conifer, and agricultural habitat would be impacted. Habitat loss, combined with other mine-related activity such as increased human activity and noise from blasting and mining operations, could result in behavioral changes in large game. Behavioral changes may affect movement patterns, resulting in displacement of large game to other areas.

Mule deer are the most abundant of the large game animals documented on the Rosebud Mine, including the project area. Mule deer are habitat generalists (populations have been documented in nearly every habitat type in the Rosebud Mine), and ample nearby suitable habitat is available for mule deer displaced by mining. Relatively low numbers (compared to mule deer) of elk and pronghorn have been documented in the direct effects analysis area. Mining in the project area may affect elk and pronghorn individuals but would not likely affect regional populations of either species because of the limited suitable habitat for these species in the project area compared to surrounding areas. Monitoring of reclaimed habitat near active portions of the Rosebud Mine indicates that large game animals have continued to inhabit areas adjacent to active mining areas throughout the duration of mining activities.

Large game animals are highly mobile and able to move to undisturbed areas relatively readily; however, mine-related disturbance may not preclude big game animals from using active mine areas. Annual monitoring reports from the Rosebud Mine indicate that large game animals do use active mine areas, including soil stockpiles, spoil piles, and areas in the process of reclamation.

Movement through the project area would be somewhat restricted due to placement of open pits, roads, stockpiles, and staging areas associated with mining activities, as well as by the use of additional fencing (if needed). Pronghorn seem to be most susceptible to such barriers (Sawyer et al. 2005). Although no big game movement corridors have been identified in the project area, mining activities could shift big game movement patterns.

Reclamation would restore vegetation communities similar to pre-mine conditions. It is likely to take several years following reclamation to restore vegetation communities to the same wildlife carrying capacity that pre-mine conditions provided. Eventual development of mature vegetation in reclaimed areas is anticipated to support large game animals in similar numbers as pre-mining. Therefore, anticipated effects are expected to be short-term and minor.

Other Big Game Species

White-tailed deer, bighorn sheep, and moose have not been documented in the project area, although limited suitable habitat for these species is available. Given the lack of documented use of the project area by these species, effects are likely to be negligible.

Birds

Upland Game Bird Species

Mining operations in the project area under Alternative 4 would impact habitat used by upland game birds. Wild turkey, sharp-tailed grouse, ring-necked pheasant, gray partridge, and mourning dove are all associated with various habitats in the analysis area. Mining activities would likely displace upland game birds from active mining areas within the project area to other areas. Each of the species listed above is somewhat mobile and is likely to avoid areas of active mining and disturbed habitat in the project area.

Figure 4.12-1. Sharp-Tailed Grouse.
© 2003, Chuck Carlson.

Annual monitoring at the Rosebud Mine and studies from the Absaloka Mine to the west show that impacts from mining activities on sharp-tailed grouse appear to be short-term. Similar results are likely for sharp-tailed grouse and perhaps other game birds in the project area. Mitigation and minimization measures such as soil salvaging outside of the spring months, phasing mine development areas, and establishing vegetation following mining would reduce impacts on sharp-tailed grouse. Planned reclamation following mining disturbance would restore habitats currently used by all game birds. Therefore, it is anticipated that the impacts on upland game birds would likely be short-term and minor.

Migratory Birds

Mining activities could cause abandonment or direct removal of nests if land-clearing activities occur during the breeding season. Bird use of undisturbed lands in the project area or adjacent lands in the direct effects analysis area could also be displaced as a result of human activity and noise from mining and vehicle travel.

Mining in the project area would impact a variety of habitats used by migratory birds. Vegetation removal would reduce available habitat for breeding, roosting, and foraging songbirds and other avian species. Common wide-ranging species such as meadowlark, American robin, and lark sparrow would be impacted by vegetation removal in all habitat types. Vesper sparrow, Brewer’s sparrow, eastern kingbird, and similar species would be impacted by the loss of grassland and shrub grassland. Forest-dwelling species such as Bullock’s oriole, black-capped chickadee, and black-headed grosbeak would be impacted by the loss of conifer and deciduous tree/shrub habitat. Mining activities would avoid disturbance in riparian and wetland habitat used by many avian species.

Habitat loss would be short-term for species that are adapted to a variety of habitats (generalists) or those adapted to open grasslands or agricultural areas (such as western meadowlark, American crow, or black-billed magpie). Longer-term impacts would occur on species that depend on shrubland or forested habitats (loggerhead shrike and woodpecker), as these habitats may take decades to become mature. Reclamation of disturbed land following coal extraction would occur concurrently with mining of new sections and would provide habitat for avian species that use grassland and cropland habitats. Effects on migratory birds under Alternative 4 would likely be short-term and minor to moderate depending on species.

Shorebirds and Waterfowl

Waterfowl and shorebird species that have been documented in the direct effects analysis area are discussed in the 2018 Final EIS in **Section 3.12.4.3, Shorebirds and Waterfowl**. Open water and aquatic habitat is limited in the project area, and most waterfowl observations have been incidental. Approximately 3.78 acres of long-term wetland impacts and about 3.41 acres of short-term wetland impacts are anticipated. Long-term impacts on wetlands would be mitigated either within the project area or within the same watershed during reclamation (see also **Section 4.7, Water Resources – Surface Water** and **Section 4.11, Wetlands and Riparian Zones**). Thus, long-term impacts on potential shorebird and waterfowl habitat from Alternative 4 would be minor.

Activities associated with mining would possibly deter shorebirds and waterfowl from using the project area as foraging habitat, but surrounding undisturbed areas and reclaimed areas would provide habitat. Development of sediment ponds may attract some species. Mining in the project area would not likely affect breeding pairs of aquatic birds because no shorebird or waterfowl breeding has been documented in the project area, and breeding pairs would likely continue to nest in suitable habitat outside of the project area.

Raptors

Raptor tolerance of disturbance varies among species and individuals within the same species (Whittington and Allen 2008). Generally, species such as golden eagle respond to disturbance (associated with human activity) at greater distances than Cooper's hawk. The U.S. Fish and Wildlife Service (USFWS) has recommended spatial nest buffers for various raptor species that occur within the western United States. The purpose of a spatial buffer is to serve as a guideline for reducing the likelihood of raptor abandonment of nests (roosting or breeding) due to human-related disturbance (e.g., construction activity). **Table 141** and **Figure 112** in the 2018 Final EIS document raptor species and nests within or adjacent to the project area and the recommended buffers for each. Mining activities within these buffers may result in nest abandonment or unsuccessful breeding.

While mining in the project area would not likely affect regional raptor populations, mining activities could disrupt normal activities of individual raptors or breeding pairs. Mining could result in the loss of nests that occur in the project area. Mining activities could cause breeding raptors to abandon nests that are located close to disturbance. Long-term effects on tree-nesting species including red-tailed hawk, golden eagle, and Cooper's hawk are possible with removal of 688 acres of conifer and 84 acres of deciduous tree/shrub areas. Ground-nesting species such as short-eared owl and northern harrier may be impacted during active mining but would likely return to the area after reclamation. Species such as northern harrier that inhabit open areas may benefit in the short term from changes in habitat until woodlands begin to form and mature.

Prey availability in the project area during mining may decrease, potentially impacting raptor foraging. Raptors currently nesting in the project area would be displaced by removal of habitat, possibly resulting in increased competition in surrounding areas. Under Alternative 4, effects on raptors would be short- and long-term and would overall likely be moderate.

Amphibians and Reptiles

Under Alternative 4, mining activities would adversely affect amphibians and reptiles due to habitat loss. Direct impacts on amphibians and reptiles would occur during land-clearing due to limited mobility and the need for fairly specialized habitat. Impacts on amphibians and reptiles would possibly be long-term because their reproductive rates are relatively low and vary seasonally. Following reclamation, it is likely that amphibians and reptiles would slowly return to the area. Planned avoidance of streams and wetlands would minimize impacts on amphibian and reptile species adapted to those habitats, although flows in some aquatic habitats may be altered, which is outlined in more detail in **Section 4.7, Water Resources – Surface Water**. Due to the limited mobility and habitat alteration, effects on amphibians and reptiles would likely be long-term, moderate, and adverse.

Aquatic Species

Habitat for aquatic species is limited and poor in the project area. Armells Creek is located about 16 miles northeast of the project area, although several tributaries to Armells Creek traverse the project area. Aquatic and riparian habitat along tributaries to Armells Creek would be avoided during mining. Alternative 4 would potentially impact local populations of macroinvertebrates and notropids that may occur in impacted stock ponds, springs, and perennial and intermittent streams. Aquatic habitat could be indirectly impacted by changes in stream flow and/or water quality due to mining. Reclamation and action to maintain the hydrologic balance would reduce potential impacts on aquatic habitat and species. Effects on surface water resources are explained in more detail in **Section 4.7, Water Resources – Surface Water**. Effects on aquatic species due to changes in stream flow and/or water quality under Alternative 4 would be short-term or long-term, minor to moderate, and adverse.

4.12.3.2 Indirect Impacts

Deposition modeling was completed to determine the indirect effects analysis area for special status species and was also used to determine the indirect effects analysis area for fish and wildlife (non-special status species) (see **Section 4.3, Air Quality** and **Section 3.12, Fish and Wildlife Resources**). The model determined deposition due to emissions from the Colstrip and Rosebud Power Plants in the analysis area for operations under Alternative 2 (here applied to Alternative 4).

Trace metals from total deposition over 20 years would minimally contribute to background concentrations. The trace concentrations from deposition, even when combined with naturally occurring background concentrations, do not exceed wildlife ecological screening thresholds for the majority of metals. The combined background levels and expected deposition of chromium, lead, and mercury would exceed the Eco-SSLs for birds. In addition, the combined background levels and expected deposition of antimony and chromium would exceed the Eco-SSLs for mammals. All other trace metals were below the Eco-SSLs for birds and mammals when background levels and expected deposition were combined. EPA studies determined that toxicity data were not sufficient to derive Eco-SSLs for fish, amphibians, and reptiles; therefore, there are no data for these classes (EPA 2005b). It is worth noting that the avian and reptilian classes share some physiological traits and may be affected similarly by various metal concentrations. Based on the determination that combustion of project area coal would have no effect on surface water quality except possibly for selenium in the East Fork Armells Creek (see **Section 4.7, Water Resources – Surface Water**), indirect effects on aquatic species (fish, amphibians, and aquatic invertebrates) are anticipated to be negligible to moderate.

Soil Invertebrates

Within the indirect effects analysis area, the 95 percent UCL background levels for each of the trace metals analyzed are below the Eco-SSLs for soil invertebrates such as earthworms or burrowing insects and arthropods (**Table 4.12-1**). Given that the expected deposition of these trace metals is below the Eco-SSLs for soil invertebrates, indirect effects on soil invertebrates from project area coal combustion would be negligible.

Birds

The total expected concentrations (background plus total deposition as modeled for Alternative 2) for arsenic, cadmium, copper, and selenium under Alternative 4 would not exceed the protective ecological screening values for birds (**Table 4.12-2**). There would be no unacceptable risks for birds from potential deposition of these trace metals under Alternative 4. There are no avian Eco-SSLs for antimony. The modeled antimony deposition over the mine life of Area F (for Alternative 2) is 0.56 percent of the background value. As such, there would be no unacceptable risks expected for birds exposed to antimony due to the potential deposition under Alternative 4.

As indicated in **Table 4.12-2**, the total expected chromium, lead, and mercury concentrations (50.51 mg/kg, 19.11 mg/kg, and 0.024 mg/kg) slightly exceed the ecological screening levels for birds (26 mg/kg, 11 mg/kg, and 0.013 mg/kg). The background values for chromium, lead, and mercury slightly exceed the bird ecological screening values. Therefore, the additional modeled total deposition over the period of operations (for Alternative 2), when added to background, exceeds the bird ecological screening values. Exceedance of these screening values alone does not mean that there would be adverse impacts on birds from chromium, lead, and mercury deposition. This indicates, however, that further scrutiny is warranted for these trace metals related to bird exposures; see detailed discussion in **Section 4.12.3.2, Indirect Impacts** (Fish and Wildlife Impacts) in the 2018 Final EIS and brief impacts summaries below.

Chromium: There is sufficient information to conclude that the total expected concentration for chromium (background plus modeled total deposition over Area F period of operations, 50.51765 mg/kg) would not pose unacceptable risks to birds.

Lead: There is sufficient information to conclude that the total expected concentration for lead (background plus modeled total deposition over Area F period of operations, 19.10757 mg/kg) would not pose unacceptable risks to birds.

Mercury: The EPA has not developed mercury Eco-SSLs for any receptor (invertebrates, birds, or mammals). However, there is sufficient information to conclude that the total expected concentration for mercury (background plus modeled total deposition over Area F period of operations, 0.02385 mg/kg) would not pose unacceptable risks to birds.

Table 4.12-1. Trace Metal Background, Potential Soil Impact Distance, and Eco-SSLs for Soil Invertebrates.

Analyte	Background – 95 Percent UCL	Total Deposition over 19-Year Period of Operations[1]	Total Expected Concentration (Background + Total Deposition)	Ecological Screening Value for Soil Invertebrates[2]	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Soil Invertebrate Ecological Screening Value[2]	Does Deposition plus Background Exceed the Soil Invertebrate Ecological Screening Value?	Potential Adverse Indirect Impacts on Soil Invertebrates
	mg/kg, DW	mg/kg, DW	mg/kg, DW	mg/kg, DW	Percent	Percent	(Yes/No)	(Yes/No)
Antimony	0.9	0.00504	0.90504	78	0.56	0.01	No	No
Arsenic	10.9	0.00694	10.90694	60	0.06	0.12	No	No
Cadmium	0.3	0.00189	0.30189	140	0.63	0.01	No	No
Chromium	50.5	0.01765	50.51765	NA	0.03	NA	No	No
Copper	17.8	0.08133	17.88133	80	0.46	0.1	No	No
Lead	19.1	0.00757	19.10757	1,700	0.04	0.01	No	No
Selenium	0.56	0.03153	0.59153	4.1	5.6	0.76	No	No
Mercury	0.023	0.00085	0.02385	0.1	3.7	0.85	No	No

NA = Not available. Insufficient data to derive ecological screening value; DW = Dry weight.

1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by EPA (2005b).

2. **Section 4.1.1.1** in the 2018 Final EIS describes the hierarchy of soil invertebrate, bird, and mammal ecological screening values.

Table 4.12-2. Trace Metal Background, Potential Soil Impact Distance, and Eco-SSLs for Birds.

Analyte	Background – 95 Percent UCL	Total Deposition over 19-Year Period of Operations[1]	Total Expected Concen-tration (Background + Total Deposition)	Ecological Screening Value for Birds[2]	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Bird Ecological Screening Value[2]	Does Deposition plus Background Exceed the Bird Ecological Screening Value?	Potential Adverse Indirect Impacts on Birds
	mg/kg, DW	mg/kg, DW	mg/kg, DW	mg/kg, DW	Percent	Percent	(Yes/No)	(Yes/No)
Antimony	0.9	0.00504	0.90504	NA	0.56	NA	No	No
Arsenic	10.9	0.00694	10.90694	43	0.06	0.02	No	No
Cadmium	0.3	0.00189	0.30189	0.77	0.63	0.25	No	No
Chromium	50.5	0.01765	50.51765	26	0.03	0.07	Yes	No
Copper	17.8	0.08133	17.88133	28	0.46	0.3	No	No
Lead	19.1	0.00757	19.10757	11	0.04	0.07	Yes	No
Selenium	0.56	0.03153	0.59153	1.2	5.60	2.6	No	No
Mercury	0.023	0.00085	0.02385	0.013	3.70	6.5	Yes	No

NA = Not available. Insufficient data to derive ecological screening levels.
1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by EPA (2005b).
2. **Section 4.12.1.1, Analysis Methods** in the 2018 Final EIS describes the hierarchy of soil invertebrate, bird, and mammal ecological screening values.

Mammals

As summarized in **Table 4.12-3**, the total expected concentrations (background plus modeled total deposition over the Area F period of operations) for arsenic, cadmium, copper, lead, mercury, and selenium would not exceed the protective ecological screening values for mammals. There would be no unacceptable risks to mammals from these trace metals related to potential deposition from Alternative 4.

As indicated in **Table 4.12-3**, the total expected concentration of antimony and chromium modeled for Alternative 2 and here applied to Alternative 4 (0.90504 mg/kg and 50.51765 mg/kg, respectively) exceed the ecological screening values for mammals (0.27 mg/kg and 34 mg/kg respectively). The background values alone for antimony and chromium exceed the mammal ecological screening values. As such, the additional modeled total deposition over lifetime of Area F, when added to background, exceeds the mammal ecological screening values. Exceedance of these screening values alone does not mean that there would be adverse impacts on mammals from antimony and chromium deposition. This indicates, however, that further scrutiny is warranted for these chemicals related to mammal exposures; see detailed discussion in **Section 4.12.3.2, Indirect Impacts** (Fish and Wildlife Impacts) in the 2018 Final EIS and brief impacts summaries below.

Antimony: There is sufficient information to conclude that the total expected concentration for antimony (background plus modeled total deposition over the Area F period of operations, 0.90504 mg/kg) would not pose unacceptable risks to mammals.

Chromium: There is sufficient information to conclude that the total expected concentration for chromium (background plus modeled total deposition over the Area F period of operations, 50.51765 mg/kg) does not pose unacceptable risks to mammals.

Table 4.12-3. Trace Metal Background, Potential Soil Impact Distance, and Eco-SSLs for Mammals.

Analyte	Background – 95 Percent UCL	Total Deposition over 19-Year Period of Operations[1]	Total Expected Concen-tration (Background + Total Deposition)	Ecological Screening Value for Mammals[2]	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Mammal Ecological Screening Value[2]	Does Deposition plus Background Exceed the Mammal Ecological Screening Value?	Potential Adverse Indirect Impacts on Mammals
	mg/kg, DW	mg/kg, DW	mg/kg, DW	mg/kg, DW	Percent	Percent	(Yes/No)	(Yes/No)
Antimony	0.9	0.00504	0.90504	0.27	0.56	1.9	Yes	No
Arsenic	10.9	0.00694	10.90694	46	0.06	0.02	No	No
Cadmium	0.3	0.00189	0.30189	0.36	0.63	0.5	No	No
Chromium	50.5	0.01765	50.51765	34	0.03	0.05	Yes	No
Copper	17.8	0.08133	17.88133	49	0.46	0.17	No	No
Lead	19.1	0.00757	19.10757	56	0.04	0.01	No	No
Selenium	0.56	0.03153	0.59153	0.63	5.6	5.0	No	No
Mercury	0.023	0.00085	0.02385	1.7	3.7	0.05	No	No

1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by EPA (2005b).
2. **Section 4.12.1.1, Analysis Methods** in the 2018 Final EIS describes the hierarchy of soil invertebrate, bird, and mammal ecological screening values.

Summary of Indirect Effects

For all trace metals except selenium, mercury, and antimony (for mammals), deposition of 1 percent of background concentrations would not be reached from combustion of project area coal over the 20-year period of operations for Alternative 4. Additionally, selenium depositions inside the indirect effects analysis area would be less than the ecological screening values for all wildlife groups.

The total expected concentrations (background plus total deposition over the 20-year period of operations for Alternative 4) for arsenic, cadmium, copper, and selenium would not exceed the protective ecological screening values for birds. For birds, the combined background levels and expected deposition for chromium, lead, and mercury exceed the ecological screening values. However, the expected deposition is less than 0.07 percent of the ecological screening values for chromium and lead, and 6.5 percent of the ecological screening values for mercury for birds. Similarly, for mammals, the combined background levels and expected deposition for antimony and chromium exceed the ecological screening values.

The total expected concentrations (background plus modeled total deposition over the 20-year period of operations for Alternative 4) for arsenic, cadmium, copper, lead, mercury, and selenium would not exceed the protective ecological screening values for mammals. Therefore, there would be no unacceptable risks to mammals from these trace metals related to potential deposition for Alternative 4; see detailed discussion and rationale in **Section 4.12.3.2, Indirect Impacts** (Fish and Wildlife Impacts) in the 2018 Final EIS.

Therefore, under Alternative 4, the indirect effects on wildlife from Colstrip and Rosebud Power Plant emissions are expected to be negligible (for metals not exceeding the ecological screening values) to minor (for those metals exceeding the ecological screening values) over the long term.

4.12.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect fish and wildlife impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct disturbance-related impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area. Alternative 5, as with Alternative 4, would likely result in minor to moderate, short- and long-term, adverse effects on fish and wildlife species due to displacement and habitat disturbance.

Over an 11-year mine life, approximately 37.1 million tons of coal would be mined from Federal and private coal leases in the project area. Under Alternative 5, as with Alternative 4, the indirect effects on wildlife from Colstrip and Rosebud Power Plant emissions are expected to be negligible (for metals not exceeding the ecological screening values) to minor (for those metals exceeding the ecological screening values) over the long term.

Under Alternative 5, direct and indirect fish and wildlife impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.12.5 Irreversible and Irretrievable Commitment of Resources

All SEIS alternatives would disturb wildlife species individuals and local populations. All SEIS alternatives would likely result in shifts in species composition from wildlife that is less tolerant of disturbance to species that are able to adapt more readily to disturbance and increased human presence. As revegetation and reclamation of disturbed areas occurs, it is likely that species composition would eventually increase but not to the levels of pre-disturbance diversity due to an anticipated reduction in overall vegetation diversity. For all SEIS alternatives, the temporal loss of native wildlife habitat would be an irreversible resource commitment.

4.13 SPECIAL STATUS SPECIES

This section discloses the direct and indirect effects on special status species resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. This analysis addresses deficiencies identified in the 2022 court order by analyzing the indirect effects on pallid sturgeon dues to water withdrawals from the Yellowstone River by the Colstrip Power Plant and a reasonable range of alternatives. Pre-mine conditions and the analysis areas used for this impacts analysis are described in **Section 3.13, Special Status Species**.

4.13.1 Analysis Methods and Impact and Intensity Thresholds

Special status species impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS; these are summarized below and detailed in **Section 4.13.1.1** in the 2018 Final EIS. Analysis methods for assessing indirect effects of surface water withdrawals from the Yellowstone River on pallid sturgeon used in this SEIS are described below. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.13.1.1 Analysis Methods

Direct Effects

Wildlife monitoring, including monitoring for special status species, has occurred on the Rosebud Mine since 1973. Baseline survey data (2006 and 2011-2013) within the direct effects analysis area (described in the 2018 Final EIS), information from Westmoreland Rosebud's annual wildlife report, and Montana Natural Heritage Program (MNHP) data (MNHP 2024) were used to describe existing conditions for species of concern (SOC) in **Chapter 3** (see **Section 3.13, Special Status Species**). Annual wildlife monitoring has been occurring and would continue for the life of the mine as described in **Section 2.4.7.6, Wildlife** in the 2018 Final EIS.

Indirect Effects

Surface Water Withdrawals from the Yellowstone River

Effects of surface water withdrawals from the Yellowstone River on pallid sturgeon were analyzed using flow metrics data from the USGS gage approximately 6 miles downstream of the diversion and immediately upstream of the Cartersville Dam at Forsythe (#06295000). Data were summarized in the flow metrics to provide a comprehensive analysis of changes to the flow regime on the daily, monthly, and annual time scales. The focus of the monthly flow metrics was on the months of February and June, to represent monthly data when flows were typically at their lowest and highest values, respectively. For most of the flow metrics, a subset of data representing the five years with the highest and lowest values for each metric were also used to represent any effects in a typically wet (above average) or dry (below average) flow year. Analysis methods for the pallid sturgeon are described in greater detail in the Biological Assessment (BA; OSMRE 2024).

Deposition Modeling

Deposition modeling results for special status species (see **Section 3.13, Special Status Species, Indirect Effects Analysis Area** and **Section 4.3, Air Quality** in the 2018 Final EIS for information on modeling and results), in conjunction with ecotoxicological screening values protective of soil invertebrates, birds, and mammals, were used to determine potential Colstrip and Rosebud Power Plant emissions impacts on special status species within the indirect effects analysis area (see detailed discussion in the 2018 Final EIS). Estimated deposition (modeled for Alternative 2 and applied to Alternative 4) relative to background values and estimated deposition combined with background concentrations of trace metals were compared to the soil invertebrate, bird, and mammal screening levels to determine if impacts on special status species may occur. Eco-SSLs are not available for reptiles, amphibians, or fish. Impacts also were qualitatively assessed based on documented occurrences of special status species within the analysis area (see **Section 3.13, Special Status Species** and **Figure 3.13-3**).

4.13.1.2 Impact and Intensity Thresholds

The thresholds for assessment of impacts (negligible, minor, moderate, or major) on surface water hydrology and water quality are the same as those defined in **Table 145** in the 2018 Final EIS. Impacts are also defined as short-term, long-term, or both (see **Appendix 1**).

4.13.2 Alternative 1 – No Action

The types of direct and indirect special status species impacts under Alternative 1 (as described in this SEIS)[80] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct disturbance-related impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area under Alternative 1. As with Alternative 4, direct disturbance to wildlife habitat within the project area and indirect impacts on surrounding lands from noise and project-related activity could adversely impact several MNHP SOC; any disturbance-related impacts on northern long-eared bat and monarch butterfly would be negligible.

Over a 6-year mine life, approximately 17.1 million tons of coal would be mined from Federal and private coal leases in the project area. As with Alternative 4, there would be no indirect effects due to emissions and deposition for most special status species. For aquatic species (fish, amphibians, and aquatic invertebrates), indirect effects could be long-term and negligible to moderate for species inhabiting East Fork Armells Creek due to potential selenium deposition. As with Alternative 4, 69 cfs would continue to be diverted from the Yellowstone River during the period of operations for Area F (6 years under Alternative 1); any resulting indirect effects of the diversion on sturgeon would likely not be discernable.

Under Alternative 1, direct and indirect special status species impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Under

[80]. Direct and indirect effects of Alternative 1 – No Action on special status species were described in **Section 4.13.2** of the 2018 Final EIS, beginning on page 585. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

As with Alternative 4, **Alternative 1 may affect, but is unlikely to adversely affect the northern long-eared bat and pallid sturgeon, and would not contribute to a trend toward Federal listing of the monarch butterfly.**

4.13.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect special status species impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.13.3** of the 2018 Final EIS, beginning on page 585. Under Alternative 4, half a million tons more coal would be mined[81] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation (including revegetation) of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

4.13.3.1 Direct Impacts

As with Alternative 2, potential adverse effects from Alternative 4 on special status species include loss of habitat due to surface disturbances that remove vegetation, direct mortality of or injury to wildlife due to vehicle/construction equipment collisions, and behavioral shifts such as a change in movement or displacement to other areas due to increased human activity and noise from blasting and mining operations.

Wildlife species are closely tied to habitat and the plant communities that characterize these specific habitats. Thus, effects on wildlife are generally related to impacts on the plant communities as described in **Section 4.10, Vegetation** and **Section 4.12, Fish and Wildlife Resources**. Reclamation of impacts on vegetation communities (at a 1:1 ratio based on acreage) would eventually offset some adverse wildlife impacts, although species composition and maturity of certain communities may take years, which may result in long-term adverse impacts or shifts in species composition. Mortality or injury may occur to wildlife from habitat removal (especially for less mobile species including ground-nesting birds, small mammals, reptiles, and amphibians) and collisions with mine-related vehicles. Restricted movement of less mobile species due to barriers such as construction fences, pits, and stockpiles is also possible during active mining. Animals that are displaced may move to less suitable habitat or suitable habitat occupied by predators or competitors, which could result in lower survival and reproduction rates.

Reclamation following mining would restore vegetation communities, but vegetation species composition and structure would take time to establish and mature. Wildlife favoring early successional stages of plant growth would be the first to move into a reclaimed area. As vegetation matures, reclaimed mined areas would support a greater diversity of wildlife.

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[81]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

Because mining would be conducted in phases, surface disturbance and vegetation removal would occur incrementally over 20 years. Reclamation of disturbed lands would begin about 2 years after the initial removal of coal and would occur in phases throughout the life of the mine until all disturbed lands are revegetated. Land in the project area that has been reclaimed and successfully revegetated, along with unmined land, would provide habitat for wildlife during mine operations.

Special Status Wildlife Species

Federally Listed Threatened, Endangered, and Candidate Species

Table 3.13-2 lists federally threatened, endangered, and candidate species that potentially occur in Rosebud, Treasure, Big Horn, and Powder River Counties. OSMRE determined based on the best current data and scientific information available that direct effects of mining in the Area F permit area and indirect effects of emissions from the Colstrip and Rosebud Power Plants would not result in adverse effects on federally listed threatened, endangered, or candidate species or any designated critical habitat. OSMRE submitted a BA to the USFWS to document potential impacts and proposed conservation measures to protect federally listed species on August 19, 2024. The BA found that the Proposed Action may affect but is not likely to adversely affect the northern long-eared bat and pallid sturgeon and would not contribute to a trend toward Federal listing of the monarch butterfly. The USFWS is currently reviewing the BA pursuant to the Endangered Species Act's (ESA's) Section 7 consultation. OSMRE effects determinations for these species are described below.

Northern Long-Eared Bat

The Proposed Action (Alternative 4) **may affect, but is not likely to adversely affect**, the northern long-eared bat. The direct effects analysis area is in the area of influence for this species; however, no known populations have been documented in this portion of the area of influence, and habitat is limited in the project area. No northern long-eared bat populations have ever been documented within the direct or indirect effects analysis areas (in Treasure, Big Horn, Rosebud, or Powder River County), and the closest known documentation of this species is in Richland and Roosevelt Counties, about 190 miles north of the project area.

If northern long-eared bats were to occur in the analysis area, potential direct effects could include loss of foraging and roosting habitat due to vegetation removal and indirect effects from potential power-plant emissions impacts on vegetation. Range-wide, habitat loss is not considered the primary threat to northern long-eared bat populations. The Proposed Action would have no effect on white nose syndrome and wind power development, which are the main threats to northern long-eared bats. Tree removal in mined areas, specifically removal of trees that provide roosting habitat, could negatively affect tree roosting bat species such as northern long-eared bats. About 4,288 acres of vegetation would be removed during mining and reclaimed after mining is complete. Vegetation removed would include about 83 acres of deciduous tree/shrub habitat and 672 acres of conifer habitat. If northern long-eared bats were present, they could be directly injured or displaced to alternative roost sites if their roost trees were removed. Vegetation removal could also reduce the amount of foraging habitat available for northern long-eared bats; however, the reduction in foraging habitat would be relatively small relative to the overall size of the action area (about 0.4 percent of over 960,000 acres). Disturbance of hibernating bats is highly unlikely because there are no known hibernation sites in southeastern Montana, and no suitable hibernation sites are known in the action area. Direct effects on this species would be negligible because it is unlikely to occur in the project area.

Pallid Sturgeon

There would be no direct effects on pallid sturgeon under Alternative 4; see discussion of pallid sturgeon in **Section 4.13.3.2, Indirect Impacts**.

Monarch Butterfly

The Proposed Action (Alternative 4) would not contribute to a trend toward Federal listing of the monarch butterfly. Mining and associated land clearing and vegetation removal activities could adversely affect monarch butterflies due to foraging habitat loss and potential loss of breeding habitat on about 4,288 acres. Foraging habitat for adult monarchs includes a variety of nectar-producing plant species, and foraging habitat for this species is present throughout the action area. Larval food plants, *Asclepias* spp., occur in the grassland, sagebrush, and woody draw vegetation communities (Cedar Creek Associates, Inc. 2016). If the avoidance and minimization measures described in **Section 2.3.1, Elements Common to All Alternatives** are not implemented, direct impacts could occur on larval butterflies or larval food plants during land-clearing activities. Monarch butterflies could breed in the action area, and milkweeds could be removed in portions of the project area. Individual monarch larvae or eggs could be destroyed if milkweeds are removed during breeding and migration, which could result in reduced fecundity or reproductive failure. These direct effects would be avoided because clearing and grubbing activities would occur from September 1 through June 1, avoiding the monarch butterfly active season from June through August. Noxious weeds could also invade areas disturbed by the Proposed Action and degrade habitat. Noxious weeds would be controlled and managed to reduce their spread by timing weed spraying to avoid the monarch butterfly breeding season (June through August), when feasible, and conducting spot spraying to limit impacts on flowering nectar plants. Direct impacts on adult monarch butterflies are unlikely because of the mobility of this species. After reclamation and restoration of plant communities, it is possible that monarch butterfly habitat would be reestablished.

The effects of Alternative 4 would be negligible overall because the total loss of potential monarch habitat would be about 4,288 acres, which is less than 0.4 percent of the analysis area and is a relatively small part of the species range, which includes a large portion of North America; noxious weeds would be controlled and managed to reduce their spread; and seed mixes used during revegetation efforts would include flowering plants and milkweed.

Western Regal Fritillary

Direct impacts on western regal fritillary are not expected due to the Proposed Action (Alternative 4) because suitable tallgrass prairie habitat with an abundance of native violets (*Viola* spp.) does not occur in the project area. Regal fritillary larvae will not survive without the presence and adequate supply of violets (USFWS 2023). Because of the lack of larval food plants for this species, western regal fritillaries are not likely to breed in the project area, and direct impacts on eggs or larvae are unlikely. In addition, the timing restrictions described above for monarch butterflies (and detailed in **Section 2.3.1, Elements Common to All Alternatives**) would avoid and minimize impacts on any regal fritillary adults, larvae, and eggs, if they were to occur in the project area.

MNHP Species of Concern

Table 3.13-3 lists MNHP SOC (northern leopard frog, plains spadefoot toad, golden eagle, northern goshawk, great blue heron, long-billed curlew, McCown's longspur, short-horned lizard, western milksnake, and hoary bat) that have been documented within 15 miles of the project area and potentially occur in the project area; this list has been updated since the 2018 Final EIS (MNHP 2024). In addition to this list, 18 species have potential to occur in the analysis area based on the presence of suitable habitat.

Direct disturbance to wildlife habitat on 4,288 acres and indirect impacts on surrounding lands from noise and project-related activity could adversely impact several MNHP SOC.

Under Alternative 4, northern goshawk, Clark's nutcracker, pinyon jay, and hoary bat could be affected by the loss of about 672 acres of conifer habitat. Disturbance to 611 acres of sagebrush shrub grassland could impact Brewer's sparrow, long-billed curlew, loggerhead shrike, sage thrasher, Merriam's shrew, hoary bat, and plains hognose snake. The loss of about 1,538 acres of grassland would potentially impact McCown's longspur, plains spadefoot toad, ferruginous hawk, short-horned lizard, and western milksnake. Because mining disturbance would avoid and minimize impacts on riparian and wetland areas, direct impacts on habitat for black-billed cuckoo, Lewis' woodpecker, red-headed woodpecker, great blue heron, northern leopard frog, fringed myotis, and western smooth green snake would be minimal. However, avian use of riparian habitats could decrease from the noise and disturbance associated with nearby mine operations. Only limited cliff habitat preferred by golden eagle and peregrine falcon for nesting is present in Area F, but impacts on grassland, woodland, and shrubland vegetation types would reduce available foraging habitat for these species. Little brown myotis, pallid bat, and Townsend's big-eared bat could be impacted by the loss of woodland habitat. Townsend's big-eared bat could also be impacted by the loss of rocky outcrops removed during mining operations. Overall direct impacts on SOC would be considered moderate due to the permanent loss or modification of habitat.

Planned reclamation following mining would restore plant communities and wildlife habitat similar to pre-mining conditions. Restoration of wildlife habitat would vary depending on the habitat types. Because conifer habitat would take longer to establish than grasslands, species like Clark's nutcracker that inhabit coniferous forest would be affected longer than grassland-associated species such as McCown's longspur. Alternative 4 would have short- and long-term, negligible to moderate impacts on MNHP SOC.

Special Status Plant Species

No impacts on sensitive plant species are anticipated because none of the potential sensitive species were found in the direct effects analysis area.

4.13.3.2 Indirect Impacts

Deposition Impacts

Deposition modeling was completed to determine the indirect effects analysis area for special status species and was also used to determine the indirect effects analysis area for fish and wildlife (non-special status species) (see **Section 4.3, Air Quality** and **Section 3.12, Fish and Wildlife Resources**). The model determined deposition due to emissions from the Colstrip and Rosebud Power Plants in the analysis area for operations under Alternative 2 (here applied to Alternative 4). There are no Eco-SSLs for specific special status species. Data from the EPA Region 4 (2015j) website exists for mammals, birds, and soil invertebrates. Therefore, it is assumed that the Eco-SSLs for mammalian and avian special status species are similar to those listed in **Table 4.13-1** below.

Deposition modeling results indicate that the operation of the Colstrip and Rosebud Power Plants during the Area F period of operations would not result in deposition over the Eco-SSLs for invertebrates, birds, or mammals (**Table 4.13-1**); see species-specific discussions below for northern long-eared bat and monarch butterfly. Studies from the EPA determined that toxicity data were not sufficient to derive Eco-SSLs for amphibians and reptiles; therefore, there are no data for reptiles and amphibians (EPA 2005b). Eco-SSLs for reptiles are possibly similar to those for birds due to some similarities between the two classes. For aquatic species (fish, amphibians, and aquatic invertebrates), indirect effects could be long-term and negligible to moderate for species inhabiting East Fork Armells Creek due to potential selenium deposition (see **Section 4.7, Water Resources – Surface Water**). It is anticipated that there would be no effect on aquatic species in other streams in the region based on the determination that combustion of project area coal would have no effect on surface water quality on streams (other than East Fork Armells Creek) (see **Section 4.7, Water Resources – Surface Water**); see species-specific discussion for pallid sturgeon below.

Table 4.13-1. Trace Metal Background, Potential Soil Impact Distance, and Ecological Screening Levels for Soil Invertebrates, Birds, and Mammals.

Analyte	Background – Geometric Mean	1 Percent of Geometric Mean Background	Area Around Colstrip and Rosebud Power Plants with Higher Deposition Than 1 Percent of Geometric Mean Background	Ecological Screening Levels for Soil Invertebrates	Ecological Screening Levels for Birds	Ecological Screening Levels for Mammals
	mg/kg, DW	**mg/kg, DW**	**Km**	**mg/kg, DW**	**mg/kg, DW**	**mg/kg, DW**
Antimony	0.7	0.007	0	78	NA	0.27
Arsenic	8.0	0.080	0	NA	43	46
Cadmium	0.2	0.002	0	140	0.77	0.36
Chromium	41.2	0.412	0	NA	26	34
Copper	13.2	0.132	0	80	28	49
Lead	15.7	0.157	0	1,700	11	56
Selenium	0.4	0.004	<19	4.1	1.2	0.63
Mercury	0.016	0.00016	<30	0.1	0.013	1.7

mg/kg = milligrams per kilogram; DW = dry weight in soil; km = kilometers.
NA = Not available. Insufficient data to derive ecological screening levels.
Section 4.13.1.1, Analysis Methods, describes the hierarchy of soil invertebrate, bird, and mammal ecological screening values.

Northern Long-Eared Bat

As previously described, a portion of Powder River County falls within the indirect effects analysis area (**Figure 3.13-3**). Powder River County is included in the area of influence for the northern long-eared bat, although the closest known documentation of this species is in Richland and Roosevelt Counties, about 190 miles north of the project area.

Indirect effects on northern long-eared bats from power plant emissions would be negligible because deposition modeling results (conducted for Alternative 2 and here applied to Alternative 4) indicate that the operation of the Colstrip and Rosebud Power Plants during the period of operations for Area F would not result in deposition over the EPA Eco-SSLs for invertebrates (such as northern long-eared bat food sources), birds, or mammals and thus would be unlikely to result in adverse effects on northern long-eared bats. Because the deposition of trace metals around the Colstrip and Rosebud Power Plants would not reach 1 percent of the background soil concentrations, would be significantly less than the Eco-SSLs for plants, or would be only a small percentage of the total concentrations (for selenium), the indirect effects from power plant emissions on vegetation that could provide habitat for this species would likely be minor.

Pallid Sturgeon

The indirect effects of coal combustion emissions from the Colstrip and Rosebud Power Plants on the Yellowstone River are not expected to be measurable. Tributaries to the Yellowstone River within the indirect effects analysis area (Sarpy Creek, Armells Creek, Rosebud Creek, and the Tongue River) would not affect water quality as a result of Colstrip and Rosebud Power Plant emissions for the following reasons (see also **Section 4.7, Water Resources – Surface Water**): (1) any effects of the Colstrip and Rosebud Power Plant deposition on the water quality of the four tributaries are not likely to be detectable in the Yellowstone River due to dilution, and (2) the percent mercury deposition from the two power plants is less than 3 percent of all mercury deposition at that location from all atmospheric sources. At the Yellowstone River about 25 miles north of Colstrip (pallid sturgeon populations are 35 miles farther downstream), the effects of mercury deposition from the two power plants are not expected to be measurable compared to worldwide atmospheric deposition sources to the Yellowstone River. Therefore, the emissions from coal combustion at the Colstrip and Rosebud Power Plants would have no indirect effects on the pallid sturgeon.

Monarch Butterfly

As described above for northern long-eared bats, indirect effects from power plant emissions are unlikely to occur because deposition modeling results (conducted for Alternative 2 and here applied to Alternative 4) indicate that the operation of the Colstrip and Rosebud Power Plants during the period of operations for Area F would not result in deposition over the Eco-SSLs for invertebrates and thus would be unlikely to result in adverse effects on monarch butterflies. Because the deposition of trace metals around the Colstrip and Rosebud Power Plants would not reach 1 percent of the background soil concentrations, would be significantly less than the Eco-SSLs for plants, or would be only a small percentage of the total concentrations (for selenium), the indirect effects from power plant emissions on vegetation that provides habitat for this species would likely be minor.

Western Regal Fritillary

As described above for monarch butterfly, indirect effects from power plant emissions are unlikely to occur.

Yellowstone River Diversions

Pallid Sturgeon

The Proposed Action (Alternative 4) may affect, but is unlikely to adversely affect, pallid sturgeon. As described in **Section 4.7, Water Resources – Surface Water**, Alternative 4 would result in the continued diversion of 69.27 cfs of water from the Yellowstone River to supply to the Colstrip Power Plant for 20 years (estimated period of operations for Area F). Any potential effects on pallid sturgeon from Alternative 4 would occur from this diversion. There would be no change in the magnitude of the diversion that would occur compared to current conditions, only an extended duration. The effects of continued water diversions are analyzed in detail in the BA (OSMRE 2024).

Water withdrawals directly impact the hydrograph, which in turn has the potential to affect pallid sturgeon through multiple pathways. Based on the analysis in the BA, stream flow in the Yellowstone River is minimally impacted by the water withdrawals for the Colstrip Power Plant, with each flow metric in average, dry, or wet years decreasing by less than 2 percent. Hydrologic alteration from water withdrawals could potentially affect sturgeon through multiple pathways; potential effects would depend on the magnitude and duration of the alterations. Potential effects could include altered spawning movements and behavior, changes in sediment transport and resulting formation and maintenance of aquatic habitat, and changes in turbidity, which could affect feeding efficiency and vulnerability to predators. Extremely low stream flows can reduce depths in riffles so that fish avoid them; this can prevent fish movement. Modest decreases in winter stream flow could directly impact sturgeon by limiting availability of desirable overwintering habitats. Changes in stream flows could also result in lower temperatures, changes in dissolved oxygen, and changes in pollutant concentrations, which could adversely affect aquatic species such as pallid sturgeon. As the water withdrawals associated with the Colstrip Power Plant only comprise 0.3 percent or less of the average peak flows and the average monthly June flows, any direct effect on the timing or success of pallid sturgeon migrations and spawning would not be discernable over the 20 years of water withdrawals associated with combustion of Area F coal. In addition, spawning has not yet been confirmed in the Yellowstone River in the action area, although with the bypass around the Intake Diversion Dam now allowing for fish passage, spawning within this reach is increasingly likely to occur over the years of this project.

Under Alternative 4, 69 cfs would continue to be diverted from the Yellowstone River for the 20-year period of operations for Area F; as noted, withdrawal of this amount is substantially less than the average daily fluctuations in the Yellowstone River in the action area. Based on this, effects on stream temperature, dissolved oxygen levels, and chemical concentrations and related effects on sturgeon would likely not be discernable.

4.13.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect special status species impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct disturbance-related impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area under Alternative 5. As with Alternative 4, direct disturbance to wildlife habitat within the project area and indirect impacts on surrounding lands from noise and project-related activity could adversely impact several MNHP SOC; any disturbance-related impacts on northern long-eared bat and monarch butterfly would be negligible.

Over an 11-year mine life, approximately 37.1 million tons of coal would be mined from Federal and private coal leases in the project area. As with Alternative 4, there would be no indirect effects due to emissions and deposition for most special status species. For aquatic species (fish, amphibians, and aquatic invertebrates), indirect effects could be long-term and negligible to moderate for species inhabiting East Fork Armells Creek due to potential selenium deposition. As with Alternative 4, 69 cfs would continue to be diverted from the Yellowstone River during the period of operations for Area F (11 years under Alternative 5); any resulting indirect effects of the diversion on sturgeon would likely not be discernable.

Under Alternative 5, direct and indirect special status species impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres (and associated wildlife habitat) would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

As with Alternative 4, Alternative 5 may affect, but is unlikely to adversely affect, the northern long-eared bat and pallid sturgeon. The project would not contribute to a trend toward Federal listing of the monarch butterfly.

4.13.5 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources for federally listed threatened or endangered species. Both action alternatives may disturb wildlife SOC individuals and local populations. Each action alternative would likely result in shifts in species composition from wildlife that is less tolerant of disturbance to species that are able to adapt more readily to disturbance and increased human presence. As revegetation and reclamation of disturbed areas occurs, it is likely that species composition would eventually increase, but not to the levels of pre-disturbance diversity due to an anticipated reduction in overall vegetation diversity. The loss of some native wildlife habitat in both alternatives would be an irreversible resource commitment.

4.14 CULTURAL AND HISTORIC RESOURCES

This section discloses the direct and indirect effects on cultural and historic resources resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine conditions and the analysis areas used for this impacts analysis are described in **Section 3.14, Cultural and Historic Resources**.

4.14.1 Analysis Methods and Impact and Intensity Thresholds

Cultural and historic resources impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.14.1** of the 2018 Final EIS, beginning on page 592. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on cultural and historic resources are the same as those defined in the 2018 Final EIS in **Table 147**. The 2023 Annual Mining Report (Westmoreland Rosebud 2024b) was reviewed, and as applicable, additional information on documented cultural resources has been added. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.14.2 Alternative 1 – No Action

The types of direct and indirect impacts on cultural and historic resources under Alternative 1 (as described in this SEIS)[82] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**).

In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. Under Alternative 1, eight potential historic properties may be adversely affected by ground-disturbing activity over the life of the mine, including six sites determined eligible for listing in the National Register of Historic Places (NRHP) and two sites that remain unevaluated for listing in the NRHP. Mitigation measures have been implemented at four archaeological properties (24RB958, 24RB2334, 24RB2339, and 24RB2438) within the analysis area per the existing memorandum of agreement (MOA) between Western Energy, SHPO, DEQ, BLM, and OSMRE. Adverse effects on the remaining four potential historic properties would be resolved through the executed Programmatic Agreement (PA) as described in **Section 3.14.1.1, Regulatory Framework, Federal Requirements, Resolution of Adverse Effects** of the 2018 Final EIS. The PA incorporated the mitigation measures for the above-referenced MOA and corresponding four sites and includes stipulations to treat unanticipated discoveries during mining.

Under Alternative 1, direct and indirect impacts on cultural and historic resources would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**).

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82. Direct and indirect cultural and historic resources impacts of Alternative 1 – No Action were described in **Section 4.14.2** of the 2018 Final EIS, beginning on page 593. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

4.14.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect impacts on cultural and historic resources under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.14.3** of the 2018 Final EIS, beginning on page 593. Under Alternative 4, half a million tons more coal would be mined[83] and approximately 28 acres more would be disturbed as compared to Alternative 2.

4.14.3.1 Direct Impacts

Under the Proposed Action, 25 potential historic properties may be adversely affected by ground-disturbing activity over the life of the mine, including 18 sites determined eligible for listing on the NRHP, 7 sites that remain unevaluated for listing on the NRHP, and 1 historic district. Direct and indirect adverse effects on historic properties within the analysis area from surface mining beyond the first 5 years of permitted operations are currently undetermined, as those determinations would be phased. An existing MOA between Western Energy, SHPO, DEQ, BLM, and OSMRE implemented mitigation measures at four archaeological properties (24RB958, 24RB2334, 24RB2339, and 24RB2438) within the analysis area that would be adversely affected within the first 5 years of permitted operations. Adverse effects on the remaining 21 potential historic properties would be resolved through the executed PA as described in **Section 3.14.1.1, Regulatory Framework, Federal Requirements, Resolution of Adverse Effects** of the 2018 Final EIS. The PA incorporated the mitigation measures for the above-referenced MOA and corresponding four sites and includes stipulations to treat unanticipated discoveries during mining.

4.14.3.2 Indirect Impacts

The analysis area for indirect effects would be the area of potential effect as described in **Section 3.14.1.2, Analysis Area** in the 2018 Final EIS; therefore, indirect effects on historic properties would not increase related to the combustion of mined coal at the power plants or other activities.

4.14.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect impacts on cultural and historic resources under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, ten potential historic properties may be adversely affected by ground-disturbing activity over the life of the mine, including six sites determined eligible for listing in the NRHP and four sites that remain unevaluated for listing in the NRHP. Mitigation measures have been implemented at four archaeological properties (24RB958, 24RB2334, 24RB2339, and 24RB2438) within the analysis area per the existing MOA between Western Energy, SHPO, DEQ, BLM, and OSMRE. Adverse effects on the remaining six potential historic properties would be resolved through the executed PA as described in **Section 3.14.1.1, Regulatory Framework, Federal Requirements, Resolution of Adverse Effects** of

[83]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

the 2018 Final EIS. The PA incorporated the mitigation measures for the above-referenced MOA and corresponding four sites and includes stipulations to treat unanticipated discoveries during mining.

Under Alternative 5, direct and indirect impacts on cultural and historic resources would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**).

4.14.5 Irreversible and Irretrievable Commitment of Resources

Adverse effects on historic properties in the analysis area were resolved initially through the MOA for the four affected properties identified above and since then through the executed PA for the remaining properties; however, agreed-upon resolved adverse effects would represent an irreversible and irretrievable commitment of resources. Because avoidance and/or minimization of effects is not feasible for historic properties, excavation is an accepted method to resolve adverse effects by recovering information important to the interpretation of history or prehistory, but this mitigation measure is not the only available option.

Accidental destruction of presently unknown cultural resources, including resources with Native American significance, would constitute irreversible and irretrievable losses. The process for resolving unanticipated discoveries is addressed in the PA (**Appendix H** in the 2018 Final EIS).

4.15 SOCIOECONOMIC CONDITIONS

This section discloses the direct and indirect effects on socioeconomic conditions resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Existing socioeconomic conditions and the analysis areas used for this impacts analysis are described in **Section 3.15, Socioeconomic Conditions**.

4.15.1 Analysis Methods and Impact and Intensity Thresholds

Socioeconomic impacts were evaluated in this SEIS using the same analysis methods used in the 2018 Final EIS, but with updated assumptions. Analysis methods are provided in **Section 4.15.1** of the 2018 Final EIS, beginning on page 595. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on socioeconomic conditions also are the same as those defined in the 2018 Final EIS **Table 148**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**. Assumptions specific to the socioeconomics analysis are discussed below in **Section 4.15.1.1, Assumptions**.

4.15.1.1 Assumptions

Analysis assumptions have been updated since 2018, due to changed conditions in the analysis area. The economic impacts modeling and analysis in the 2018 Final EIS are likely an overestimate of current conditions, primarily due to the early retirement of Units 1 and 2 of the Colstrip Power Plant. Since 2018, analysis assumptions have been updated to reflect the increased diversity and changing socioeconomic conditions in the analysis area, as well as the early closure of Units 1 and 2.

The total minority populations have risen notably in Montana, Big Horn County, Rosebud County, and the reservations, indicating growing diversity. Concurrently, poverty rates have generally decreased, showing some economic improvement. However, persistent high poverty rates among American Indian populations on the Northern Cheyenne and Crow Reservations suggest that these communities continue to face substantial socioeconomic challenges.

4.15.1.2 Analysis Methods

As with the 2018 Final EIS, the regional economic effects of current and future mine operations were evaluated in 2024 by BBC Research & Consulting (BBC) using an input-output model (IMPLAN), to support the socioeconomics analyses in this SEIS (**Appendix 4**) (BBC 2024b); as applicable, content from that analysis has been incorporated in the SEIS. Input-output analysis is a means of examining relationships within an economy between businesses, and between businesses and final consumers. Three types of economic impacts (effects) are identified in the analysis: direct, indirect, and induced. Direct effects are associated with the immediate effects tied to mine activity (e.g., the payroll and the supplies, materials, and services purchased by the Rosebud Mine) and should not be confused with direct effects as described in **Appendix 4**. Indirect effects are production changes resulting from spending during operations in industries that supply products and services to mine operations and should not be confused with indirect effects as described in **Appendix 4**. Induced effects are changes in economic activity resulting from households spending income earned directly or indirectly as a result of mine operations. The sum of indirect and induced economic effects are referred to as secondary effects, which is the term used in the remainder of the discussion. Additional details about the methods BBC used in its SEIS analysis are in **Section 4.15.1.2, Analysis Methods**, in the 2018 Final EIS.

Socioeconomic conditions in the analysis area (and potential impacts on them due to the leasing of Federal coal in the region) were recently evaluated by the BLM in support of the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). OSMRE and the EIS consultant team reviewed the data presented in that document and found it to be generally consistent with what was presented in the 2018 Final EIS.

4.15.2 All Alternatives

Similar to the analysis in the 2018 Final EIS and as described in the sections below, the annual economic effects associated with continued operation of the Rosebud Mine would be the same for Alternative 1 – No Action, Alternative 4 – Proposed Action, and Alternative 5 – Partial Mining Alternative. Under the No Action alternative, the operational life of the Rosebud Mine would be expected to end in 2025. The difference among alternatives is that selection of Alternatives 4 or 5 would extend the life of operations for Area F (and the annual direct, indirect, and induced socioeconomic effects) beyond the No Action alternative by 14 years or 5 years, respectively (see **Section 2.2.6, Life of Operations**). The analysis in this EIS assumes, based on information from Westmoreland, that employment and annual coal production would remain the same through the end of mine life under any alternative. It should be noted that ceasing production in Area F earlier than 2039 (either 2025 under Alternative 1 or 2030 under Alternative 5), would cause Westmoreland Rosebud to shift mining operations to other approved permit areas, such as Area B, potentially leading to increased production rates for those permit areas and potential closure of the Rosebud Mine earlier than 2045; however, the sequence of events and mine production rates in this scenario are uncertain.

Socioeconomic Impacts of Mine Closure

The summary of socioeconomic impacts of mine closure would be similar to those described in the 2018 Final EIS in **Section 4.15.2** on page 598, with the exception of the early (January 2020) closure of Units 1 and 2.

4.15.2.1 Direct Impacts – All Alternatives

Direct effects of all alternatives in this SEIS are assumed to occur in the same areas as described in the 2018 Final EIS in **Section 4.15.2.1** on page 598. Currently, the Rosebud Mine supports an annual average of approximately 320 direct jobs and $148 million in annual direct economic output (including wages and revenue generated from the purchase of supplies, materials, and services by the Rosebud Mine) (**Table 4.15-1**) (BBC 2024b); this level of employment and direct economic output would be expected to continue through 2025 for all alternatives. Similarly, based on the Northern Cheyenne Reservation's share of the Rosebud County economy, the Rosebud Mine provides almost 46 jobs; this level of employment and direct economic output also would be expected to continue through 2039 for Alternative 4 and 2030 for Alternative 5. About 14 percent of employees at the Rosebud Mine are members of the Tribe (BBC 2024b). Another 30 of the 320 workers (9 percent) are Native Americans, who are not members of the Northern Cheyenne tribe, are likely predominantly members of the relatively nearby Crow tribe.

Table 4.15-1. Annual Direct Effects by Location from the Rosebud Mine.

Area	Employment	Total Output
Rosebud County	320	$148,073
Big Horn County	0	$0
Treasure County	0	$0
Total	320	$148,073

Source: BBC 2024b.

4.15.2.2 Indirect Impacts – All Alternatives

The estimated indirect effects of all alternatives in this SEIS are assumed to occur in the same areas as described in the 2018 Final EIS in **Section 4.15.2.2** on page 599. The estimated indirect economic effects on the region from the Rosebud Mine are shown in **Table 4.15-2**. Indirect effects likely would continue to occur outside of the three-county analysis area—particularly in Yellowstone County, which includes the City of Billings. Billings is the largest city and the primary regional trade center in southeastern Montana. The effects beyond the three-county study area are not captured in this analysis.

The Rosebud Mine supports 53 indirect jobs (**Table 4.15-2**). This level of indirect employment would be expected to continue through 2039 for Alternative 4 and 2030 for Alternative 5. The mine also generates approximately $18.4 million annually in indirect economic output in the region. This level of indirect economic output would be expected to continue under all action alternatives (**Table 4.15-2)**.

Table 4.15-2. Indirect Effects by Location from the Rosebud Mine.

Area	Employment	Total Output
Rosebud County	49	$17,091
Big Horn County	1	$465
Treasure County	3	$819
Total	53	$18,375

Source: BBC 2024b.

4.15.2.3 Induced Effects – All Alternatives

Table 4.15-3 shows the estimated induced effects of the Rosebud Mine within Rosebud, Big Horn, and Treasure Counties and within the Northern Cheyenne Reservation. For all alternatives, the Rosebud Mine would continue to support approximately 65 induced jobs and over $10 million in annual induced output across the tri-county analysis area through 2039 for Alternative 4 and 2030 for Alternative 5.

Table 4.15-3. Induced Effects by Location from the Rosebud Mine.

Area	Employment	Total Output
Rosebud County	49	$17,091,000
Big Horn County	1	$465,000
Treasure County	3	$819,000
Total	53	$18,375,000

Source: BBC 2024b.

4.15.2.4 Total Economic Effects – All Alternatives

The total regional economic employment and output of the mine is derived by combining the direct, indirect, and induced impacts described in previous sections. The majority of the economic effects would continue to occur at or near the mine; and Rosebud County would continue to experience the largest economic impacts until the end of operational mine life. However, since indirect and induced spending occurs across the larger regional economy, both Big Horn and Treasure Counties would continue to experience some economic effects due to mine operations until the end of operational mine life (**Table 4.15-4).** As noted previously, about 23 percent of the mine's direct workforce are members of the Northern Cheyenne tribe (14 percent) or other Native Americans (9 percent).

Table 4.15-4. Total Annual Economic Effects from the Rosebud Mine.

Area	Employment	Total Output
Rosebud County	427	$174,912,000
Big Horn County	7	$1,372,000
Treasure County	4	$904,000
Total	438	$177,188,000

Source: BBC 2024b.

The Rosebud Mine is estimated to currently support about 438 direct, indirect, and induced jobs throughout the three-county region and to stimulate about $177 million in annual economic output within the region. As noted previously, about 23 percent of the mine's direct workforce are members of the Northern Cheyenne tribe (14 percent) or other Native Americans (9 percent).

4.15.2.5 Impacts on Government Revenues – All Alternatives

Another important component of the mine's economic effects is the resulting fiscal revenues provided to local governments, the state of Montana, and the Federal government.

The Rosebud Mine is estimated to provide approximately $52 million in annual direct revenues to Rosebud County, the state of Montana, and the Federal government, as summarized in **Table 4.15-5**. These revenues include Federal and state royalties, severance taxes, resource indemnity trusts, gross proceeds taxes, and property taxes.

As shown in **Table 4.15-5**, the Rosebud Mine directly generated approximately $32 million in annual state revenues in 2023. Local governments received approximately $11 million, and the Federal government received approximately $9 million in annual taxes and royalties.

Table 4.15-5. Direct Governmental Revenues from the Rosebud Mine.

Revenue Type	Local Governments	State of Montana	Federal Government
Taxes	$10,643,000	$30,338,000	$0
Royalties	$0	$2,003,000	$9,068,000
Total	$10,643,000	$32,341,000	$9,068,000

Source: BBC 2024b.

In addition to the direct fiscal impacts, the indirect and induced economic activity generated by the mine throughout the region produces additional tax revenues. These effects include payroll and income taxes, property taxes, and other fees. Induced fiscal effects are relatively small because there are no sales taxes in Montana that capture revenues from the induced increase in household spending.

As shown in **Table 4.15-6**, the indirect and induced effects, combined with the direct effects shown in Figure 5, are estimated to generate approximately $12 million, $33 million, and $11 million in annual revenues in 2023 for local governments, the state of Montana, and the Federal government, respectively.

Table 4.15-6. Total Annual Governmental Revenues from the Rosebud Mine.

Revenue Type	Local Governments	State of Montana	Federal Government
Direct	$10,643,000	$32,341,000	$9,068,000
Indirect	$750,000	$452,000	$918,000
Induced	$258,000	$236,000	$687,000
Total	$11,651,000	$33,029,000	$10,673,000

Source: BBC 2024b.

4.16 ENVIRONMENTAL JUSTICE

This section discloses the direct and indirect impacts on environmental justice communities resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Characteristics of existing environmental justice communities in the analysis areas are described in **Section 3.16, Environmental Justice**.

4.16.1 Analysis Methods and Impact and Intensity Thresholds

Environmental justice impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.16.1** of the 2018 Final EIS, beginning on page 604. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on environmental justice communities are the same as those defined in the 2018 Final EIS **Table 156**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

The population and demographic data trends outlined in **Sections 3.16.1** through **3.16.3** of this SEIS have been updated to build upon the information presented in the 2018 Final EIS, incorporating the latest data from the United States Census Bureau's 2022 American Community Survey Data Tables.

A new IMPLAN analysis was completed by BBC (2024b) to support the socioeconomics analyses in this SEIS (**Appendix 4**); as applicable, content from that analysis has been incorporated in the SEIS. Environmental justice communities in the analysis area (and potential impacts on them due to the leasing of Federal coal in the region) were recently evaluated by the BLM in support of the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). OSMRE and the EIS consultant team reviewed the data presented in that document and found it to be generally consistent with what was presented in the 2018 Final EIS.

4.16.2 All Alternatives – Socioeconomic Impacts

The alternative selected for this project may have ramifications for the operations of the Rosebud Mine as a whole and for environmental justice populations employed by the mine. Direct and indirect socioeconomic impacts on environmental justice populations from the Proposed Action would be the result of the life of the mine being extended beyond the life of the No Action alternative by 14 years under Alternative 4 and 6 years under Alternative 5 (see **Section 2.2.3, Life of Operations**).

As described in **Section 4.15, Socioeconomic Conditions** of the 2018 Final EIS**,** the reduction in mine production because of the retirement of the Colstrip Power Plant Units 1 and 2 in 2022 has occurred regardless of the alternative. The closure of Colstrip Units 1 and 2 has resulted in reductions to the employment and economic output that contributes to the well-being of environmental justice populations between 2022 and mine closure (BBC 2024b). Socioeconomic impacts on environmental justice populations that result from the closure of the Colstrip Power Plant Units 1 and 2 and the closure of the mine are analyzed in **Chapter 5, Environmental Justice**.

Based on production estimates for Area B and other currently approved permit areas, including Area F, the operational life of the Rosebud Mine is assumed to end in 2045 (**Section 2.2.6 Life of Operations**). Full development of Area F under Alternative 4, which is consistent with the approved state operating permit C2011003F and the 2019 approved Federal mining plan is expected to be about 20 years (through 2039). Ceasing production in Area F earlier than 2039 (either 2025 under Alternative 1 or 2030 under

Alternative 5), would cause Westmoreland Rosebud to shift mining operations to other approved permit areas, such as Area B, potentially leading to increased production rates for those permit areas and potential closure of the Rosebud Mine earlier than 2045. The impacts from the mine closure are discussed below to provide context.

Socioeconomic Impacts of Mine Closure on Environmental Justice Communities

As discussed in the Final 2018 EIS (**see Section 4.16.2**), Colstrip Power Plant Units 1 and 2 were estimated to close in July 2022 (as mentioned above, the Colstrip Power Plant Units 1 and 2 closed in January 2020, earlier than the estimated closure date). When the Rosebud Mine eventually closes (the closure year is dependent on the selection of the No Action alternative or Alternatives 4 or 5; see **Section 2.2.6, Life of Operations),** unemployment rates would likely increase, and income would decrease with the loss of jobs. It is possible the analysis area would experience further negative population growth and increased poverty rates compared to both present conditions and conditions post-closure of the Colstrip Power Plant Units 1 and 2 (see **Sections 3.15** and **4.15, Socioeconomic Conditions**). Sources of revenue from the mine that fund community institutions and essential social services would be eliminated after mine closure. These institutions would likely experience further decreases in funding as a result of lower employment rates, lower wages, and the total loss of tax revenue from the mine operation.

Direct socioeconomic impacts on environmental justice communities would occur within Rosebud County and on the Northern Cheyenne Indian Reservation, as a result of employment and economic output from the mine operations. Indirect and induced impacts (as defined in **Section 4.15, Socioeconomic Conditions**) on environmental justice populations would be experienced within Rosebud, Treasure, and Big Horn Counties, and within the Northern Cheyenne Indian and Crow Reservations (see **Section 4.15, Socioeconomic Conditions**).

Both low-income and minority environmental justice populations in Rosebud County, specifically American Indian, would be directly and indirectly impacted from the loss of wages and economic activity from mine operations when the mine closes. Rosebud Mine jobs and direct economic output that contribute to the well-being of the Northern Cheyenne Tribe would cease, as well as access to future jobs for Northern Cheyenne tribal members under the Lujan Settlement (see **Section 3.16.1.1, Regulatory Framework** in the 2018 Final EIS).

The direct and indirect impacts from the mine closure would be disproportionately borne by Northern Cheyenne tribal members, as they are likely to be less mobile than other populations due to family and cultural ties to the reservation and have limited transportation options for commuting to other economic centers. There are limited economic opportunities in the region that would replace the jobs and wages resulting from the mine. Likewise, Northern Cheyenne tribal members may be unlikely to relocate to areas where social services and infrastructure meet their needs. Low-income populations may be restricted as well by lack of transportation and ability to relocate to areas where there are greater economic opportunities and social services. As a result, public health, education, and access to necessary services may decrease, resulting in long-term adverse impacts on these communities, if there is no other economic growth and development in the area that would replace the lost jobs and wages. Currently, there are limited economic opportunities in the region that would replace the jobs and wages resulting from the mine.

4.16.2.1 Direct Impacts

Alternative 1 – No Action

Direct impacts from Alternative 1 – No Action would be similar to the impacts described in **Section 4.16.2.1** of the 2018 Final EIS for Alternative 1 – No Action. The Rosebud Mine is a major economic driver within Rosebud County and the Northern Cheyenne Indian Reservation (see Section 3.15, Socioeconomics). Under the No Action alternative, Area F would support the economic activity described in **Appendix 4** through 2025. Once closure of the Rosebud Mine happens, which would likely be earlier than 2045 since other permit areas would need to increase production to compensate for lost production in Area F, all associated economic activity, including employment and economic output, would cease. This eventual closure would negatively affect all populations within Rosebud County, particularly the substantial environmental justice populations. The impacts would be similar to those associated with the No Action alternative described in the 2018 Final EIS but with an increased burden on American Indian populations as reflected by current employment. The number of direct jobs held by Native Americans at the Rosebud Mine has increased from the 2017 report, where 15 to 20 percent of employees were members of the Northern Cheyenne Tribe, to the 2024 report, which states that 14 percent of the mine's workers are Northern Cheyenne and an additional 9 percent are other Native Americans, likely including Crow Tribe members (24 percent total) (BBC 2024b). As a result, the impacts of the mine's eventual closure based on current conditions would have an increased disproportionate impact on the American Indian population.

Alternative 4 – Proposed Action (Current Federal Mining Plan)

Under Alternative 4, direct impacts would be similar to those described under Alternative 2 in the 2018 Final EIS. Mining in Area F would support the economic activity described in **Appendix 4** through 2039. As with the No Action alternative, after the mine closes, all populations would be negatively affected, including the substantial environmental justice populations. Alternative 4 would delay the onset of the adverse impacts discussed under the No Action alternative above, possibly allowing time for other sectors such as agriculture and renewable energy projects to develop and mitigate some of the economic effects of its closure. The number of direct jobs held by Native Americans at the Rosebud Mine has increased from the 2017 report, where 15 to 20 percent of employees were members of the Northern Cheyenne Tribe, to the 2024 report, which states that 14 percent of the mine's workers are Northern Cheyenne and an additional 9 percent are other Native Americans, likely including Crow Tribe members (24 percent total) (BBC 2024b). As a result, the impacts of the mine's closure based on current conditions would have an increased disproportionate impact on the American Indian population. Therefore, the 20-year Area F period of operations under Alternative 4 would result in a short-term and minor impact because the mine would continue to support local economic activity that contributes to the well-being of environmental justice populations.

Alternative 5 – Partial Mining Alternative

Under Alternative 5, impacts would be similar to those described for Alternative 4, except Area F would support the economic activity described in **Appendix 4** through 2030 rather than 2039. Once closure of the Rosebud Mine happens, which would likely be earlier than 2045 because other permit areas would need to increase production to compensate for lost production in Area F, all associated economic activity, including employment and economic output, would cease. As with the No Action alternative, after the mine closes, all populations would be negatively affected, including the substantial environmental justice populations. Alternative 5, similar to Alternative 2 in the 2018 Final EIS, would delay the onset of the adverse impacts discussed under the No Action alternative above, possibly allowing time for other sectors such as agriculture and renewable energy projects to develop and mitigate some of the economic effects of its closure. The number of direct jobs held by Native Americans at the Rosebud Mine has increased from the 2017 report, where 15 to 20 percent of employees were members of the Northern Cheyenne Tribe, to the 2024 report, which states that 14 percent of the mine's workers are Northern Cheyenne and an additional 9 percent are other Native Americans, likely including Crow Tribe members (24 percent total) (BBC 2024). As a result, early closure of the mine based on current conditions would have an increased disproportionate impact on the American Indian population. Therefore, the 11-year Area F period of operations under Alternative 5 would result in a short-term minor impact because the mine would continue to support local economic activity that contributes to the well-being of environmental justice populations. This would result in a short-term and minor impact because the mine would continue to support local economic activity that contributes to the well-being of environmental justice populations.

4.16.2.2 Indirect and Induced Impacts

Alternative 1 – No Action

Under the No Action alternative, mining in Area F would support the economic activity described in **Appendix 4** through 2025. Jobs and economic output indirectly associated with the Rosebud Mine would be reduced if mining in Area F ceased in 2025. Once closure of the Rosebud Mine happens, which would likely be earlier than 2045 because other permit areas would need to increase production to compensate for lost production in Area F, the indirect and induced impacts described in **Appendix 4** would cease. Indirect impacts would be felt by the counties and the Northern Cheyenne and Crow Reservations as losses of jobs and wages that are indirectly supported by mine operations, similar to the direct impacts discussed above. Overall, indirect effects on environmental justice populations as a result of the No Action alternative would be long-term, negligible, and adverse.

Alternative 4 – Proposed Action (Current Federal Mining Plan)

Under Alternative 4, mining in Area F would support the economic activity described in **Appendix 4** through 2039. As with the No Action alternative, once closure of the Rosebud Mine happens (expected in 2045 based on current life of mine estimates) the indirect and induced impacts described in **Appendix 4** would cease. All populations would be negatively affected, including the substantial environmental justice populations. Alternative 4 would delay the onset of the adverse impacts discussed under the No Action alternative above, possibly allowing time for other sectors such as agriculture and renewable energy projects to develop and mitigate some of the economic effects of its closure. This would result in a short-term and minor impact because the mine would continue to support local economic activity that contributes to the well-being of environmental justice populations.

Alternative 5 – Partial Mining Alternative

Under Alternative 5, mining in Area F would support the economic activity described in **Appendix 4** through 2030. Once closure of the Rosebud Mine happens, which would likely be earlier than 2045 because other permit areas would need to increase production to compensate for lost production in Area F, the indirect and induced impacts described in **Appendix 4** would cease. As with the No Action alternative, after the mine closes, all populations would be negatively affected, including the substantial environmental justice populations. Alternative 5 would delay the onset of the adverse impacts discussed under the No Action alternative above, possibly allowing time for other sectors such as agriculture and renewable energy projects to develop and mitigate some of the economic effects of its closure. This would result in a short-term and minor impact because the mine would continue to support local economic activity that contributes to the well-being of environmental justice populations.

4.16.3 Public Health Impacts

Analysis of public health impacts on environmental justice populations is similar to the analysis in the 2018 Final EIS in **Section 3.5** and **Section 4.5, Public Health**. This section examines potential impacts on the public health of environmental justice populations described in **Section 3.16, Environmental Justice**. Effects related to the timing of mine closure are dependent on selection of the No Action alternative or Alternatives 4 and or 5 (see **Section 2.2.6, Life of Operations**).

4.16.3.1 Alternative 1 –No Action

Under Alternative 1 – No Action, direct and indirect impacts on public health in environmental justice communities are similar to those described for Alternative 1 in **Section 4.16.3** of the 2018 Final EIS. As discussed above, public health impacts from eventual mine closure (potentially before 2045 under Alternative 1) would be disproportionately borne by Northern Cheyenne tribal members and by low-income populations, as they are likely to be less mobile and are less likely to relocate due to limited transportation options, accessing public health services may become more difficult if local services become less available from reduced funding, and there are limited economic opportunities in the region that would replace the jobs and wages resulting from the Rosebud Mine. As a result, public health and access to necessary services may decrease, resulting in long-term minor to moderate adverse public health impacts on these communities.

4.16.3.2 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect public health impacts on environmental justice populations under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.16.3.2** of the 2018 Final EIS, beginning on page 608.

Direct Impacts

Direct impacts of Alternative 4 on the public health of environmental justice communities are similar to the impacts under Alternative 2 in the Final 2018 EIS (see **Section 4.16.3.2**). The potential impacts on public health, including environmental justice populations, are discussed in **Section 4.5, Public Health** and **Section 4.3, Air Quality**.

Tribal consultation with the Northern Cheyenne and Crow Tribes has been re-initiated regarding impacts on culturally significant resources within the direct effects analysis area and to mitigate impacts on cultural resources that might affect traditional tribal ways of life and well-being (see **Section 6.1.3, Tribal Consultation Process**).

Indirect Impacts

The indirect impacts of Alternative 4 on public health of environmental justice communities are similar to the impacts under Alternative 2 in the Final 2018 EIS (see **Section 4.16.3.2**).

Alternative 4 would support continued indirect and induced revenues and jobs within the analysis area through 2039, resulting in continued support and access to local health resources and funding of disease prevention, treatment, and response services, including those used by environmental justice populations (see **Section 4.5, Public Health**). About 14 percent of the direct jobs at the Rosebud Mine are held by members of the Northern Cheyenne Tribe, and another 9 percent by other Native Americans, likely predominantly members of the Crow Tribe (BBC 2024b). Since preparation of the Final 2018 EIS, Colstrip Units 1 and 2 have been retired, resulting in lower employment rates for the surrounding populations, including the Northern Cheyenne and most likely Crow. Under Alternative 4, mining in Area F would support the economic activity described in **Appendix 4** through 2039, resulting in sustained indirect and induced economic support of public health services, income, and availability of health insurance through indirect jobs and revenues. About 30 percent of the indirect jobs created from the Rosebud Mine are made up of members of the Northern Cheyenne Tribe. Thus, the Proposed Action would have a short-term, minor, beneficial effect on the public health of environmental justice populations.

Alternative 4 would support continued indirect revenues and jobs within the analysis area, resulting in continued support and access to local health resources and funding of disease prevention, treatment, and response services, including those used by environmental justice populations (see **Section 4.5, Public Health**). Thus, the Proposed Action would have a short-term, minor, beneficial effect on the public health of environmental justice populations.

4.16.3.3 Alternative 5 – Partial Mining Alternative

Direct and indirect public health impacts on environmental justice populations under Alternative 5 – Partial Mining Alternative, would be similar to those for Alternative 1. Under Alternative 5, though, mining in Area F would proceed through 2030, delaying the economic impacts described for Alternative 1.

4.16.4 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of socioeconomic resources as they relate to environmental justice populations. Likewise, there would be no irreversible and irretrievable commitments of public health resources as they relate to environmental justice populations as a result of any of the alternatives analyzed in this section.

4.17 VISUAL RESOURCES

This section discloses the direct and indirect impacts on visual resources resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine visual conditions and the analysis areas used for this impacts analysis are described in **Section 3.17, Visual Resources.**

4.17.1 Analysis Methods and Impact and Intensity Thresholds

Visual impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.17.1** of the 2018 Final EIS, beginning on page 610. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on visual resources are the same as those defined in the 2018 Final EIS in **Table 157**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.17.2 Alternative 1 – No Action

The types of direct and indirect visual impacts under Alternative 1 (as described in this SEIS)[84] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would occur over a 6-year mine life. Under Alternative 1, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). As with Alternative 4, there would be short-term, moderate, adverse impacts during the life of the mine on drivers traveling along Horse Creek Road (County Road 384) through the project area. Under Alternative 1, however, direct and indirect visual impacts would be less than those under Alternative 4 because disturbance and mine operations would be limited to the southeastern portion of the project area (**Figure 2.4-1**), and the life of mine operations in Area F (and the corresponding impacts) would be 14 years shorter than under Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Under Alternative 1, reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes particulate and gaseous air pollutants that contribute to regional haze in the surrounding viewshed. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

4.17.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

The types of direct and indirect visual impacts under Alternative 4 would be similar to those described in the 2018 Final EIS for Alternative 2.

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84. Direct and indirect visual impacts of Alternative 1 – No Action were described in **Section 4.17.2** of the 2018 Final EIS, beginning on page 610. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

4.17.3.1 Direct Impacts

There would be no direct visual impacts from project area mining operations on Colstrip residences, commercial sites, local recreation areas such as Winchester Park and Castle Rock Lakes, or locations along State Highway 39 in the analysis area, due to the following conditions:

- The nature of the topography in the area, which includes long, rolling hills and occasional bluffs and excludes views of the project area from Colstrip residences, businesses, and recreation sites, which are about 12 miles east of the project area
- The location of the existing mining operations between the project area and the observation points in Colstrip, local recreation areas, and State Highway 39
- The relatively small size of the proposed operations visible from observation points due to the relatively long distance between the observation points and proposed operations

Under Alternative 4, mining operations (**Figure 2.5-1**) would result in increased visual contrast in a small portion of the landscape in the direct effects analysis area, including changes in the color of the landscape from removal of vegetation and exposure of soil, as well as changes to the contour of the landscape. Large equipment may be visible during active mining. However, viewing times would be relatively short (only while driving through the project area) and would be negligible relative to existing mining operations adjacent to the proposed operations in the project area. Also, a segment of Horse Creek Road would be relocated as mining progresses through the project area (**Figure 2.5-1**); one segment was already relocated in 2019. Visual impacts such as ground disturbance and construction activities from relocation of Horse Creek Road would be short-term and limited to the period of construction (in about 5–7 years based on current estimates).

Residences (observation points) identified in the analysis area outside of Colstrip are listed in **Table 4.17-1** and are shown on **Figure 113** in the 2018 Final EIS. There would be no impact on residences R1, R5, R6, and R7 because topography would screen the view of mining operations. Impacts on R2 and R3 would be long-term but minor, because active mining may be visible in a small amount of the viewshed of these residences and the project area is adjacent to existing mining areas. Impacts on R4, located directly west of the project area, would be long-term and moderate because no other active mining areas are visible from this residence.

Table 4.17-1. Approximate Distances from Residences to Mining Areas.

Label	Location	Direction from Mine	Distance to Area F (Miles)	Visual Impacts
R1	Airport Road	SE of the project area	4.0	Not visible due to topography – no impact
R2	Armells Creek Road	NE of the project area	2.9	Possibly visible as mining progresses – long-term but minor due to small area visible and existing mining
R3	Armells Creek Road	NE of the project area	2.2	Possibly visible as mining progresses – long-term but minor due to small area visible and existing mining
R4	Horse Creek Road	W of the project area	3.2	Possibly visible as mining progresses – long-term and moderate effect since no other mining activity is visible
R5	Highway 384	SW of the project area	8.0	Not visible due to topography – no impact
R6	Unnamed rural road	S of the project area	5.5	Not visible due to topography – no impact
R7	Unnamed rural road	S of the project area	4.7	Not visible due to topography – no impact

4.17.3.2 Indirect Impacts

Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years. The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes particulate and gaseous air pollutants that contribute to regional haze in the surrounding viewshed. Depending on atmospheric conditions and sources of emissions, haze could continue to reduce the visibility of distant mountains and hills, contribute a “smoky” appearance, and detract from the clarity of the landscape. Quantitative analysis of haze-producing pollutants is provided in **Section 4.3, Air Quality**. The Colstrip and Rosebud Power Plants installed Best Available Retrofit Technology on combustion units to increase efficiency and reduce emissions, as described in **Section 4.3, Air Quality** of the 2018 Final EIS. As summarized in **Table 3.17-1** of this SEIS, Montana developed the Regional Haze State Implementation Plan for the state to meet Federal haze standards. As discussed in **Section 4.3, Air Quality** of the 2018 Final EIS, the modeled change in haze index due to indirect impacts of Alternative 4 was compared to annual average natural conditions (in terms of the number of days the haze index value would exceed 0.5 or 1.0 at any Class I area) and reported in **Table 111** of the 2018 Final EIS (replicated in this SEIS in **Table 4.3-12**). Indirect impacts of Alternative 4 on haze visibility impairment at Class I areas would be short-term, minor, and adverse.

Visibility effects are expected to emanate up to 300 km from the area surrounding the Colstrip Power Plant, the Rosebud Power Plant, and the Rosebud Mine, based on the modeling for haze-producing pollutants. Six Class I areas (defined in **Section 3.3, Air Quality**, in the 2018 Final EIS) are located within 300 km of the Colstrip and Rosebud Power Plants. The Northern Cheyenne Reservation is the closest Class I area and is 21 km (around 13 miles) away (see **Section 3.3, Air Quality**, in the 2018 Final EIS**)**. Potential impacts on the Northern Cheyenne Reservation and other Class I areas are discussed in **Section 4.3, Air Quality**. Visibility impairment is expected to be negligible for all Class I areas under any alternative.

4.17.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect visual impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would occur over an 11-year mine life. Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). As with Alternative 4, there would be short-term, moderate, adverse impacts during the life of the mine on drivers traveling along Horse Creek Road (County Road 384) through the project area. and the life of mine operations in Area F (and the corresponding impacts) would be 9 years shorter than under Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Under Alternative 5, reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes particulate and gaseous air pollutants that contribute to regional haze in the surrounding viewshed. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4. Similar to Alternative 4, visibility impairment is expected to be negligible for all Class I areas under Alternative 5.

4.17.5 Irreversible and Irretrievable Commitment of Resources

An irreversible and irretrievable commitment of visual resources would occur from the proposed project. Surface mining would be short-term during the life of the mine; the area would be reclaimed after mining is complete. Although the land would be recontoured and revegetated during reclamation, visual changes would include loss of natural rock outcrops, diverse vegetation, and natural drainages, gradually blending into the surrounding landscape over time. Visual changes to the land postmining would be subtle and negligible to some viewers (i.e., viewers in cars traveling on Horse Creek Road through the project area) and minor to moderate to viewers more familiar with the pre-mining landscape (i.e., residences near the project area).

4.18 RECREATION

This section discloses the direct and indirect effects on recreation resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine reclamation opportunities and the analysis areas used for this impacts analysis are described in **Section 3.18, Recreation**.

4.18.1 Analysis Methods and Impact and Intensity Thresholds

Recreation impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.18.1** of the 2018 Final EIS, beginning on page 616. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on recreation are the same as those defined in the 2018 Final EIS in **Table 159**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.18.2 Alternative 1 – No Action Alternative

The types of direct and indirect recreation impacts under Alternative 1 (as described in this SEIS)[85] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would occur over a 6-year mine life. Under Alternative 1, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). As with Alternative 4, there would be long-term, moderate, and adverse impacts on recreation due to a loss of recreation opportunities during mining operations. Hunting opportunities within the analysis area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. Under Alternative 1, though, recreation impacts would be less than those under Alternative 4 because disturbance and mine operations would be limited to the southeastern portion of the project area (**Figure 2.4-1**), and the life of mine operations in Area F (and the corresponding impacts) would be 14 years shorter than under Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Under Alternative 1, reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Therefore, pre-mine recreational use of the analysis area could resume 14 years earlier as compared to Alternative 4.

There would be no indirect impacts on recreation other than potential regional haze as described in **Section 4.3, Air Quality**. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4. Regional haze impacts on recreation in the analysis area would be long-term, minor, and adverse.

4.18.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect recreation impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.18.3** of the 2018 Final EIS,

85. Direct and indirect recreation impacts of Alternative 1 – No Action were described in **Section 4.18.2** of the 2018 Final EIS, beginning on page 616. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

beginning on page 617. Under Alternative 4, half a million tons more coal would be mined[86] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation (including revegetation) of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.18.3.1 Direct Impacts

During the life of operations (about 20 years under Alternative 4), use of the lands within the analysis area would be devoted to mining and associated activities. All current use of the land for recreation (primarily hunting) would be unavailable during mine operations, displacing some individuals onto other nearby lands for hunting and other recreation opportunities. However, since the analysis area represents less than 0.01 percent of Hunting District 702, the private lands within the project area represent a relatively small portion of the currently accessible public (state) surface lands for recreational opportunity within the respective hunting area.

There would be a loss of recreation opportunities since hunting in the analysis area would not be possible during mining operations. Hunting opportunities on mine-related disturbance areas within the analysis area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. Thus, impacts on recreation in the project area would be long-term, moderate, and adverse.

Adjacent Recreational Uses

Adjacent recreation uses during mine operations would be affected to some extent; these impacts are described in **Section 4.22, Noise**; **Section 4.17, Visual Resources**; and **Section 4.12, Fish and Wildlife Resources**. There would be no impacts on recreation uses in and immediately surrounding the city of Colstrip or in southeastern Montana.

4.18.3.2 Indirect Impacts

There would be no indirect impacts on recreation other than potential regional haze as described in **Section 4.3, Air Quality**. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years. Regional haze impacts on recreation in the analysis area would be long-term, minor, and adverse.

4.18.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect recreation impacts under Alternative 5 (as described in this SEIS) would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would occur over an 11-year mine life. Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). As with Alternative 4, there would be long-term, moderate, and adverse impacts on recreation in the analysis area due to a loss of

86. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

recreation opportunities during mining operations. Hunting opportunities within the analysis area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. Under Alternative 5, though, recreation impacts would be less than those under Alternative 4 because disturbance and mine operations would be limited to the southeastern portion of the project area (**Figure 2.4-1**), and the life of mine operations in Area F (and the corresponding impacts) would be 9 years shorter than under Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Under Alternative 5, reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Therefore, pre-mine recreational use of the analysis area could resume 9 years earlier as compared to Alternative 4.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes particulate and gaseous air pollutants that contribute to regional haze in the surrounding viewshed. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

4.18.5 Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of recreation resources would occur. Surface mining in the analysis area would be short-term, and the land would likely be available for hunting again after mining is complete and the land is reclaimed.

4.19 PALEONTOLOGY

This section discloses the direct and indirect effects on paleontology resources resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine conditions and the analysis areas used for this impacts analysis are described in **Section 3.19, Paleontology**.

4.19.1 Analysis Methods and Impact and Intensity Thresholds

Paleontology impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.19.1** of the 2018 Final EIS, beginning on page 618. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on paleontology are the same as those defined in the 2018 Final EIS in **Table 160**.

4.19.2 Alternative 1 – No Action

The types of direct and indirect impacts on paleontology resources under Alternative 1 (as described in this SEIS)[87] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). Under Alternative 1, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. As with Alternative 4, paleontology resources may be present in the disturbance area; any not identified or salvaged prior to mining would be permanently lost, resulting in a long-term major adverse impact.

Under Alternative 1, direct and indirect impacts on paleontological resources would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**).

4.19.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect impacts on paleontological resources under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.19.3** of the 2018 Final EIS, beginning on page 618. Under Alternative 4, half a million tons more coal would be mined[88] and approximately 28 acres more would be disturbed as compared to Alternative 2.

4.19.3.1 Direct Impacts

Paleontological resources of scientific significance could be present in the area to be disturbed (4,288 acres) under Alternative 4. BLM classifies the clinker in the analysis area with a Potential Fossil Yield Classification (PFYC) rating of 2, the Quaternary Alluvium with a PFYC rating of 2, and all the members of the Fort Union Formation with a PFYC rating of 4 (BLM 2017). Since only the Fort Union Formation would be removed during mining, paleontological resources not identified or salvaged prior to mining

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87. Direct and indirect paleontology impacts of Alternative 1 – No Action were described in **Section 4.19.2** of the 2018 Final EIS, beginning on page 618. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

88. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

would be permanently lost, resulting in a long-term major adverse impact. Paleontological resources are likely to be destroyed during mining operations; however, based on the results of the survey (SWCA 2016), some resources might be recognized before being completely destroyed; therefore, some may be potentially salvaged.

Paleontological resources belong to the owner of the surface estate (all of which is privately held), and the owners may wish to (1) donate scientifically significant fossils to a public institution for research and education for the good of everyone, (2) retain the fossils for personal use, or (3) determine to not salvage the fossils and allow them to be destroyed or eroded.

4.19.3.2 Indirect Impacts

There would be no indirect impacts on paleontological resources; all impacts would be direct impacts.

4.19.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect impacts on paleontology resources under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). Under Alternative 5, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. As with Alternative 4, paleontology resources may be present in the disturbance area; any not identified or salvaged prior to mining would be permanently lost, resulting in a long-term major adverse impact.

Under Alternative 5, direct and indirect impacts on paleontological resources would be less than under Alternative 4: 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**).

4.19.5 Irreversible and Irretrievable Commitment of Resources

Removal of the Rosebud Coal and the associated overburden in the project area would be an irreversible and irretrievable impact on paleontological resources.

4.20 ACCESS AND TRANSPORTATION

This section discloses the direct and indirect effects on access and transportation resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. The existing transportation system and the analysis areas used for this impacts analysis are described in **Section 3.20, Access and Transportation**.

4.20.1 Analysis Methods and Impact and Intensity Thresholds

Access and transportation impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.20.1** of the 2018 Final EIS, beginning on page 620. The thresholds for assessment of impacts (negligible, minor, moderate, or major) to access and the transportation network are the same as those defined in the 2018 Final EIS in **Table 161**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.20.2 Alternative 1 – No Action

The types of direct and indirect access and transportation impacts under Alternative 1 (as described in this SEIS)[89] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, road construction (and associated impacts) would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

Under Alternative 1, direct and indirect access and transportation impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including road removal) and PMT would be achieved in the project area 14 years earlier than under Alternative 4.

4.20.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect transportation impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.20.3** of the 2018 Final EIS, beginning on page 621. As described in **Chapter 2** of this SEIS, slight adjustments have been made to the alignments for the relocation of the Horse Creek Road (MR 15) from those described for Alternative 2 in the 2018 Final EIS due to on-the-ground conditions. Other differences (**Table 2.2-5**) between the 2018 Proposed Action and Alternative 4 that are relevant to the transportation network include reorienting haul roads (MR 14 and MR 17) and adding culvert locations (MR 14).

[89]. Direct and indirect access and transportation impacts of Alternative 1 – No Action were described in **Section 4.20.2** of the 2018 Final EIS, beginning on page 620. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

4.20.3.1 Direct Impacts

Road Construction Impacts

Road construction proposed under the project is described in **Section 2.4.3.4**, **Roads**, in the 2018 Final EIS. Road alignments for Alternative 4, which would be consistent with those already approved by DEQ and/or OSMRE, are shown on **Figure 2.2-3** in **Chapter 2**. Road construction impacts would be short-term, negligible, and adverse as they would be limited to the period during mine construction and operations. Westmoreland Rosebud would use BMPs to mitigate environmental quality impacts. Temporary and permanent erosion-control measures would be utilized as necessary during road construction to control sedimentation and minimize erosion (see **Section 2.4.5.2, Surface Water Management and Sediment-Control Measures** in the 2018 Final EIS for a discussion of sediment BMPs). All cut-and-fill slopes would be re-soiled and revegetated, or otherwise stabilized, at the first seasonal opportunity. Cut slopes would not be greater than 1v:1.5h (vertical rise versus horizontal run) for unconsolidated materials or 1v:0.25h in rock.

Following abandonment, roads would be reclaimed in accordance with the approved reclamation plan. All bridges and culverts would be removed and natural drainage patterns restored to meet the approved postmining topography. Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**, are described in **Chapter 2** of this SEIS. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

Relocation of Horse Creek Road

To accommodate the proposed mining plan, Westmoreland Rosebud would relocate Horse Creek Road in two locations. One segment in Rosebud County (about 4.2 miles long) was relocated in 2019 during initial mine development. Another segment (about 1.4 miles long) located in Treasure County would be relocated when mining moves into the northwestern corner of the project area (in about 5–7 years based on current estimates). Westmoreland Rosebud would work with the Treasure County Boards of Commissioners (as they did with the Rosebud County Commissioners for relocation of the first segment) to plan and develop a means for relocating the road per MSUMRA, Section 82-4-227(7)(d), MCA, and ARM 17.24.1135. Designs for the road relocation would be submitted to DEQ and Treasure County for review and approval. Westmoreland Rosebud would be required to provide a public hearing, appropriately noticed, to determine whether the interests of the public and affected landowners would be protected per ARM 17.24.1135(3-4). A written finding based on the information from the public hearing would be produced and submitted to DEQ (ARM 17.24.1135[5]). The relocation of Horse Creek Road would result in short-term minor adverse impacts on transportation and access.

Haul Roads, Ramp Roads, and Service Roads

No long-term impacts would be expected from construction of haul roads, ramp roads, or service roads (**Figure 2.5-1**) as effects would be limited to construction and operations of the mine. Road materials to be used in construction include pit run and crushed and/or screened scoria as described in **Section 2.4.3.4**, **Road Materials** in the 2018 Final EIS.

Transportation Impacts

Traffic

During construction, operation, and reclamation associated with the project, traffic congestion and possible accidents could occur on roads and highways used in the project area. After reclamation, impacts from project traffic would cease, and no additional impacts on traffic would be expected. Mine haul traffic would not use the mine access roads, but rather would use the existing and expanded haul roads, consistent with current mine practice.

Road Maintenance Impacts

Existing access roads would continue to be graded and/or maintained as done in other permit areas of the Rosebud Mine, resulting in short-term, negligible, adverse impacts on mine access roads. Public access roads such as State Highway 39 would continue to be maintained for local and regional traffic. No additional maintenance on public access roads is anticipated; therefore, there would be no impact on public access road maintenance.

Ingress and Egress Impacts

Westmoreland Rosebud would not conduct mining activities within 100 feet of the right-of-way line of any public road except where mine access or haul roads join that right-of-way. Agricultural lessees would continue to have road access to most parts of the permit area. Exceptions would include the immediate vicinity of active coal-mining areas and coal-handling facilities and the two periods of time when the Horse Creek Road is relocated (see discussion above). Alternative 4 would have a short-term negligible adverse impact on residents' mobility and access through the local area.

4.20.3.2 Indirect Impacts

Indirect impacts on transportation and access may occur on recreational users or hunters due to mine-related traffic and closures in active mining areas. Employees traveling to and from the Rosebud Mine would contribute to local traffic, but effects would not change from current conditions. Increases in noise, dust, and lights from road construction (haul roads, ramp roads, etc.) traveling through, and to and from, the project area may impact local traffic, residents, recreationists, and hunters. Overall, indirect effects on access and transportation would be short-term, minor, and adverse.

4.20.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect access and transportation impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, road construction (and associated impacts) would be limited to the southern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, direct and indirect access and transportation impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including road removal) and PMT would be achieved in the project area 9 years earlier than under Alternative 4.

4.20.5 Irreversible and Irretrievable Commitment of Resources

All alternatives would contribute traffic on the roadways during construction, operations, and reclamation, thereby increasing the amount of fuel used by vehicles beyond that used prior to development of Area F. Fuel is a non-renewable resource; thus, traffic related to Alternatives 1, 4, and 5 would result in an irreversible commitment of resources.

4.21 SOLID AND HAZARDOUS WASTE

This section discloses the direct and indirect solid and hazardous waste impacts resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Existing waste management conditions and the analysis areas used for this impacts analysis are described in **Section 3.21, Solid and Hazardous Waste**.

4.21.1 Analysis Methods and Impact and Intensity Thresholds

Impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.21.1** of the 2018 Final EIS, beginning on page 627. The thresholds for assessment of impacts (negligible, minor, moderate, or major) are the same as those defined in the 2018 Final EIS in **Table 162**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.21.2 Alternative 1 – No Action

The types of direct and indirect solid and hazardous waste impacts under Alternative 1 (as described in this SEIS)[90] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan), but would be limited to a 6-year mine life. Mining would be more limited with only about 17.1 million tons of coal mined from Federal and private leases within a 1,021 acre-disturbance area limited to the southeastern portion of the project area (east of Donley Creek); no mining would occur in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). As with Alternative 4, the potential for leaks or releases within the project area would be short-term, negligible, and adverse: only small quantities of waste (less than or equal to 55 gallons per accumulation point) would be collected at project area accumulation points. Impacts from the potential release of solid or hazardous wastes at the central storage location in Area A (due to mining in Area F) would be short-term, negligible, and adverse due to the continued implementation of the Solid and Hazardous Waste Management Plan (SHWMP), the Spill Prevention Control and Counter Measure Plan (SPCCMP), and the Contingency and Emergency Response Plan (CERP).

Under Alternative 1, about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

4.21.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect solid and hazardous waste impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.21.3** of the 2018

90. Direct and indirect solid and hazardous waste impacts of Alternative 1 – No Action were described in **Section 4.21.2** of the 2018 Final EIS, beginning on page 627. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

Final EIS, beginning on page 628. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

4.21.3.1 Direct Impacts

Under Alternative 4, Westmoreland Rosebud would not construct any facilities or storage areas in the project area, since any that would be needed already exist and are available for use in other permit areas (see **Figure 63** in the 2018 Final EIS). As for other permit areas, hazardous wastes would be collected in 55-gallon drums at satellite accumulation points within the project area (the number of satellite accumulation points and drums would be based on the waste stream generated); within three days of filling, the waste drums would be transported to the hazardous-waste storage area located in Area A for shipment to a treatment, storage, and disposal facility. Impacts from the potential release of solid or hazardous wastes stored in Area A would be short-term, negligible, and adverse due to the continued implementation of the SHWMP, SPCCMP, and CERP. Given the small quantities that would be collected in project area satellite accumulation points (less than or equal to 55 gallons per accumulation point), potential leaks or releases within the analysis area would be short-term, negligible, and adverse.

Final disposal of non-coal solid wastes, if encountered, would be either at the Rosebud County Landfill or in the mine pits in an approved landfill site for solid wastes. Mining-related non-hazardous waste such as non-treated wood, wooden pallets, concrete, and dragline cable and wooden cable spools would be placed in the mine pits in accordance with ARM 17.24.507. On a case-by-case basis, other non-hazardous construction, mining, or agricultural debris would also be placed within the mine pits if approved to do so by DEQ (PAP, ARM 17.24.507). Any waste materials meeting the definition of “hazardous” would be handled in accordance with applicable regulations (see **Section 3.21.1.1, Regulatory Framework**, in the 2018 Final EIS). Excess waste liquid not used within the Rosebud Mine would be handled under Westmoreland Rosebud’s Waste Management Program. Because of these actions, impacts would be short-term, negligible, and adverse.

4.21.3.2 Indirect Impacts

Under Alternative 4, CCR waste would continue to be generated at both the Colstrip and Rosebud Power Plants in proportion to the amount of coal burned at the plants. Coal from the project area burned at the power plants would add to the amount of CCR generated. In other permit areas of the Rosebud Mine, Westmoreland Rosebud would continue to use bottom ash generated from the Colstrip Power Plant in the construction of parking facilities, as a sanding agent for ramp and haul roads during periods of poor road conditions due to weather, and as tank and culvert bedding. Under all alternatives, no bottom ash would be used in the project area. Because use of bottom ash in other parts of the mine is contingent on the requirements of the monitoring plan, impacts from boron toxicity related to the receipt and use of bottom ash at the mine would be short-term and negligible and identified before the impact has long-term consequences.

Impacts on groundwater related to the storage of CCR from the power plants are discussed in **Section 4.8, Water Resources – Groundwater**, in the 2018 Final EIS. Beneficial use of CCR from the power plants would also likely continue into the future, and the CCR generated from project area coal would contribute to the total amount of CCR available for beneficial use in proportion to the amount generated.

4.21.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect solid and hazardous waste impacts under Alternative 5 would be similar to those described for Alternative 4 – Proposed Action (Current Federal Mining Plan), but would be limited to an 11-year mine life. Mining would be more limited with only about 37.1 million tons of coal mined from Federal and private leases within a 2,495 acre-disturbance area limited to the southeastern portion of the project area (east of Donley Creek); no mining would occur in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). As with Alternative 4, the potential for leaks or releases within the project area would be short-term, negligible, and adverse: only small quantities of waste (less than or equal to 55 gallons per accumulation point) would be collected at project area accumulation points. Impacts from the potential release of solid or hazardous wastes at the central storage location in Area A (due to mining in Area F) would be short-term, negligible, and adverse due to the continued implementation of the SHWMP, SPCCMP, and CERP.

Under Alternative 5, about 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

4.21.5 Irreversible and Irretrievable Commitment of Resources

There is no irreversible or irretrievable commitment of resources related to solid or hazardous waste because waste is not considered a resource.

4.22 NOISE

This section discloses the direct and indirect noise impacts resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine noise sources and the analysis areas used for this impacts analysis are described in **Section 3.22, Noise**.

4.22.1 Analysis Methods and Impact and Intensity Thresholds

Noise impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.22.1** of the 2018 Final EIS, beginning on page 630. The thresholds for assessment of noise impacts (negligible, minor, moderate, or major) are the same as those defined in the 2018 Final EIS in **Table 163**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.22.2 Alternative 1 – No Action

The types of direct and indirect noise impacts under Alternative 1 (as described in this SEIS)[91] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would be limited to a 6-year mine life. In addition, mining would be more limited with only about 17.1 million tons of coal mined from Federal and private leases within a 1,021 acre-disturbance area (**Figure 2.4-1**). Under Alternative 1, about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres would be disturbed as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Mining would be limited to lands east of Donley Creek, with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4.

4.22.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect noise impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.22.3** of the 2018 Final EIS, beginning on page 631. Under Alternative 4, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 20 years.

4.22.3.1 Direct Impacts

The primary sources of noise from surface coal mining include blasting operations and the excavation and hauling of the coal off-site. For blasting air overpressure (noise level), applicable noise limits are a maximum of 120 dB to minimize human annoyance and 134 dB to protect against damage to residential structures (USDI 1987). For excavating, hauling, and other non-blasting sources, the EPA recommends an outdoor noise limit of 55 dBA (L_{dn}). This corresponds to a limit of 55 dBA during the daytime hours

[91] Direct and indirect noise impacts of Alternative 1 – No Action were described in **Section 4.22.2** of the 2018 Final EIS, beginning on page 630. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

(7 a.m. to 10 p.m.) and 45 dBA during the nighttime hours (10 p.m. to 7 a.m.) (EPA 1974). Because the mining operations are proposed to occur 24 hours per day and 7 days per week, the constraining guideline is 45 dBA. The following describes the expected noise from each operation and the potential noise impacts on the nearest residences in each direction from the site.

Blasting within the project area is expected to occur with similar frequency to what is done in other permit areas, which includes coal blasting one to three days per week and overburden blasting four to six times per month. The 2018 Final EIS noted that a predicted overpressure limit of 120 dB is reached at a distance of 450 feet from blasts in the project area and dissipates to around 88 dB at the nearest residence 2.2 miles away. Thus, only locations within 450 feet of the blasting are predicted to result in any human annoyance as previously described. These predicted levels are considered to be conservatively high because terrain – which impedes noise propagation – was not taken into account. Thus, no air overpressure impacts are expected from blasting in the project area. The noise generated from mining in the project area was predicted for Alternative 2 (and here applied to Alternative 4) at the seven nearest known residential receptors, as well as in Colstrip; the resulting noise impacts, which are considered to be worst case (as described in the 2018 Final EIS), would be minor to negligible at all locations (**Table 4.22-1**). All predicted noise levels are below the nighttime limit of 45 dBA and would be in compliance with EPA guidelines. This result is not unexpected as most receptors are more than 2 miles from the nearest mining activities. For mine workers and equipment operators in proximity to mining noise sources, protective hearing devices would be worn in accordance with MSHA regulations when exposed to loud noise sources. Noise impacts on wildlife are discussed in **Section 4.12, Fish and Wildlife Resources** and **Section 4.13, Special Status Species**.

Table 4.22-1. Predicted Noise Levels from Mining in the Project Area.

Location	Maximum Noise Level (dBA)	Abandoned Property (Yes/No)	Noise Impact and Intensity Threshold
R1	<40 dBA	No	Minor
R2	41 dBA	No	Minor
R3	42 dBA	No	Minor
R4	41 dBA	No	Minor
R5	<30 dBA	Unknown	Negligible
R6	<30 dBA	No	Negligible
R7	<30 dBA	No	Negligible
Colstrip	<30 dBA	N/A	Negligible

4.22.3.2 Indirect Impacts

Indirect noise impacts would include noise from the Colstrip Power Plant (Units 3 and 4) and its associated paste plant, plus the Rosebud Power Plant because coal from the project would be combusted in the power plants. Noise from the Colstrip Power Plant was estimated based on noise measurements (Hankard 2015) of other power plants and estimations (Bradley 1985). The nearest residences to the Colstrip Power Plant's paste plant are 4 miles west in Colstrip; thus, its noise-level impact is below the intensity threshold and not discussed any further.

The noise from operating Colstrip Power Plant Units 3 and 4 at full capacity is estimated (Bradley 1985) to be 59 dBA at 1,000 feet away. Noise from its associated cooling tower to the west of the plant is estimated at 56 dBA at 1,000 feet. The nearest residences to these two noise sources are in Colstrip about 1,500 feet west of the cooling towers and 2,700 feet from Units 3 and 4. This equates to a total noise level of 54 dBA attributable to the Colstrip Power Plant. A measured level of a similar coal-fired power plant (Hankard 2015) would suggest that this is a reasonable estimate. Based on these estimates, the impact of noise from the Colstrip Power Plant when operating at full capacity would be considered long-term, moderate, and adverse for these nearest Colstrip residences. With regard to the seven residences nearest to the project area (see **Figure 115** in the 2018 Final EIS), estimated Colstrip Power Plant noise levels would be less than 30 dBA because all residences are at least 9 miles from the Colstrip Power Plant. This would be considered a less-than-negligible impact.

The Rosebud Power Plant, which is about 6.5 miles north of the Colstrip Power Plant, is also a consideration for indirect noise impacts. This single unit produces about 42 MW (DEQ Montana 2014), which is estimated to produce about 45 dBA at 1,000 feet. The noise from the associated air-cooled condenser unit is estimated to produce about 52 dBA at 1,000 feet for a total of 53 dBA at 1,000 feet. The nearest residences (R8 to R17) range from 1,000 to 3,500 feet away (**Figure 116** in the 2018 Final EIS), which equates to an estimated noise level range of 42 to 53 dBA. This would correlate to a long-term minor to moderate adverse impact. With regard to the estimated Rosebud Power Plant noise levels at the seven residences nearest to the project area and the city of Colstrip (**Table 4.22-2**), they would all be less than 30 dBA because they are all at least 6 miles from the Rosebud Power Plant. This would be considered a less-than-negligible impact.

Table 4.22-2. Predicted Noise Levels from the Rosebud Power Plant.

Location	Maximum Noise Level (dBA)	Abandoned Property (Yes/No)	Noise Impact and Intensity Threshold
R8	52 dBA	Unknown	Moderate
R9	53 dBA	Unknown	Moderate
R10	49 dBA	Unknown	Moderate
R11	49 dBA	Unknown	Moderate
R12	48 dBA	Unknown	Moderate
R13	46 dBA	Unknown	Moderate
R14	44 dBA	Unknown	Minor
R15	42 dBA	Unknown	Minor
R16	42 dBA	Unknown	Minor
R17	42 dBA	Unknown	Minor

4.22.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect noise impacts under Alternative 5 would be similar to those described for Alternative 4 – Proposed Action (Current Federal Mining Plan) but would be limited to an 11-year mine life. In addition, mining would be more limited with only about 37.1 million tons of coal mined from Federal and private leases within a 2,495 acre-disturbance area (**Figure 2.4-1**).

Under Alternative 5, about 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres would be disturbed as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). Mining would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4.

4.22.5 Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources would be associated with noise.

4.23 LAND USE

This section discloses the direct and indirect land use impacts resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine land uses and the analysis areas used for this impacts analysis are described in **Section 3.23, Land Use**.

4.23.1 Analysis Methods and Impact and Intensity Thresholds

Land use impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.23.1** of the 2018 Final EIS, beginning on page 640. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on land use are the same as those defined in the 2018 Final EIS in **Table 168**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.23.2 Alternative 1 – No Action Alternative

The types of direct and indirect land use impacts under Alternative 1 (as described in this SEIS)[92] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). Westmoreland Rosebud would not fully utilize Federal coal lease MTM 082186 under Alternative 1. In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases. Selection of Alternative 1 may require revision of Westmoreland Rosebud's state operating permit for the project area (C2011003F). Any revisions needed would be determined by DEQ after review of the Mining Plan Decision Document.

Under Alternative 1, direct and indirect land use impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres (and associated land uses) would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 14 years earlier than under Alternative 4. Therefore, postmining land uses could be commenced 14 years earlier as compared to Alternative 4.

4.23.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect land use impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.23.3** of the 2018 Final EIS, beginning on page 640. Under Alternative 4, half a million tons more coal would be mined[93] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur

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92. Direct and indirect land use impacts of Alternative 1 – No Action were described in **Section 4.23.2** of the 2018 Final EIS, beginning on page 640. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

93. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**. Under Alternative 4, Westmoreland Rosebud would maximize recovery of coal in the Federal coal lease MTM 082186 (**Table 2.2-7**).

During the life of the operation, use of the lands in the direct effects analysis area would be devoted to mining and associated activities. All pre-mine land uses within the analysis area would be temporarily disturbed during mine operations. Westmoreland Rosebud would grade, apply soil, and seed each mine pass within two years of mining; however, this analysis assesses land uses permitted area-wide and does not consider contemporaneous reclamation that would occur during active mining.

4.23.3.1 Direct Impacts

Because grazing was the pre-mine land use of most of the lands in the direct effects analysis area, livestock grazing by Booth Land and Livestock Company would be the land use most impacted by mining operations. Under Alternative 4, impacts would occur during mine operations (approximately 20 years) and would extend until the postmining land use, domestic livestock grazing, is achieved through reclamation. Impacts on grazing land would be long-term, moderate, and beneficial. However, Westmoreland Rosebud proposes 3,930 acres of postmining grazing land, which would be an increase of 476 acres over pre-mine conditions, to achieve landowner preference for grazing lands.

Similarly, impacts on cropland and wildlife habitat would occur during the period of active mining and would extend until the postmining land use, cropland, is achieved. During active mining, there would be no cropland or wildlife habitat. Impacts on cropland and wildlife habitat would be long-term, moderate, and adverse. After reclamation, Westmoreland Rosebud proposes 318 acres of cropland, which would be a 32 percent reduction from pre-mine conditions, and 9 acres of wildlife habitat, a 25 percent reduction from pre-mine conditions. Note, however, that all the lands within the project area have a joint land use of wildlife habitat (see detailed discussion in **Sections 4.12, Fish and Wildlife Resources** and **4.13, Special Status Species**).

Westmoreland Rosebud does not propose pastureland as a postmining land use, so the 516 acres of existing pastureland that Westmoreland Rosebud proposes to disturb during mining operations would be permanently converted to grazing land. Impacts on pastureland would be long-term, major, and adverse. However, Westmoreland Rosebud and the respective landowners previously agreed on the change in land use based on the landowners' preference for additional grazing land over cropland.

Other Land Uses

There would be no impacts on forestry or residential land uses as a result of the Proposed Action.

Impacts on developed water resources (i.e., stock ponds) located within the area of disturbance in the project area are discussed in **Section 4.9, Water Resources – Water Rights**.

Industrial or commercial uses would be relatively unaffected. Westmoreland Rosebud would mine around the 230-kV high-voltage transmission line owned by Mid-Yellowstone that bisects the southern portion of the project area, leaving a 300-foot buffer (**Figure 2.5-1** in **Chapter 2**). Likewise, Westmoreland Rosebud would mine around the 1.4 miles of a 12-inch underground natural gas transmission pipeline owned and operated by Westmoreland Power, Inc. in the northern portion of the project area. About 10 miles of 7.2-kV distribution lines within the project area would be relocated (see **Section 2.4.3.3, Utility Corridors in Proposed Permit Area**). To accommodate the proposed mining plan, Westmoreland Rosebud would relocate the Horse Creek Road (**Figure 2.5-1** in **Chapter 2**). There would be a temporary disturbance to local traffic during road construction (**Section 4.20, Access and Transportation**). Impacts on recreation land uses are discussed in **Section 4.18, Recreation**. Impacts on these other land uses would be short-term, minor, and adverse.

Adjacent Land Uses

Adjacent land use during mine operations would be affected to some extent; these impacts are described in **Sections 4.17, Visual Resources** and **4.22, Noise**. There would be no impacts on land uses in and immediately surrounding Colstrip.

4.23.3.2 Indirect Impacts

Alternative 4 would not create unplanned development or present the potential to open up new off-site areas for development. Alternative 4 would not create improved access to real estate, reduce development restrictions, or substantially induce new development in unanticipated areas. Therefore, there would be no indirect impacts on land use associated with Alternative 4.

4.23.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect land use impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). Westmoreland Rosebud would not fully utilize Federal coal lease MTM 082186 under Alternative 5. In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases. Selection of Alternative 5 may require revision of Westmoreland Rosebud's state operating permit for the project area (C2011003F). Any revisions needed would be determined by DEQ after review of the Mining Plan Decision Document.

Under Alternative 5, direct and indirect land use impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres (and associated land uses) would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including revegetation) and PMT would be achieved in the project area 9 years earlier than under Alternative 4. Therefore, postmining land uses could be commenced 9 years earlier as compared to Alternative 4.

4.23.5 Irreversible and Irretrievable Commitment of Resources

Grazing and cropland production on mine-related disturbance areas within the project area would be lost until revegetation and forage production are comparable to pre-mining levels associated with adjacent land. These resources would be irretrievably affected. Westmoreland Rosebud does not propose pastureland as a postmining land use, so the 516 acres of pre-mine pastureland that Westmoreland Rosebud proposes to disturb during mining operations would be permanently converted to grazing land.

4.24 SOIL

This section discloses the direct and indirect soil impacts resulting from implementation of Alternative 1 – No Action, Alternative 4 – Proposed Action (Current Federal Mining Plan), or Alternative 5 – Partial Mining Alternative. Pre-mine soil conditions and the analysis areas used for this impacts analysis are described in **Section 3.24, Soil**.

4.24.1 Analysis Methods and Impact and Intensity Thresholds

Soil impacts were evaluated in this SEIS using the same methods used in the 2018 Final EIS. Analysis methods are provided in **Section 4.24.1** of the 2018 Final EIS, beginning on page 643. The thresholds for assessment of impacts (negligible, minor, moderate, or major) on soil are the same as those defined in the 2018 Final EIS in **Table 170**. Assumptions for each alternative, which informed the scope of the effects analyses in this SEIS, are presented in **Section 2.4, Alternative 1 – No Action**, **Section 2.5, Alternative 4 – Proposed Action (Current Federal Mining Plan)**, and **Section 2.6, Alternative 5 – Partial Mining Alternative**.

4.24.2 Alternative 1 – No Action

The types of direct and indirect soil impacts under Alternative 1 (as described in this SEIS)[94] would be similar to those described below for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 1, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.4-1**). In total, about 1,021 acres would be disturbed in the project area over a 6-year mine life that would produce approximately 17.1 million tons of coal from Federal and private coal leases.

Under Alternative 1, direct and indirect soil impacts would be less than under Alternative 4: about 54 million fewer tons of coal would be mined and approximately 3,267 fewer acres (and associated vegetation) would be disturbed under Alternative 1 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). With fewer acres disturbed, the potential for erosion and sediment transport would be less under Alternative 1 than under Alternative 4. As with Alternative 4, erosion impacts on soil resources would be short-term, minor, and adverse, and would return to pre-mine erosion rates within 2 years once vegetation stabilizes the surface. The life of operations for Area F (and the corresponding impacts) would be 14 years shorter under Alternative 1 than under Alternative 4. Reclamation (including application of stockpiled soils and revegetation) as well as the PMT would be achieved in the project area 14 years earlier than under Alternative 4. With shorter stockpile times, changes to the physical, chemical, and biological properties of stockpiled soils would be less likely under Alternative 1 than under Alternative 4. As with Alternative 4, those impacts on physical, chemical, and biological soil characteristics that would occur would be long-term, minor, and adverse. It would be many years before these soil characteristics return to pre-mine conditions.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes trace metals, such as mercury, as well as SO_2 and NO_2 to the air, which are then deposited into analysis area soils. Under Alternative 1, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 6 years, which is 14 years fewer as compared to Alternative 4. Therefore, fewer trace metals, SO_2, and NO_2 would be deposited in analysis area soils. As with Alternative 4, soil

94. Direct and indirect soil impacts of Alternative 1 – No Action were described in **Section 4.24.2** of the 2018 Final EIS, beginning on page 644. As described in **Chapter 2** of this SEIS, Alternative 1 – No Action has been revised since the 2018 Final EIS.

resources at a distance less than 12.6 km from the Colstrip Power Plant may experience long-term, minor, and adverse impacts due to trace metal deposition. Beyond that distance, the impact likely would be negligible. As with Alternative 4, indirect impacts on acidic soil would be long-term, minor, and adverse.

4.24.3 Alternative 4 – Proposed Action (Current Federal Mining Plan)

Direct and indirect soil impacts under Alternative 4 – Proposed Action (Current Federal Mining Plan) would be similar to those described for Alternative 2 in **Section 4.24.3** of the 2018 Final EIS, beginning on page 644. Under Alternative 4, half a million tons more coal would be mined[95] and approximately 28 acres more would be disturbed as compared to Alternative 2. Reclamation would occur contemporaneously with mining (see discussion of the phases of reclamation in **Section 1.6.4, Bond Release**, in the 2018 Final EIS). Once mining has ceased, reclamation of disturbed areas (up to 4,288 acres) in the project area would occur according to Westmoreland Rosebud's approved reclamation plan (**Figure 2.2-5**) and PMT (**Figure 2.2-6**), which are similar to those described for Alternative 2 in 2018 Final EIS **Section 2.4.4, Reclamation Plan**. Modifications since 2018 are described in **Section 2.2.2.2, Area F Operations and Development**.

4.24.3.1 Direct Impacts

Under Alternative 4, 4,288 acres would be disturbed by mining operations in the project area. Impacts on soil in the disturbance area would determine, in part, the potential success of reclaiming the land to postmining uses. Western Rosebud's reclamation plan (see **Section 2.4.4, Reclamation Plan** in the 2018 Final EIS) and measures to control on-site erosion and sediment transport (see **Section 2.4.5.2, Surface Water Management and Sediment-Control Measures** in the 2018 Final EIS) would mitigate some disturbance impacts and increase reclamation success; however, some direct effects, which are typical of any operation where soil is removed, would persist.

Some of the soil from the project area disturbance would be direct-hauled, and the rest would be stored and then later respread. Direct impacts on soil would include:

- Soil erosion in disturbed areas and of salvageable soil through handling
- Changes in physical, chemical, and biological characteristics of soil from salvage, storage, and respreading (leading to reduced soil productivity and decreased soil development)

Soil Erosion

Areas cleared of vegetation would be susceptible to soil erosion from wind and water. Erosion of soil would also occur as a result of soil removal and storage during mine operations and soil exposure during respreading and stabilization. Soil erosion caused by wind and water likely would occur during all phases of the project. Soil erosion on disturbed areas would likely occur until vegetation is established and surfaces are protected from erosive forces. Based on modeled sediment rates at 75 drainages in Areas A, B, C, D, and E at the Rosebud Mine, pre-mining average annual sediment yields range from 0.002 to 2.34 tons/acre/year with a mean of 0.24 tons/acre/year. Once vegetation reaches 60–80 percent canopy cover, average annual sediment yields would range from 0 to 2.01 tons/acre/year with a mean of 0.065 tons/acre/year (Sjolund 2015a). It typically takes about 2 years for vegetation (much of which consists of annual plants) on reclaimed sites to provide a sufficient canopy cover to protect the soil from accelerated erosion (Sjolund 2015b). Some areas such as steep slopes – especially south- and west-facing slopes –

[95]. See coal tonnage and disturbance comparison in **Table 2.2-8**. Under Alternative 4, mine passes would not be authorized for 74 acres of Federal coal (approximately 1.9 million tons of recoverable coal). The 74 acres that would not be mined could still be used for other project-associated surface disturbance, such as overburden or topsoil stockpile locations (**Figure 2.5-1**).

may require more time for the ground cover to stabilize reclaimed areas. Westmoreland Rosebud is required under MSUMRA (ARM 17.24.723) to monitor vegetation success in reclaimed areas for a minimum of 10 growing seasons to ensure production, cover, and density meet the approved success standards and that a stable landscape has been established consistent with the approved postmining land use (see **Section 2.4.7.4, Revegetation Monitoring Plan** in the 2018 Final EIS). Erosion impacts on soil resources would be short-term, minor, and adverse, and would return to pre-mine erosion rates within 2 years once vegetation stabilizes the surface.

Sediment

Existing sediment yield to drainages within the analysis area was estimated by the USDA WEPP, and postmining sediment yield to drainages within the analysis area was estimated by SEDCAD (see **Section 4.7, Water Resources – Surface Water** in the 2018 Final EIS). Existing annual sediment yields ranged from 0 to 0.871 tons/acre/year and ranged from 0.001 to 0.18 tons/acre/year for postmining conditions once vegetation cover reaches 80 percent. The model estimated that postmining sediment yield would increase in some drainage basins within the direct effects analysis area and decrease in other drainage basins (see **Section 4.7, Water Resources – Surface Water** for discussion of sediment yield in drainage basins).

Other direct effects on soil resources include the potential for sediment to be transported off-site and to impact off-site resources. In general, the larger the disturbance, the greater the potential for soil erosion. This effect would be unlikely because runoff would be directed to sediment storage structures, but it could occur during very heavy storm events where disturbances are unprotected. Approximate disturbances resulting from Alternative 4 encompass 4,288 acres (**Figure 2.5-1**). The disturbance acres would include the mining areas, stockpile areas, scoria pits, haul roads, haul-road ramps, proposed overhead power line, proposed shoefly (high-voltage line), and relocation alignment of Horse Creek Road.

Changes to Physical, Chemical, and Biological Soil Characteristics

Soil characteristics that would be impacted by Alternative 4 include physical and chemical properties and soil biota. Loss of soil structure through mechanical handling followed by tillage to relieve compaction would alter the native soil profile. This soil handling would adversely affect soil/plant interaction due to decreased soil water-holding capacity, loss of aeration and pore space, and increased bulk density (Sharma and Doll 1996). Soil compaction, loss of soil structure, and loss of organic matter due to mixing and storage could lower postmining vegetation vigor and diversity for an extended period of time. Developing root systems, infiltration of biota, climate, and physical processes such as freezing/thawing cycles would restart the soil-forming process and help establish a new natural soil profile over time. However, this process would require decades.

Chemical effects occur in soil stockpiled for prolonged periods. Degradation of chemical properties may include changes in available nutrients, accumulation of ammonium, and the loss of organic carbon through heat and leaching. When the input of organic matter ceases, there is a reduction or loss of nutrient levels (Strohmayer 1999). Changes in biological properties also occur in soil that is stored for prolonged periods – most importantly the loss of soil microorganisms such as mycorrhizal fungi (Abdul-Kareem and McRae 1984). Many plants depend on mycorrhizae, which are important structures that develop when certain fungi and plant roots form a mutually beneficial relationship. They are of great importance to phosphorus nutrition and water uptake in plants (Skujins and Allen 1986). The association of mycorrhizae with plants in southeastern Montana is especially critical because of the semiarid climate and naturally low plant-available phosphorus levels in soil (Muir 1971). The loss of microorganisms in soil stored for prolonged periods could lower plant diversity and vigor, but eventually mycorrhizae would invade reclaimed soil (within a few years to more than a decade, depending on soil conditions). Mycorrhizae seem to be sensitive to soil properties such as organic matter, salts, structure, and water-holding capacity, so when respread soil conditions start improving, mycorrhizae would colonize more quickly. Impacts on physical, chemical, and biological soil characteristics would be long-term, minor, and adverse. It would be many years before these soil characteristics return to pre-mine conditions.

4.24.3.2 Indirect Impacts

Trace-Metal Deposition

Modeling for trace metal deposition from the Colstrip and Rosebud Power Plants due to combustion of Area F coal was conducted for Alternative 2 in the 2018 Final EIS; the results are applied here for Alternative 4, as the alternatives are substantially similar and only differ due to on-the-ground and operational changes that necessitated minor revisions as Area F has been developed.

Table 4.24-1 and **Table 4.24-2** show the predicted maximum deposition over the Area F operations period for each trace metal and the total expected concentration for each trace metal (background plus the maximum deposition). For all trace metals (those having sufficient data to derive screening levels), the background concentration plus the maximum deposition over the Area F period of operations is less than the plant and soil invertebrate soil screening levels (SSLs), except for selenium (for plant SSL only). This implies that the increase in soil metal concentrations due to combustion of project area coal over the Area F period of operations would not affect plants and soil invertebrates, except selenium could have an adverse impact on plants. Given that the Eco-SSLs are conservative and the selenium SSL for plants is lower than the selenium 95th percentile of background in typical U.S. soil, and given the low selenium levels found in project area soil, at a distance less than 12.6 km from the Colstrip Power Plant, selenium may have a long-term, minor, and adverse impact on plants and soil resources. Beyond that distance, the impact likely would be negligible.

Table 4.24-1 and **Table 4.24-2** also show the total concentration limits, or total original concentrations, of a solid at which the EPA would require a Toxicity Characteristic Leaching Procedure (TCLP) test (Method 1311, Section 1.2) (EPA 1992). TCLP is an analytical test to determine the mobility of metals in a solid (e.g., soil), and if the solid meets the definition of the EPA toxicity level for solid waste (40 Code of Federal Regulations 261.24).

Table 4.24-1. Alternative 2 Modeling for Trace Metal Background, Total Concentrations, and Eco-SSLs for Plants.

Analyte	Background – 95 Percent UCL	Maximum Deposition over 19-Year Operations Period[1]	Total Expected Concentration (Background + Total Deposition)	EPA Limit for Solid Waste Test	Eco-SSL for Plants	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Plant Eco-SSL	Does Deposition + Background Exceed the Plant Eco-SSL? (Yes/No)
	mg/kg, DW	mg/kg, DW	mg/kg, DW	mg/kg	mg/kg, DW	Percent	Percent	
Antimony	0.9	0.005	0.905	None	NA	0.56	NA	No
Arsenic	10.9	0.007	10.907	100	18	0.06	0.04	No
Cadmium	0.3	0.002	0.302	20	32	0.63	0.01	No
Chromium	50.5	0.018	50.518	100	NA	0.03	NA	No
Copper	17.8	0.081	17.881	None	70	0.46	0.12	No
Lead	19.1	0.008	19.108	100	120	0.04	0.01	No
Mercury	0.023	0.001	0.024	4	0.3	3.70	0.28	No
Selenium	0.56	0.032	0.592	20	0.52	5.60	6.10	Yes

NA = Not available. Insufficient data to derive Eco-SSLs. DW = Dry weight.
1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by EPA (2005).

Table 4.24-2. Alternative 2 Trace Metal Background, Total Concentrations, and Eco-SSLs for Soil Invertebrates.

Analyte	Background – 95 Percent UCL	Maximum Deposition over 19-Year Operations Period[1]	Total Expected Concentration (Background + Total Deposition)	EPA Limit for Solid Waste Test	Eco-SSL for Soil Invertebrates	Percentage of Deposition Relative to Background	Percentage of Deposition Relative to Soil Invertebrates Eco-SSL	Does Deposition + Background Exceed the Soil Invertebrates Eco-SSL? (Yes/No)
	mg/kg, DW	mg/kg, DW	mg/kg, DW	mg/kg	mg/kg, DW	Percent	Percent	
Antimony	0.9	0.005	0.905	None	78	0.56	1.2	No
Arsenic	10.9	0.007	10.907	100	NA	0.06	NA	No
Cadmium	0.3	0.002	0.302	20	140	0.63	0.2	No
Chromium	50.5	0.018	50.518	100	NA	0.03	NA	No
Copper	17.8	0.081	17.881	None	80	0.46	22.4	No
Lead	19.1	0.008	19.108	100	1,700	0.04	1.1	No
Mercury	0.023	0.001	0.024	4	0.1	3.70	23.9	No
Selenium	0.56	0.032	0.592	20	4.1	5.60	14.5	No

NA = Not available. Insufficient data to derive Eco-SSLs. DW = Dry weight.
1. Assumes an untilled soil mixing depth of 2 centimeters and a soil dry-bulk density of 1.5 g/cm^3 as recommended by EPA (2005).

Sulfur Dioxide and Nitrogen Oxide Deposition

Sulfur and nitrogen oxides (SO_2 and NO_2) emitted from the combustion of coal can be converted into acids (sulfuric acid and nitric acid) in the atmosphere through oxidation and can then return to earth as components of rain and snow. Acidification of the soil through acid deposition can impact microorganisms, leach soil nutrients, and cause aluminum toxicity to plants (Air-quality.org 2017). In turn, this can reduce vegetation vigor and cover, which can increase erosion. Soil that is more alkaline, however, does not suffer the effects from acid deposition as does more acidic soil, because the soil alkalinity buffers the acid rain by neutralizing the acidity in the water flowing through it. This capacity depends on the thickness and chemistry of the soil and the type of bedrock underneath it. In soil with pH conditions above 4.5, and in areas where precipitation is relatively low as in the analysis area, the effects on soil from acid deposition are likely minimal (Air-quality.org 2017).

The soil surface layers in the project area are typically neutral to slightly alkaline (pH 6.6 to 7.8), and the subsoil is typically slightly alkaline to strongly alkaline (pH 7.4 to 9.0) (PAP, Appendix G). In addition, the soil surface layers within the indirect effects analysis area are typically neutral to strongly alkaline, and the subsoil is slightly to strongly alkaline (USDA-SCS 1967, 1975, and 1977). This soil has a capacity to neutralize acid deposition. Given this acid-neutralizing capacity, the relatively low precipitation (15.17 inches annually at Colstrip), the relatively short period of combustion of project area coal (19 years), and the low concentrations modeled of SO_2 and NO_2, which are well below the NAAQS and MAAQS (see **Section 4.3.3.2, Indirect Impacts of Coal Combustion**), impacts on soil within the indirect effects analysis area from acid deposition would be long-term, minor, and adverse.

Given the long-range transport of these gases, however, areas outside the indirect effects analysis area that contain acidic soils could also be impacted by acid deposition (see **Section 3.3.1.2, Air Quality** in the 2018 Final EIS for a discussion of transport distances). Soil derived from granitic rocks, such as granite and metamorphic rocks derived from granitic parent rocks, is typically acidic and lacks or has little buffering capacity, and therefore is more vulnerable to acidification (Ecological Society of America 2000). These rocks do not occur in the analysis area, but they occur in mountainous areas in Wyoming and western Montana. Based on the low concentrations of these gases modeled, impacts on acidic soil also would be long-term, minor, and adverse.

Hazardous Waste

A potential indirect effect on soil resources is from oil and gas spills and releases related to project operations that could occur in other permit areas of the Rosebud Mine. There have not been any known significant hazardous waste releases at the Rosebud Mine in the past, but there have been occasional small oil and gas releases from seal ruptures on large equipment or from overfilling vehicles at fuel islands (see discussion in the 2018 Final EIS). If minor oil and gas releases or spills occur in undisturbed or reclaimed soil, the impact would be short-term, minor, and adverse. Depending on the characteristics of the released constituent, a major release on undisturbed land could require removing a significant volume of at least the more productive surface soil layer, which would require decades to return to natural productivity. Major releases on undisturbed or reclaimed land, although much less likely than on fueling islands and road surfaces, would have long-term, moderate, and adverse impacts on soil resources.

4.24.4 Alternative 5 – Partial Mining Alternative

The types of direct and indirect soil impacts under Alternative 5 – Partial Mining Alternative would be similar to those described above for Alternative 4 – Proposed Action (Current Federal Mining Plan). Under Alternative 5, though, direct impacts would be limited to the southeastern portion of the project area (east of Donley Creek) with no mining occurring in the Trail Creek, McClure Creek, and Robbie Creek drainages (**Figure 2.6-1**). In total, about 2,495 acres would be disturbed in the project area over an 11-year mine life that would produce approximately 37.1 million tons of coal from Federal and private coal leases.

Under Alternative 5, direct and indirect soil impacts would be less than under Alternative 4. About 34 million fewer tons of coal would be mined and approximately 1,793 fewer acres (and associated vegetation) would be disturbed under Alternative 5 as compared to Alternative 4 (**Table 2.3-1** and **Table 2.3-2**). With fewer acres disturbed, the potential for erosion and sediment transport would be less under Alternative 1 than under Alternative 4. As with Alternative 4, erosion impacts on soil resources would be short-term, minor, and adverse, and would return to pre-mine erosion rates within 2 years once vegetation stabilizes the surface. The life of operations for Area F (and the corresponding impacts) would be 9 years shorter under Alternative 5 than under Alternative 4. Reclamation (including application of stockpiled soils and revegetation) as well as the PMT would be achieved in the project area 9 years earlier than under Alternative 4. With shorter stockpile times, changes to the physical, chemical, and biological properties of stockpiled soils would be less likely under Alternative 5 than under Alternative 4. As with Alternative 4, those impacts on physical, chemical, and biological soil characteristics that would occur would be long-term, minor, and adverse. It would be many years before these soil characteristics return to pre-mine conditions.

The continued combustion of coal at the Rosebud and Colstrip Power Plants contributes trace metals, such as mercury, as well as SO_2 and NO_2 to the air, which are then deposited into analysis area soils. Under Alternative 5, coal from the project area would be available for combustion in the Colstrip and Rosebud Power Plants for up to 11 years, which is 9 years fewer as compared to Alternative 4. As with Alternative 4, soil resources at a distance less than 12.6 km from the Colstrip Power Plant may experience long-term, minor, and adverse impacts due to trace metal deposition. Beyond that distance, the impact likely would be negligible. As with Alternative 4, indirect impacts on acidic soil would be long-term, minor, and adverse.

4.24.5 Irreversible and Irretrievable Commitment of Resources

Some soil would be irreversibly lost under all alternatives during soil removal and storage, construction and operation of the mine, and reclamation prior to the reestablishment of vegetation. Under all alternatives, soil productivity would be irreversibly lost because the Lift 1 soil materials would consist of a mix of topsoil and subsoil. Altering the soil profile would deteriorate soil structure and mix more-fertile topsoil with less-fertile subsoil, which would leave less productive soil in the root zone. Granular soil structure, which occurs mainly in the surface layer, increases water and air movement in the soil; its loss would reduce water and air movement. It would take many years for soil magnified in reclaimed areas where respread soil consists of a single-lift salvage of the upper 24 inches (the tree soil salvage class; see **Section 3.24, Soil** in the 2018 Final EIS).Irreversible effects on soil productivity would also result from prolonged soil storage in stockpiles and at disturbances that would not be reclaimed until the end of mine life, such as haul roads. These irreversible effects on soil productivity would take many years to return to pre-mine productivity levels. Under Alternative 4, about 2.9 acres of soil productivity would be irreversibly lost due to the realignment of Horse Creek Road, which would remain after mine closure. In addition, about 3.78 acres of wetland soil would be permanently lost under this alternative.

As described above, any irreversible and irretrievable effects would be less under Alternatives 1 and 5 than under Alternative 4.

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CHAPTER 5. CUMULATIVE IMPACTS

5.1 INTRODUCTION

This chapter discloses and analyzes the cumulative effects that may result from selection and implementation of the alternatives described in **Chapter 2** of this Supplemental Environmental Impact Statement (SEIS) and other actions in the vicinity that are occurring, have occurred, or will occur. The National Environmental Policy Act (NEPA) (described in **Chapter 1**) requires Federal agencies to examine and disclose to the public the potential impacts on the human environment of proposed projects or activities that require state or Federal approval. Direct and indirect impacts are presented in **Chapter 4**.

Analyses in this chapter have been updated to address the deficiencies identified in the September 30, 2022, court order (see **Section 1.1, Introduction**). Specifically, this SEIS includes surface water cumulative impacts analysis and analyzes a reasonable range of alternatives. Impacts analyses and conclusions in this SEIS were based on the review of existing literature and studies, information provided by resource specialists and other agencies, professional judgment, agency staff insights, and public input; resource-specific analysis methodologies are provided in the introductions to each resource section. Analysis definitions are in **Appendix 1**.

5.2 RELATED PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

In general, the related past, present, and reasonably foreseeable future actions are similar to those described in Chapter 5 of the Final EIS, beginning on page 654. **Table 5.2-1** summarizes the past, present, and reasonably foreseeable future actions that were considered in the SEIS cumulative effects analyses and the corresponding resources they have the potential to affect. Key changes since the 2018 Final EIS include the retirement of Units 1 and 2 of the Colstrip Power Plant in 2020, decreased production at Montana coal mines (due to market conditions and mine closure), new and future renewable energy projects in the vicinity of Colstrip, and the Bureau of Land Management (BLM) issuance of the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* in 2024 (BLM 2024a).

The general analysis area considered for cumulative effects analyses is shown on **Figure 5.2-1**; some resources, though, such as surface water (Figure **3.7-2**), socioeconomics (**Figure 3.15-1**), special status species (**Figure 3.13-3**), and air quality considered a larger geographic analysis area. For air quality, please see the description of modeling in the 2018 Final EIS (**Section 3.2, Air Quality** and **Appendix D-6** in that document) because the list of actions below does not cover all actions used in air quality modeling for cumulative effects.

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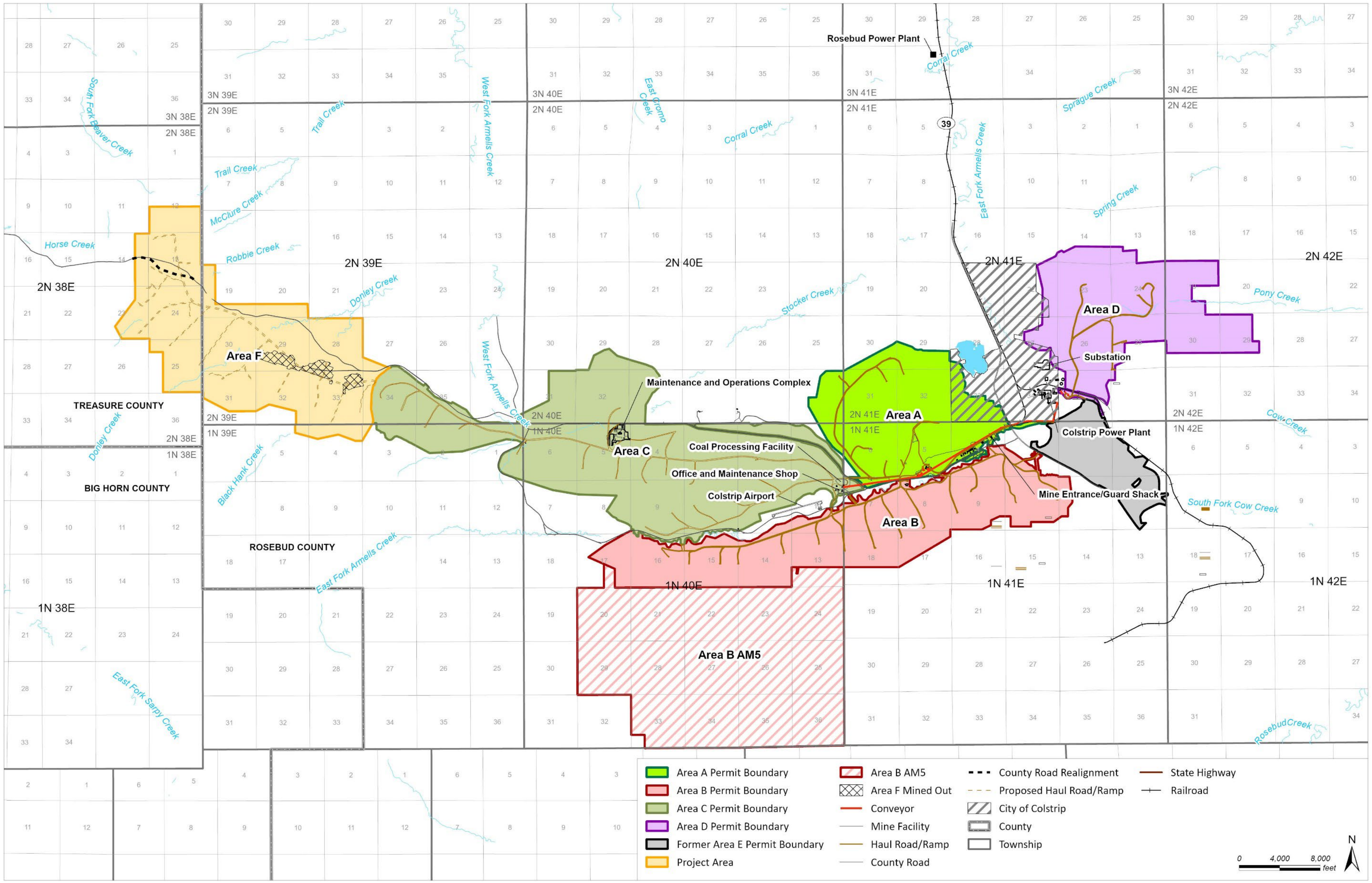

Figure 5.2-1. General Area of Cumulative Impacts and Contributing Actions

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Table 5.2-1. Key Past, Present, and Reasonably Foreseeable Future Actions.

Action	Type of Action	Past, Present, or Reasonably Foreseeable Future Action (RFA)	Action Description	Impacted Resources
Agriculture	Private	Past and present	The project area and surrounding areas have been used for agricultural purposes – particularly stock-watering and grazing – for decades, and continue to be used in this manner. Agriculture has historically had and continues to have a substantial effect on land and water use in the three drainages surrounding the project area. Continuous strips of irrigated farmland border the Rosebud Creek, Armells Creek, and Sarpy Creek drainages (Figure 3.7-2), with extensive dryland areas between the drainages used primarily for grazing. The source of water for irrigation is predominantly surface water. According to U.S. Department of Agriculture (USDA) 2015 statistics, the largest portion of irrigated farmland is used for hay production, with barley and sugar beets as additional crops (USDA 2015). Irrigated acreage accounts for about 1 percent of the land in the Rosebud, Armells, and Sarpy Creek watersheds (Montana Department of Natural Resources and Conservation 2016). Agricultural operations are expected to continue for the reasonably foreseeable future. Agricultural water uses are discussed below in this table under “Water uses and discharges.”	Land Use Water Resources Special Status Species
Alternative energy and transmission development and infrastructure	Private	Past, present, or RFA.	The Clearwater Wind project was developed by NextEra Energy Resources in conjunction with Orion Renewable Energy Group in the southeastern counties of Rosebud, Custer, and Garfield and began its operation in November 2022. It has the capacity to produce up to 750 megawatts, contributing to Montana’s expanding renewable energy production. However, as renewables projects are developed across the state, more transmission capacity will be needed to export energy and distribute it locally. Westmoreland Rosebud is building a transmission line project to provide increased power transmission capacity through connections to existing transmission lines in the area. A section of the Clearwater to Colstrip Transmission Line Project (Clearwater Project) includes a 500 kV transmission line that crosses in a general north-south orientation near the western edge of Permit Area D for approximately 1.7 miles. The Montana Department of Environmental Quality (DEQ) prepared an Environmental Assessment (EA) to disclose potential impacts that may result from the proposed and alternative actions in 2021. Grid United is proposing the development of a power transmission line, North Plains Connector, that would bridge the Eastern and Western energy grids by running power lines between Colstrip substation and Center, North Dakota. The line would total 415 miles of high voltage and would increase the potential for energy generation and the availability of power in Montana. A joint NEPA/MEPA analysis is expected to be completed in 2024 or 2025 for this project by the U.S. Department of Energy and DEQ.	All analysis resources
Airport	Private	Past, present, and RFA	Rosebud County owns and operates a small public airfield located between Areas B and C of the Rosebud Mine (about 3 miles southwest of Colstrip). The airfield, which is identified as M46 by the Federal Aviation Administration, has operated since 1990 and has two runways open daily from sunrise to sunset. Eleven single-engine aircraft are based at the airfield. The airfield averages 62 flights per week (Airnav.com 2014). The M46 airfield is expected to continue to operate for the reasonably foreseeable future.	Noise
Air emissions and associated land uses/disturbance: **Colstrip Power Plant**	Private	Past, present, and RFA	Detailed information about past and present operations of the Colstrip Power Plant is provided in **Chapter 1** in **Section 1.2.2, Coal Combustion**. The Colstrip Power Plant is located within the city of Colstrip and currently is operated by Talen Energy. Units 1 and 2, which each have 307 megawatts (MW) of generating capacity, were constructed in 1972 and operating since 1975 and 1976, respectively; they were retired from use on January 2, 2020, and January 3, 2020, respectively. Units 3 and 4, which each have about 740 MW of generating capacity, started operating in 1984 and 1986, respectively, and are anticipated to operate through at least 2042. Combustion of Area F coal in Units 3 and 4 is analyzed as an indirect effect by resource (as applicable) in **Chapter 4**. The Colstrip Power Plant and the operations of its associated facilities (paste plant, ponds, etc.) are governed by a certificate issued by DEQ under the Major Facility Siting Act, Section 75-20-101, Montana Code Annotated et seq. In recent years, the Rosebud Mine has delivered between about 5.5 million tons and 7.1 million tons of coal to the Colstrip Power Plant primarily by a covered conveyor system and a small amount by truck. The Colstrip Power Plant currently exclusively uses coal from the Rosebud Mine; in 2023, coal combusted in Units 3 and 4 came from Area F (the project area) and Area B. Emissions from the Colstrip Power Plant, which is a major source pursuant to Title V, are regulated by the applicable requirements outlined in Title V operating permit OP0513-18 and Montana Air Quality Permit (MAQP) #0513-16. Current and historic emissions for criteria air pollutants (CAPs) and hazardous air pollutants (HAPs) are provided in **Table 3.3-2** through **Table 3.3-6**; modeled combustion impacts, including cumulative impacts, are discussed in **Section 4.3.3.2, Indirect Impacts of Coal Combustion**. As detailed in **Appendix 4**, operations of the Colstrip Power Plant and the Rosebud Power Plant (combined) support 361 local jobs and $403 million in annual economic output (BBC 2024b).	All analysis resources
Air emissions and associated land uses/disturbance: **Rosebud Power Plant**	Private	Past, present, and RFA	Detailed information about past and present operations of the Rosebud Power Plant is provided in **Chapter 1** in **Section 1.2.2, Coal Combustion**. The Rosebud Power Plant is a 24-MW coal-fired power plant located about 6 miles north of the city of Colstrip that has been operating since May 1990. The Rosebud Power Plant was designed to burn low-Btu (British thermal unit) “waste coal” from the Rosebud Mine, which is coal not suitable for use at the Colstrip Power Plant due to the high sulfur content and low calorific value. This waste coal is typically found in the first 1-foot layer of the Rosebud Coal deposit. Coal from all of the active permit areas is currently used in the plant. The Rosebud Mine trucks 300,000 tons of coal annually to the Rosebud Power Plant using a fleet of five covered haul trucks (Spang 2013). Three of the five trucks operate daily, with each truck delivering 6.5 loads, for a total of 19.5 total loads daily. The Rosebud Power Plant currently exclusively uses coal from the Rosebud Mine; in 2023, coal combusted in the plant came from Area F (the project area) and Area B. The Rosebud Power Plant is expected to continue operations, using waste coal from Areas B and F through 2045 and 2039, respectively. Emissions from the Rosebud Power Plant, which is a major source pursuant to Title V, are regulated by the applicable requirements outlined in Title V OP2035-05 and MAQP #2035-08. Current and historic CAPs and HAPs are provided in **Table 3.3-2** through **Table 3.3-6**; modeled combustion impacts, including cumulative impacts, are discussed in **Section 4.3.3.2, Indirect Impacts of Coal Combustion**. Combustion of Area F coal is analyzed as an indirect effect by resource (as applicable) in **Chapter 4**. As detailed in **Appendix 4**, operations of the Colstrip Power Plant and the Rosebud Power Plant (combined) support 361 local jobs and $403 million in annual economic output (BBC 2024b).	All analysis resources

Table 5.2-1. Key Past, Present, and Reasonably Foreseeable Future Actions.

Action	Type of Action	Past, Present, or Reasonably Foreseeable Future Action (RFA)	Action Description	Impacted Resources
Air emissions and associated land uses/disturbance: **Rosebud Mine**	Private	Past, present, and RFA	Westmoreland Rosebud's past and present operations at the Rosebud Mine are described in **Section 2.2, Description of Existing Mine and Reclamation Operations**. The Rosebud Mine includes 40,127 permitted and bonded acres within five permit areas (A, B, C, D, and F), of which 19,062 acres are currently disturbed (**Table 2.2-3**). As of 2023, as shown in **Table 2.2-4**, the following acreage has been released from the following bond phases in Permit Areas A, B, C, and D: 10,678 acres (Phase I), 9,154 acres (Phase II), 4,391 acres (Phase III), and 263 acres (Phase IV). DEQ retains $184.75 million in bond for the Rosebud Mine as of 2023. The most recent addition to the Rosebud Mine was the DEQ-approved Amendment 5 (AM5) to the Area B Permit (C1984003B) in 2022, which added additional acreage adjacent to the southern boundary of the original Area B permit area (**Figure 5.2-1**). Like the project area, Area B AM5 expanded the disturbance footprint of the Rosebud Mine (by approximately 2,658 acres). The AM5 disturbance area and estimated production approved by DEQ was less than what was analyzed for Area B AM5 in the 2018 Area F Final EIS and associated air quality modeling: in DEQ's selected alternative, Westmoreland Rosebud was prohibited from mining in Richard Coulee. Over a 21-year period, about 43 million tons of coal are anticipated to be mined from the AM5 addition to Area B. Between 1975 and 2023, just under 514 million tons of coal were recovered from the mine's Permit Areas A, B, C, D, E, and F (Westmoreland Rosebud 2024a). In recent years, total mine production has ranged from a low around 5.4 million tons (Peterson 2022) to a high around 7.1 million tons in 2023 (Westmoreland Rosebud 2024a). Two mine areas are no longer actively mined: Area D (4,475 acres, permit C1986003D) is being reclaimed, and Area E (1,026 acres, former permit C1981003E) was released from DEQ jurisdiction in 2019. Mining occurred in Area D from 1986 to 2013 and in Area E from 1976 (or prior) to 1988. Reclamation has occurred concurrently with mine operations in all permit areas as required by the Montana Strip and Underground Mine Reclamation Act. In 2023, approximately 7.1 million tons of coal was produced from the Rosebud Coal Mine; of that total, approximately 4.6 million tons came from Area F (project area), and the remaining 2.5 million tons came from Area B. No coal was produced from Area A or C in 2023. As described in **Appendix 4**, the Rosebud Mine supports a total of 438 local jobs and $177 million in annual economic output – primarily, though not exclusively, in Rosebud County. Approximately 23 percent of the mine's labor force are Native Americans, including about 14 percent of the workforce that are members of the Northern Cheyenne Tribe (BBC 2024b). Future production from the Rosebud Mine will depend on a number of factors, including market conditions (see additional discussion in **Section 2.2.6, Life of Operations** and annual production estimates in **Section 4.3.3.1, Direct Impacts** (Air Quality). In this SEIS, the Rosebud Mine is assumed to continue operations through 2045. During this time the mine is expected to produce up to 112.5 million tons of coal. Changes to production rates, additions of other mine permit areas, reduced mining in Area F, or changed market conditions may influence the operational life of the Rosebud Mine as a whole or of individual permit areas. As described in **Section 2.2.3, Other Existing Permits**, the Rosebud Mine's five existing operating areas (A, B, C, D, and F) are currently covered by three MAQPs: • MAQP #1570-09 (Permit Areas C and F), issued June 19, 2019. Area F was incorporated into MAQP #1570-07 with a final permit previously issued on May 30, 2019. Combined coal production from Areas C and F is limited to 8 million tons per year per MAQP #1570-09, with an Area F–specific production cap of 4 million tons per year. • MAQP #1483-09, issued June 19, 2019, for Areas A, B, and D and former Area E. Annual combined coal production from Areas A, B, and D is limited to 13 million tons per year. • MAQP #4436-01, issued July 11, 2019, for operating a portable crusher.	All analysis resources

Table 5.2-1. Key Past, Present, and Reasonably Foreseeable Future Actions.

Action	Type of Action	Past, Present, or Reasonably Foreseeable Future Action (RFA)	Action Description	Impacted Resources
Air emissions and associated land uses/disturbance: **Other coal mines in southeastern Montana**	Private	Past, present, and RFA	In addition to the Rosebud Mine, three coal mines currently operate in Montana: the Bull Mountains Mine (underground mine that produces about 7.4 million tons per year), the Spring Creek Mine (more than 11.5 million tons per year), and the Absaloka (about 2.2 million tons per year). Several others operated in the recent past in the near vicinity of the Rosebud Mine, including the Big Sky Mine (adjacent to the Rosebud Mine, last operated more than a decade ago) and the East and West Decker coal mines (closed in 2021). The BLM developed reasonably foreseeable development scenarios for the Rosebud Mine and the Spring Creek Mine in its recent *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a); see discussion in this table below under "Federal land management" and in **Chapter 3, Section 3.4.2.1, Climate and Emissions Trends, Coal Production**. The Bull Mountains Mine is operated by Signal Peak Energy and is located 30 miles north of Billings (more than 50 miles away); this mine is not expected to influence or be influenced by the proposed Area F permitting action. The Office of Surface Mining Reclamation and Enforcement (OSMRE) currently is preparing an SEIS for the Bull Mountains Mine Amendment 3 as directed by the U.S. District Court of Montana to address the deficiencies identified in OSMRE's 2018 EA. 2022 production for this mine was about 7.4 million tons. The Spring Creek Mine is operated by Navajo Transitional Energy Company, LLC and is located north of Decker in Big Horn County (more than 50 miles away); this mine is not expected to influence or be influenced by the proposed Area F permitting action. A Lease by Application 1 Mining Plan Modification EA was published by OSMRE on October 3, 2016. OSMRE currently is preparing an EIS for the Spring Creek Mine Federal Mining Plan Modification for Federal Coal Lease MTM 94378 to address deficiencies identified in a February 3, 2021, ruling by the United States District Court for the District of Montana in *Guardians v. Bernhardt*, No. CV 17-80-BLG-SPW (U.S. District Court of Montana 2021). The DEQ released a Final EIS on August 11, 2023, analyzing the potential impacts from the proposed fifth amendment to the surface mine permit (C1979012) of the Spring Creek Mine to add a haul road extending to the Wyoming border. Production for the Spring Creek Mine in 2022 was 11.6 million tons. The BLM estimates that the Spring Creek Mine has Federal lease reserves to support 88.2 million tons of production through 2035 (BLM 2024a). Big Sky (reclaimed) and Absaloka are located near the Rosebud Mine. Big Sky Mine is a surface coal mine that was operated by Peabody Energy from 1984 to 2003 and is located just south of Area B of the Rosebud Mine. Big Sky Mine is fully reclaimed, and the Phase IV bond has been released. Westmoreland Resources currently operates the Absaloka Mine, a 10,427-acre surface coal mine located about 8 miles southwest of the project area in Big Horn County on the Crow Indian Reservation near Hardin. The mine has produced coal since 1974; production in 2022 was about 2.2 million tons. Until recently, coal produced in this mine was used in both the nearby Sherco plant owned by Xcel Energy and the Hardin plant operated by Rocky Mountain Power. The Absaloka Mine is no longer supplying coal to the Sherco plant: the plant closed one of its three coal units in 2023 and is expected to close the remaining two in 2026 and 2030. The remaining customer for the Absaloka Mine is the Hardin plant, and reclamation of large areas of the mine is ongoing. The East Decker Mine and the West Decker Mines were located near Decker in Big Horn County but closed in January 2021, after the owner of the mines, Decker Coal Company (Lighthouse Resources), filed for bankruptcy (AP 2021). DEQ holds reclamation bonds for the mines, which will not be released until full reclamation requirements have been satisfied. Westmoreland Rosebud has one active prospecting permit for Rosebud County, No. X2004322, which was renewed September 8, 2013, and one active Notice of Intent for Rosebud and Treasure Counties, No. N2006005, which was renewed February 15, 2014 (Peterson 2014a).	Air Quality Climate and Climate Change
Air emissions and associated land uses/disturbance: **Gravel quarries**	Private	Past, present, and RFA	There are eight gravel quarries operating within 25 miles of the project area. These quarries have operating permits through DEQ's Opencut Mining Program. Westmoreland Rosebud has five gravel quarry sites for mining scoria (used on road surfaces within the Rosebud Mine). These quarries are authorized under Westmoreland Rosebud's existing Rosebud Mine operating permits. Gravel quarry operations are expected to continue for the reasonably foreseeable future.	All analysis resources
Climate change	N/A	Present and RFA	Detailed information on the direct and indirect impacts of the project on greenhouse gas (GHG) emissions is provided and discussed in the SEIS Climate Change sections (**Section 3.4** and **Section 4.4**) and **Appendix 2 – Social Cost of GHGs**. Climate change is anticipated to increase the frequency and intensity of wildfire, alter precipitation patterns, and increase temperature, which is expected to impact water quality and quantity, wildlife habitats, threatened and endangered species habitat, and soil resources. Climate change may also contribute to exacerbating the potential impacts of the proposed project on these resources. Minority and disadvantaged communities may be disproportionally affected by climate change (see **Section 4.16, Environmental Justice**).	All analysis resources

Table 5.2-1. Key Past, Present, and Reasonably Foreseeable Future Actions.

Action	Type of Action	Past, Present, or Reasonably Foreseeable Future Action (RFA)	Action Description	Impacted Resources
Federal land management: **U.S. Department of the Interior–BLM**	Federal	Past, present, and RFA	There is no BLM-administered Federal surface land within the immediate vicinity of the project area, though there is within wider analysis areas considered for socioeconomics, air quality, and other resources. BLM-administered subsurface Federal mineral estate (including coal), which is administered by the Miles City Field Office (MCFO), is located both within and in the vicinity of the project area (see **Figure 1.1-3** and **Section 3.23, Land Use**). The BLM's MCFO recently revised and combined the Big Dry (1996) and Powder River (1985) Resource Management Plans (RMPs), as amended, into one document, the MCFO RMP. The MCFO planning area includes 17 Montana counties: Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Treasure, and Wibaux Counties as well as portions of Big Horn and Valley Counties (northern Big Horn County is under the Billings Field Office Management Plan). The BLM administers about 2.7 million acres of surface lands and 11.7 million acres of subsurface Federal coal estate in the planning area. The amended RMP applies to BLM surface and subsurface Federal coal estate. Following a 2022 court order issued regarding litigation of the RMP amendment (*Western Organization of Resource Councils, et al., vs BLM*), the BLM prepared and issued the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) in May 2024. The BLM selected Alternative D as the proposed plan for allocating BLM-administered coal (BLM 2024b; 89 FR 97 2024); under this alternative, Federal coal (about 1.75 million acres of subsurface Federal coal estate) would not be available for leasing within the MCFO planning area (see Figure 2-4a in BLM 2024a). The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing leases with sufficient coal reserves to maintain existing mine production levels until 2035 for Spring Creek Mine and 2060 for Rosebud Mine (BLM 2024a). Oil and gas leases were issued by the BLM in the past, but currently none are authorized in the near vicinity of the project area. Oil and gas production and refineries were considered in the air quality and emissions modeling completed for the 2018 Final EIS (see **Appendix D** in that document). The BLM estimates that peak oil production from the MCFO planning region would be 3.0 million barrels of oil and that peak gas production would be 13.1 billion cubic feet of gas (BLM 2024a). Federal oil and gas development is not anticipated to contribute to regional exceedances of the National Ambient Air Quality Standards (NAAQS) and Montana Ambient Air Quality Standards (MAAQS) (BLM 2024a). Other actions on BLM-managed Federal lands in the near vicinity of the project area must be completed in compliance with the amended RMP and include the following: vegetation management, fire management, forestry, livestock grazing, recreation (trails and travel management), and road maintenance. Other actions include BLM authorized rights-of-way for powerlines and pipelines, administration of coal leases and mineral material sites, land withdrawals, and land sales and exchanges. BLM land management actions within the MCFO planning area are expected to continue for the reasonably foreseeable future.	Land Use Climate
Federal land management: **USDA – Forest Service (Custer Gallatin National Forest)**	Federal	Past, present, and RFA	The Custer Gallatin National Forest is located in southeastern Montana. The closest ranger district, the Ashland District, is about 35 miles to the southeast of the project area. With the exception of management activities such as controlled burns, past and present management activities on the Ashland District are not expected to influence or be influenced by the proposed Area F permitting action. The applicable land and resource management plan, the Custer Gallatin Land Management Plan, was approved in January 2022. Management actions by the Custer Gallatin National Forest are expected to continue for the reasonably foreseeable future.	Air Quality Climate and Climate Change Water Resources Vegetation
Hunting	Federal, state, and private	Past, present, and RFA	Montana Fish, Wildlife and Parks (FWP) Hunting District 702, which is 1,793,846 acres, includes the Rosebud Mine. During hunting season for big game (mule deer, white-tailed deer, pronghorn, and elk) and upland birds, Westmoreland Rosebud allows public access to inactive areas of the mine through FWP's Block Management Program. A cooperative program between private landowners and FWP, Block Management helps landowners manage hunting activities and provides the public with free hunting access to private land, and sometimes to adjacent or isolated public lands. Based on data presented in **Section 3.18.2.1** of the 2018 Final EIS, an average of 465 hunter days (all days hunted by all hunters) each year have been hunted on the mine site. Hunter success for all species is around 20 percent (average). Mule deer and upland birds are the most common species harvested on the mine site. Hunting also occurs on public (state) and private land surrounding the mine, and hunters likely reach these locations using the Horse Creek Road, which passes through the Rosebud Mine and the Area F project area.	Fish and Wildlife Recreation
Rail transport	Private	Past	The Northern Pacific Railway established the city of Colstrip and its associated mine in the 1920s to provide fuel for the railway's steam-locomotive trains. BNSF Railway currently owns and operates a functioning rail spur that runs north-south from Nichols, Montana, to the Rosebud Mine, but it has not been used since 2010. Westmoreland Rosebud has intermittently shipped coal via this line in the past (as recently as 2010) but does not have a current contract to ship coal via railway. As stated in the 2018 Final EIS, the Tongue River Railroad Company Inc. (TRRC) intended to construct and operate a rail line between Miles City and Ashland, Montana; the initial customer of the rail line would have been the proposed Otter Creek Mine. TRRC's preferred alignment was the 42-mile Colstrip Alternative, which would generally parallel Greenleaf Road (S-447). However, on April 26, 2016, the Surface Transportation Board issued a decision dismissing the Tongue River Railroad proceeding without prejudice because the Otter Creek Mine permit application with DEQ was suspended. At this time, the development of the Tongue River Railroad is no longer a reasonably foreseeable future action.	Air Quality Fish and Wildlife Vegetation
Water uses and discharges: **Rosebud Power Plant**	Private	Past, present, and RFA	Deep groundwater wells provide water to the Rosebud Power Plant. Colstrip Energy Limited Partnership, owner of the Rosebud Power Plant, is permitted under Montana Pollutant Discharge Elimination System (MPDES) Permit MT-0031780 to discharge water from a storm-water control pond to an unnamed ephemeral tributary to the East Fork Armells Creek. The discharge must meet effluent limitations and conditions.	Water Resources Wetlands and Riparian Zones
Water uses and discharges: **Colstrip Power Plant**	Private	Past, present, and RFA	Water piped from the Yellowstone River (up to 69 cubic feet per second [cfs]) is the source of water to the Colstrip Power Plant, which operates as a zero-discharge facility. Process water is contained in ponds on the plant site. Water use from the Yellowstone River is expected to continue for the reasonably foreseeable future. Discharges of storm water from construction activities is permitted under MPDES, storm-water construction permit MTR106638, effective January 1, 2023, for the Colstrip steam electric station borrow area.	Water Resources Wetlands and Riparian Zones

Table 5.2-1. Key Past, Present, and Reasonably Foreseeable Future Actions.

Action	Type of Action	Past, Present, or Reasonably Foreseeable Future Action (RFA)	Action Description	Impacted Resources
Water uses and discharges: **Rosebud Mine**	Private	Past, present, and RFA	As discussed in **Section 2.2.3, Other Existing Permits**, Westmoreland Rosebud has three MPDES Permits that regulate point source discharges of pollutants from the Rosebud Mine. In addition to MPDES Permit MT-0031828, which covers Area F discharges, Westmoreland holds MPDES Permit MT-0023965 and MPDES Permit MT-0032042. MPDES Permit MT-0023965 (Modification 2) regulates discharges of mine drainage and drainage from coal preparation plant and coal preparation plant associated areas, as those terms are defined at 40 Code of Federal Regulations Part 434, including Areas A, B, C, and D. MT-0023965 became effective on August 1, 2021 (expires July 31, 2026), and provides effluent limits, monitoring requirements, and other special conditions for discharges from 153 outfalls. The receiving waters include East Fork Armells Creek, Stocker Creek, Lee Coulee, West Fork Armells Creek, Black Hank Creek, Donley Creek, Cow Creek, Spring Creek, and Pony Creek. MPDES Permit MT-0032042 (Modification 2), effective October 1, 2022 (expires September 30, 2027), regulates discharges of mine drainage from 18 outfalls associated with Area B AM5. Receiving waters include Lee Coulee and Richard Coulee, which are both tributaries to Rosebud Creek.	Water Resources Wetlands and Riparian Zones
Water uses and discharges: **Colstrip Water Treatment Plant**	Private	Past, present, and RFA	The Colstrip Water Treatment Plant provides potable water from Castle Rock Reservoir to the city of Colstrip. The water supply to Castle Rock Reservoir is piped from the Yellowstone River. Backwash from the potable water treatment plant is discharged back to the reservoir under MPDES Permit MT-0030422. Municipal sewage flows via a collection system to the Colstrip Wastewater Treatment Plant, which operates at about 200,000 gallons per day, about one-third of stated capacity (DEQ 2015d). The city of Colstrip is authorized to discharge from its sewage treatment plant to the East Fork Armells Creek pursuant to MPDES Discharge Permit MT-0022373. Discharges and water uses are expected to continue for the reasonably foreseeable future.	Water Resources Wetlands and Riparian Zones
Water uses and discharges: **Irrigation – golf course**	Private	Past, present, and RFA	A nine-hole public golf course is located adjacent to the East Fork Armells Creek about 1 mile downstream of Colstrip. Water used to maintain the greens infiltrates into the creek, likely causing undefined changes in water level and water quality. Irrigation water for the golf course comes from the municipal water supply, which is piped from the Yellowstone River. Water use is expected to continue for the reasonably foreseeable future.	Water Resources Wetlands and Riparian Zones
Water uses and discharges: **Agricultural diversions**	Private	Past, present, and RFA	Cartersville Dam is a six-foot-high, 800-foot-long irrigation diversion dam/weir spanning the Yellowstone River at Forsyth, Montana. The dam is approximately 235 miles upstream from the mouth of the Yellowstone River and 165 miles upstream from the Intake Diversion Dam. The dam was originally constructed during the 1930s and consists of a rock and willow structure capped in concrete. The dam provides head for gravity diversion to the Cartersville Irrigation District. Cartersville Dam is a private irrigation dam owned and operated by the Cartersville Irrigation District. The dam has been documented as a barrier to upstream fish migration of Yellowstone River native warm-water fish (including shovelnose sturgeon, blue sucker, sauger, and burbot). The dam itself is also a safety concern for recreational fishermen and boaters due to uneven crest and turbulence. The headgate structure, which diverts water into the canal, is currently unscreened, and there is concern that native fish may be unintentionally entrained into the canal. The Cartersville Dam has suffered some deterioration due to age, high flow, and ice events. A multi-agency collaborative effort has been initiated to work with the irrigation district to pursue fish passage and potential screening of the canal for ecosystem restoration purposes. Cartersville Dam is the second diversion dam upstream from the mouth of the Yellowstone River, approximately 165 river miles above Intake Diversion Dam. Other diversion dams upstream from Cartersville are somewhat smaller and are believed to be only partial barriers to fish migration. Restoring fish passage at Cartersville Dam would complement ongoing rehabilitation work at Intake Dam to provide unimpeded passage from the Bighorn River confluence to the mouth, a total distance of over 300 miles. There are approximately 100 active surface water rights on the Yellowstone River within the surface water and special status species cumulative effects analysis areas with a maximum diversion potential of approximately 1,400 cfs. Most of those water rights are dedicated exclusively for irrigation purposes, including the largest three of those water rights (425 cfs, 144 cfs, and 109 cfs).	Water Resources Special Status Species
Wildland fire and prescribed burns	N/A	Past, present, or RFA	Wildland fires have historically occurred in the vicinity of the Rosebud Mine. During the 2012 wildland fire season, the McClure Creek and Donley Creek fires burned 221 acres, impacting vegetation and wildlife on and around the southern boundary of Rosebud Mine Areas B, C, and F. Prescribed burns have also occurred from time to time on BLM or USDA Forest Service lands in southeastern Montana. The 2012 Chalky Fire burned 131,000 acres south of Area B, including the majority of the AM5 area. The Poverty Flats Fire burned over 75,000 acres in Big Horn County in July 2021 and threatened the safety of county residents and infrastructure east of the project area. In the summer of 2021, the Richard Spring Fire, which began in a coal seam approximately 10 miles southwest of Colstrip on August 8, burned 171,130 acres in the vicinity of the Rosebud Mine, including nearly the entire project area. Vegetation burned in the fire was primarily short grass beneath a ponderosa pine overstory but also included interspersed areas of sage brush and juniper (InciWeb 2021). Effects of wildland fires, such as the Poverty Flat Fire and the Richard Spring Fire, include impacts on water quality, alteration of vegetation communities, increases or decreases in nonnative and noxious weed species, alteration of wetland habitats, and reduction in insect pests that may be adversely affecting native vegetation. Wildland fires and prescribed burns are expected to occur for the reasonably foreseeable future.	All Resources

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5.3 RESOURCES

5.3.1 Topography

Cumulative effects on topography would be similar to those described in **Section 5.3.1** of the 2018 Final EIS, beginning on page 665. The analysis area for evaluation of cumulative impacts for topography includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure** 5.2-1). **Table 5.3-1** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect topography in the analysis area.

Table 5.3-1. Topography: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas) and gravel quarry sites for mining scoria (used on road surfaces within the Rosebud Mine)	Past, present, and RFA	Past and ongoing mining at the Rosebud Mine along with ongoing mining of scoria for road surfaces has resulted in short-term minor cumulative impacts during mining activities and long-term minor cumulative impacts on the overall topography due to the removal of geologic outcrops and scoria, and slight differences in the pre-mine topography versus the postmining topography. Mining in the project area and possible future mining of other sites at the Rosebud Mine would result in additional short-term minor cumulative topographic changes during active mining and long-term minor cumulative topographic changes following reclamation.

5.3.2 Air Quality

Cumulative effects on air quality would be similar to those described in **Section 5.3.2** of the 2018 Final EIS, beginning on page 666. The analysis area for cumulative impacts on air quality is the same as that used for the indirect effects for air quality, a rectangular region extending to about 300 km from Colstrip in all directions (see **Section 3.3, Air Quality**). The air quality modeling performed for the 2018 Final EIS with the CAMx modeling system, which is described in **Section 4.3.1, Analysis Methods and Impact and Intensity Thresholds** of the 2018 Final EIS, considered cumulative impacts in addition to direct and indirect impacts. **Table 5.3-2** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect air quality in the analysis area. More detail, including a more comprehensive list of actions, is provided in the 2018 Final EIS (see **Section 5.3.2** and **Appendix D**).

Table 5.3-2. Air Quality: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Airport	Past, present, and RFA	Past and current airport operation has contributed and continues to contribute to air quality degradation due to emissions from aircraft, equipment, and stationary and vehicle sources. Emissions from aircraft are mainly caused by fuel combustion in the engines. Aircraft disturb the atmosphere by changing background levels of trace gases and particles. As stated at the beginning of this chapter, the airfield averages 62 flights per week, which likely results in some cumulative air quality impacts. However, only smaller turboprop planes use the Colstrip Airport, which includes only two short runways. Therefore, air pollution from local airport operation and aircraft use is likely minor because turboprops burn less fuel than jet planes.
Rosebud Mine (other permit areas)	Past, present, and RFA	Past and current coal mining in Areas A, B, C, D, and E of the Rosebud Mine have contributed to cumulative impacts on local air quality. Similarly, future coal mining in other permit areas of the Rosebud Mine will contribute to cumulative impacts on air quality. Existing CAP and HAP emissions from these permit areas have been estimated in **Section 3.3.4.1, Existing Emissions from the Rosebud Mine**. Future cumulative CAP and HAP emissions from Areas A, B (including AM5), and C (including the portable crusher) are included in the Environmental Protection Agency (EPA) National Emissions Inventory (NEI) and in the EIS air quality modeling (see **Section 5.3.2** and **Appendix D** in the 2018 Final EIS). In general, other areas of the Rosebud Mine had relatively small contributions to the occurrences of high cumulative CAPs concentrations and to the exceedance of NAAQS or MAAQS in the direct and indirect/cumulative effects analysis areas. Similarly, impacts of other Rosebud Mine permit areas on nitrogen and sulfur deposition were relatively small.

Table 5.3-2. Air Quality: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Coal combustion	Past, present, and RFA	CAP and HAP emissions due to Colstrip Units 1 and 2 (retired in January 2020) are listed in Table D-6-2, Appendix D-6 (**Appendix D** in the 2018 Final EIS); Units 1 and 2 are no longer sources of emissions. Emissions of oxides of nitrogen (NO_x) were the largest among the CAPs from Units 1 and 2, with a total of 5,808 tons/year, followed by SO_2 at 3,758 tons/year. The approach used for calculating these emissions is similar to that used for estimating CAP and HAP emissions from Colstrip Units 3 and 4 as discussed in **Section 4.3.3.2, Indirect Impacts of Coal Combustion** in the 2018 Final EIS. In general, Units 1 and 2 had relatively small contributions to the occurrences of high cumulative CAP concentrations and to the exceedance of NAAQS or MAAQS in the direct and indirect/cumulative effects analysis areas. Indirect effects of Area F coal would constitute less than 1 percent and 0.1 percent of the cumulative nitrogen and sulfur deposition in lakes and streams in the analysis area (**Appendix D** in the 2018 Final EIS). Across the Class I areas in the indirect/cumulative impacts analysis area, the change in haze index due to cumulative impacts varies from 6.0 to 22.2, with the peak values modeled at Medicine Lake NWR and Flathead Indian Reservation (**Table D-6-7, Appendix D-6** in the 2018 Final EIS). At these two locations, direct and indirect impacts represent up to 0.1 percent and 3.1 percent, respectively, of the cumulative change in haze index. The change in haze index due to direct impacts does not exceed 0.5 or 1.0 on any days at any Class I area except at Northern Cheyenne, where it is exceeded two days in the year. The change in haze index due to indirect impacts exceeds 0.5 on 14 days or less except at Northern Cheyenne, where it is exceeded 96 days in the year. The modeled wet and dry deposition of mercury due to indirect effects (Colstrip Units 3 and 4 and the Rosebud Power Plant) is provided in **Appendix D** in the 2018 Final EIS. The contribution of indirect effects to cumulative mercury deposition is relatively small, less than 8 percent in the vicinity of Colstrip, and 1 percent or less farther away.
Federal land management – BLM and Forest Service	Past, present, and RFA	Emissions sources from Federal land management (BLM and Forest Service) were considered in the modeling completed for the 2018 Final EIS (see **Section 5.3.2** and **Appendix D**). Since that time, the BLM has issued an SEIS for the MCFO RMP and indicated selection of Alternative D, which would disallow any new leasing of the Federal coal estate in the MCFO planning area. Therefore, there would be no emissions or air quality impacts from coal mining, transportation, and downstream combustion due to pending Federal lease applications or potential future subsequent Federal leases (BLM 2024a).
Energy and mineral development	Past, present, and RFA	Energy and mineral development in the region could result in adverse impacts on air quality. CAP and HAP emissions from current and reasonably foreseeable mineral development and other large regional sources are described in **Section 3.3.4.3, Existing Emissions from Other Regional Sources, Section 4.3.2.1, Regional Emissions**, and the 2018 Final EIS (see **Section 5.3.2** and **Appendix D**).
Rail transport	Past, present, and RFA	Local and regional rail transport contributes to air quality degradation from exhaust emissions, particularly carbon monoxide (CO), NO_x, and particulate matter (PM). Rail transport emissions are included in the EPA NEI and in the EIS air quality modeling (see **Section 5.3.2** and **Appendix D** in the 2018 Final EIS).
Wildland fire	Past, present, and RFA	Wildland fires can result in substantial air pollution, particularly through the release of fine particles. However, the severity of the impacts depends on the scale and frequency of fires. Periodic wildland fires in the vicinity of the Rosebud Mine could negatively affect local air quality. The air quality modeling for the 2018 Final EIS uses wildland fire data for the year 2012/2013 from the BLM-MT/DK inventory (BLM 2016a) discussed in **Section 4.3.2.1, Regional Emissions** in the 2018 Final EIS.

Table 5.3-2. Air Quality: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Climate change	Past, present, and RFA	Not only does air pollution affect climate change, but the close connection between climate and air quality is also reflected in the impacts of climate change on air pollution levels. Ozone and particle pollution are strongly influenced by shifts in the weather (e.g., heat waves or droughts). Based on projected future climate scenarios, the Intergovernmental Panel on Climate Change (IPCC) projected "declining air quality in cities" into the future as a result of climate change (IPCC 2014). According to Zeng et al. (2008), a hypothetical 50 percent increase in isoprene emissions due to climate change by 2100 could increase ground-level ozone concentrations over the United States by up to 6 parts per billion (ppb), while a hypothetical doubling of soil NO_x emissions due to climate change could increase ozone concentrations by up to 5 ppb. Cumulative ozone concentrations could be further exacerbated by climate change on days when weather is already conducive to high ozone concentrations. In the Great Plains Region, average temperatures are already increasing, along with the frequency of extreme heat, droughts, wildland fires, heavy precipitation events, and reduced air quality (Melillo et al. 2014). Because climate represents meteorological conditions over a long period, it is difficult to identify exactly whether emissions reductions from air quality regulations are outpacing cumulative climate impacts. Climate change is discussed further under **Sections 3.4**, **4.4**, and **5.3.3, Climate and Climate Change.**
Other sources	Past, present, and RFA	CAP and HAP emissions from other regional sources of air pollution will also contribute to the cumulative impacts on air quality in the analysis area. Emissions from all sources in the BLM-MT/DK 2025/2032 future year modeling platform (BLM 2016a, 2016b) originally derived from EPA's 2025 projection of the 2011 NEI that are within the indirect/cumulative impacts analysis area are included in the CAMx air quality modeling (see **Section 5.3.2** and **Appendix D** in the 2018 Final EIS).

5.3.3 Climate and Climate Change

Climate change cumulative effects would be similar to those described in **Section 5.3.3** of the 2018 Final EIS, beginning on page 676. GHG emissions sources and trends occur at global, national, state, and regional scales. For this section, the focus is cumulative effects at a regional scale, and the analysis area is the same as that used for cumulative effects for air quality, a rectangular 300-km extent. **Table 5.3-3** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect climate change. More detail is provided in the 2018 Final EIS.

Table 5.3-3. Climate Change: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Agricultural development in the area consists mostly of cropland, pastureland, and grazing lands. Continued agricultural development would contribute to local GHG emissions and surface warming due to land-use changes, thus contributing to global warming. Agricultural soil management practices and livestock contribute to Montana GHG emissions; see additional discussions on current national and Montana agricultural emissions in **Section 3.4.2.1, Climate and Emissions Trends**. Emerging management practices in Montana are already moving toward reducing emissions and storing more carbon in soil (sequestering). Consequently, Montana agricultural soil is believed to remain positive for carbon sinks. As discussed in **Section 3.4.2** of the 2018 Final EIS, the impacts of climate change (e.g., rising temperatures, changes to precipitation, etc.) on agriculture will continue.
Airport	Past, present, and RFA	Airport construction and continued operation has not only resulted in land-use changes and loss of grasslands but has contributed to changes in atmospheric composition due to GHG emissions from the combustion of fossil fuels. Aircraft disturb the atmosphere by changing background levels of trace gases and particles, including GHGs, and by forming condensation trails. Direct emissions from aircraft accumulate in the atmosphere, change its chemistry and microphysics, and trap heat that would otherwise escape from Earth, contributing to global warming (IPCC 1999). However, only smaller turboprop planes use the Colstrip Airport, which has two short runways. Therefore, emissions from local airport operation and aircraft use are likely minor, as turboprops burn less fuel than jet planes.
Rosebud Mine (other permit areas)	Past, present, and RFA	Projected annual GHG emissions from other Rosebud Mine permit areas are provided in **Tables 173** and **174** in the 2018 Final EIS. As discussed in **Section 4.3.3.1, Direct Impacts** (Air Quality), the GHG emissions presented in the 2018 Final EIS likely overestimate total emissions for the Rosebud Mine Area B but represent a reasonable upper bound. Because the life of the mine could change based on the tenure of mining in the project area, slightly greater cumulative impacts would occur under Alternative 4 (as compared to Alternatives 1 and 5) from increased GHG emissions over the long term. However, Alternative 4 is expected to have a very small contribution to cumulative impacts on regional climate since GHG emissions from indirect effects due to combustion of Area F coal would constitute a small fraction of total U.S. GHG emissions. The national GHG emissions may decrease further with the ongoing transition to renewable energy sources across the country.
Coal combustion	Past, present, and RFA	Estimated annual GHG emissions from Colstrip Units 1 and 2 were provided in **Section 4.4.2.5, Future GHG Emissions from Colstrip and Rosebud Power Plant** in the 2018 Final EIS. Units 1 and 2 were retired in January 2020 and are no longer sources of emissions. GHGs from Units 3 and 4 are considered indirect effects in this analysis, regardless of whether the coal was sourced from Area F or Area B.

Table 5.3-3. Climate Change: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Federal land management – BLM and Forest Service	Past, present, and RFA	GHG emissions sources from Federal land management activities were considered in the 2018 Final EIS (see **Section 5.3.3**). Since that time, the BLM has issued an SEIS for the MCFO RMP and indicated selection of Alternative D, which would disallow new leasing of the Federal coal estate in the MCFO planning area. Therefore, there would be no GHG emissions impacts (or associated social costs) from coal mining, transportation, and downstream combustion due to pending Federal lease applications or potential future subsequent Federal leases (BLM 2024a)
Alternative energy development	Past, present, and RFA	Alternative energy development in the region could result in cumulative GHG impacts. On the other hand, development of wind projects, for example, could potentially reduce GHG emissions in the area over the long term.
Wildland fire	Past, present, and RFA	Fire affects climate change through loss of vegetation and the release of CO_2 and other GHGs into the atmosphere. Large amounts of stored CO_2 are released when vegetation burns, which significantly influences the Earth's atmosphere and climate (Cole 2001; Sommers et al. 2014). Periodic wildland fires would result in negative cumulative effects on climate change.
Other GHG activities	Past, present, and RFA	The GHG emissions from large regional, national, and non-U.S. (global) sources and climate and climate change impacts are discussed under No Action and Proposed Action in **Section 4.4, Climate and Climate Change** of the 2018 Final EIS. There is a general scientific consensus that the cumulative effects of GHGs have influenced the ambient environment on a global scale (e.g., IPCC 2014); this is considered a major cumulative effect. Global anthropogenic GHG emissions were about 52 gigatons (Gt)-CO_2e in 2010, and by 2037 (the last year of the period of the Proposed Action) global GHG emissions estimates vary from 30 to 80 Gt-CO_2e across RCP scenarios (IPCC 2014).

5.3.4 Public Health and Safety

Cumulative effects on public health and safety would be similar to those described in **Section 5.3.4** of the 2018 Final EIS, beginning on page 679. The analysis area for evaluation of cumulative impacts on public health includes Rosebud, Big Horn, and Treasure Counties, and the Northern Cheyenne and Crow Indian Reservations (**Figure 3.15-1**). **Table 5.3-4** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect public health and safety in the analysis area.

Table 5.3-4. Public Health and Safety: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Past, present, and future agricultural production within the analysis area includes production of commodity crops and domestic livestock grazing. While some of these products may be consumed within the analysis area, it is not likely that subsistence farming, hunting and gathering, and gardening comprise a significant part of the overall source of nutrition in the area. As noted in **Section 5.3.3, Climate and Climate Change**, agricultural production would contribute to GHG emissions and to climate change, as well as to changes in land use patterns. Increased GHGs and climate change may adversely impact public health, to which the Proposed Action would contribute negligibly.
Air pollution	Past, present, and RFA	Air pollution sources include fugitive dust from unpaved roads and wind erosion. The town of Lame Deer is identified as a nonattainment area for PM_{10} under the NAAQS due to fugitive dust (DEQ 2017a). Vehicle emissions may contribute marginally to environmental health, although population density in the area is sparse and exposure to emissions is not likely. The cumulative impacts within the area of other air pollution sources would be short- to long-term, minor to major, and adverse, to which the Proposed Action would contribute negligibly.
Rosebud Mine (other permit areas)	Past, present, and RFA	The past, ongoing, and future activities at the Rosebud Mine may affect air quality and the socioeconomics of the area, as discussed in **Section 5.3.3, Climate and Climate Change**, **Section 5.3.2, Air Quality**, **Section 5.3.14, Socioeconomic**, and **Section 5.3.15, Environmental Justice**. Cumulative impacts from Rosebud Mine operations may include continued emissions of HAPs and PM that could impact public health, especially among subpopulations with compromised respiratory and circulatory health close to the Rosebud Mine (Stanek et al. 2011; Jenkins et al. 2015). The Rosebud Mine, however, contributes substantially to the area's economy through direct and indirect jobs and revenues. These contribute to the funding and availability of public-health resources and social services and to the community health and well-being of the area through sustained economic resources. As discussed below (**Section 5.3.14, Socioeconomic**), future operations at the mine, including the proposed Area B AM5, would have long- and short-term moderate to major adverse economic impacts on the area, to which the Proposed Action would contribute negligibly.
Oil, gas, and other mines (coal and gravel)	Past, present, and RFA	Other past, present, and future land uses in the area include other coal mines, oil and gas development, and quarrying. These activities likely adversely affect the environmental health of the area through exposure to HAPs and PM and release of GHGs (see **Section 5.3.2, Air Quality** and **Section 5.3.3, Climate and Climate Change**) while contributing beneficial economic resources that support public-health resources and social services.

Table 5.3-4. Public Health and Safety: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Coal combustion	Past, present, and RFA	The Colstrip and Rosebud Power Plant activities contribute to the area's public health through environmental and socioeconomic impacts, as discussed in **Section 5.3.3, Climate and Climate Change**, **Section 5.3.2, Air Quality**, **Section 5.3.14, Socioeconomic**, and **Section 5.3.15, Environmental Justice**. Combustion at these plants contributes to the overall environmental status of the area, including air and water quality. While the current environmental quality in the area meets state and Federal standards, the local population has higher rates of chronic disease, including respiratory illness and cancer (see **Section 3.5**, **Public Health and Safety**). It is possible that past and present combustion at these facilities contributes to this and may exacerbate symptoms through incidental and long-term exposure to HAPs in plant emissions (Kelly and Fussell 2011; Ghio et al. 2012). The retirement of Colstrip Units 1 and 2 would reduce the amount of HAP and PM emissions in the area (see **Section 5.3.2, Air Quality**), and may contribute to improved environmental health conditions. Like the Rosebud Mine, however, the Colstrip and Rosebud Power Plants contribute substantially to the area's economy with direct and indirect jobs and revenues contributing to the funding of public health and social services and the economic stability of individuals and households. Therefore, the power plants' contribution to the area's environmental health is long-term, minor to moderate, and adverse, to which the Proposed Action would contribute negligibly. The power plants' contribution to the area's community well-being is long-term, minor to moderate, and beneficial, to which the Proposed Action would contribute negligibly. The closure of Colstrip Units 1 and 2 would result in long-term minor effects on environmental health and long-term moderate adverse effects on community well-being, to which the Proposed Action would not contribute.
Water use and discharge	Past, present, and RFA	Past, present, and future surface water usage and discharges are discussed in **Section 5.3.6, Water Resources – Surface Water**. Cumulative impacts on water resources in the area would be long-term, moderate to major, and adverse. Public health impacts could result if exposure to HAPs and other pollutants becomes likely through incidental contact with water and recreation (swimming, wading, fishing, etc.). Municipal and residential drinking water in the area comes from Castle Rock Lake (filled with water piped from the Yellowstone River) and from a few domestic water wells. MPDES requires discharge permitting, water quality monitoring, and mitigation of point source contamination to protect public and environmental health. With regulation and mitigation, the cumulative impacts on public health from surface water quality would be long-term, minor, and adverse, to which the Proposed Action would contribute negligibly.
Wildland fire	Past, present, and RFA	Past and future wildland fires may result in short- and long-term adverse effects on environmental health and well-being. As discussed in **Section 5.3.3, Climate and Climate Change**, **Section 5.3.6, Water Resources – Surface Water**, and **Section 5.3.17, Recreation**, wildland fire may contribute to surface water quality and the local effects of climate change. Short-term impacts from wildland fire on air quality may exacerbate the symptoms of respiratory illness among sensitive subpopulations. Wildland fire may have long-term adverse impacts on community well-being within Montana through the loss of property, displacement of populations, and cost of response and management (Power and Power 2015). The Proposed Action would not contribute directly to the short- and long-term adverse impacts of wildland fire but could contribute negligibly through climate change.

Table 5.3-4. Public Health and Safety: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Climate change	Past, present, and RFA	Climate change threatens public health and well-being in many ways. Increased extreme-weather events, regional drought, wildland fire, decreased air quality, impacts on mental health and culturally significant resources, and exacerbation of the spread of infectious diseases transmitted by food, water, and disease carriers (insects and wildlife) are all anticipated threats to public health from climate change (Luber et al. 2014). The impacts of climate change would vary locally. Anticipated changes to Montana's climate include increased year-round temperatures, increased winter precipitation, and decreased summer precipitation (NOAA 2013). Adverse socioeconomic impacts could include losses to sectors of the economy such as agriculture, recreation, and tourism (Power and Power 2015). The impacts of climate change on both environmental health and well-being would be long-term, major, and adverse, to which the Proposed Action would contribute negligibly.

5.3.5 Geology

Cumulative effects on geology would be similar to those described in **Section 5.3.4** of the 2018 Final EIS, beginning on page 682. The analysis area for evaluation of cumulative impacts for geology includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure 5.2-1**). **Table 5.3-5** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect geology in the analysis area.

Table 5.3-5. Geology: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas) and gravel quarry sites for mining scoria (used on road surfaces within the Rosebud Mine)	Past, present, and RFA	Past and ongoing mining at the Rosebud Mine and scoria mining has resulted in cumulative impacts on the overall geologic formations in the region and the loss of horizontal continuity in geologic beds overlying the coal. Because scoria mining and surface mining of the Rosebud Coal and overlying geologic formation are small relative to the entire Fort Union deposit, mining in the project area and possible future mining of other sites at the Rosebud Mine would result in long-term minor cumulative impacts on geologic resources.

5.3.6 Water Resources – Surface Water

Cumulative effects on surface water have been updated from those that were described in **Section 5.3.6** of the 2018 Final EIS, beginning on page 683; this section now incorporates information from the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), which is referred to as the CHIA. The surface water cumulative impacts analysis area is the same as the indirect effects analysis area (**Figure 3.7-2**) and includes the Sarpy Creek, Armells Creek, and Rosebud Creek watersheds, and the reach of the Yellowstone River between the Cartersville Dam and the confluence with the Tongue River. **Table 5.3-6** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect surface water resources in the analysis area.

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Specific areas within the cumulative impacts analysis area have been used for decades for agricultural purposes focused on crop irrigation and livestock watering and grazing, which is expected to continue through the reasonably foreseeable future. About 1 percent of the cumulative impacts analysis area adjacent to Rosebud Creek, Armells Creek, and Sarpy Creek drainages supports hay (primary crop), barley, and sugar beet production with irrigation water that is diverted from the streams. The portion of the irrigation water that is not consumed by evaporation and vegetative transpiration eventually reenters the streams through surface water and groundwater return flows. Extensive dryland areas between the surface water drainages are used for livestock grazing. Surface water diverted from the Yellowstone River also supports a significant amount of agricultural irrigation along the northern part of the cumulative impacts analysis area (see discussion in this table below under: “Water uses and discharges: Agricultural diversions”). A relatively small amount of surface water in the cumulative impacts analysis area is consumed by livestock from springs that discharge native groundwater to the land surface, from ponds that impound localized surface water runoff behind small man-made dams, and from stream channels that convey localized and regional surface water flow. Agriculture historically has and continues to have a substantial effect on surface water resources in the cumulative impacts analysis area (Rosebud Creek, Armells Creek, and Sarpy Creek watersheds) through the following activities: • <u>Surface water diversions</u> – Based on data collected from the Montana Department of Natural Resources and Conservation (DNRC) Water Rights Bureau (DNRC 2024), there are approximately 1,400 active surface water rights associated with spring, pond, and stream water diversions that are dedicated to agricultural irrigation (about 200 water rights) and stock watering (about 1,200 water rights) within the cumulative impacts analysis area. Those water rights collectively represent a combined maximum diversion potential of about 400 cfs used primarily for irrigation purposes. Such diversions reduce local and regional surface water flow rates, which can adversely affect corresponding surface water hydrology if the actual diversion rates reflect a significant portion of available quantities of surface water from the springs, ponds, and streams. Historical levels of regional agricultural diversions are expected to continue through the reasonably foreseeable future. Further quantitative analysis has not been completed due to data limitations for historical agricultural diversions in the cumulative impacts analysis area. Corresponding impacts on surface water hydrology in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity. • <u>Irrigation return flows</u> – The return flows from agricultural irrigation activities can contain elevated levels of contaminants that can adversely affect the quality of surface water in a watershed. Contaminants can include nutrients, herbicides, insecticides, and other agrochemicals if used for crop production in the cumulative impacts analysis area. Water evaporation and transpiration by plants can also increase salinity in agricultural return flows. These collective contaminants can contribute to non-point-source pollution of surface water resources. Historical levels of regional irrigation activities and corresponding return flows are expected to continue through the reasonably foreseeable future. Quantitative analysis has not been completed due to data

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
		limitations for historical irrigation return flows and for the use and presence of the contaminants of concern in the cumulative impacts analysis area. Corresponding impacts on surface water quality in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity. • Livestock grazing – The grazing of livestock near springs, ponds, and streams can adversely affect surface water quality through increased sedimentation (from trampling and heavy grazing), increased levels of pathogenic microorganisms (from fecal deposits), and increased temperature (from vegetative defoliation and streambank widening). Historical levels of regional grazing activities are expected to continue through the reasonably foreseeable future. Quantitative analysis has not been completed due to data limitations for historical levels of the contaminants of concern in the cumulative impacts analysis area. Corresponding impacts on surface water quality in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity.
Air emissions and associated land uses/disturbance: **Colstrip Power Plant and Rosebud Power Plant**	Past, present, and RFA	The Colstrip Power Plant, located within the city of Colstrip, historically included power generation Units 1 and 2 that were retired from use in 2020, and now includes Units 3 and 4 that started operating in 1984 and 1986, respectively, and are anticipated to operate through at least 2042. The power plant currently exclusively uses coal from the Rosebud Mine (Areas B and F as of 2023). The Rosebud Power Plant, located about 6 miles north of the city of Colstrip, has been operating since 1990. Coal from all of the active permit areas is currently used in the plant. The Rosebud Power Plant currently exclusively uses coal from the Rosebud Mine; in 2023, coal combusted in the plant came from Area F (the project area) and Area B. The Rosebud Power Plant is expected to continue operations, using waste coal from Areas B and F through 2045 and 2039, respectively. The area of deposition of coal combustion emissions in soil and surface water around the Colstrip Power Plant and the Rosebud Power Plant is described in **Section 4.3, Air Quality** (see also **Section 3.7.1.2, Analysis Area** in the 2018 Final EIS). An analysis of potential effects on stream water quality from deposition from the Colstrip Power Plant and the Rosebud Power Plant was limited to mercury, selenium, copper, nitrate+nitrite, and total nitrogen. Other metals were not evaluated because the deposition areas for antimony, arsenic, cadmium, chromium, and lead were predicted to be very small. Historical levels of atmospheric deposition from the power plants are expected to continue through the reasonably foreseeable future. Following is a summary of corresponding cumulative impacts of atmospheric deposition from the Colstrip Power Plant and the Rosebud Power Plant on water quality of streams in the cumulative impacts analysis area (see **Section 4.7.3.3, Indirect Impacts, Surface Water Quality** for detailed quantitative analysis): • Sarpy Creek (mercury): Short-term, negligible to moderate, and adverse possible impacts. • Rosebud Creek (mercury and copper): Short-term, negligible to moderate, and adverse possible impacts. • West Fork Armells Creek (selenium): Short-term, negligible to moderate, and adverse possible impacts. • East Fork Armells Creek (selenium and copper): Long-term, negligible to moderate, and adverse possible impacts.
Climate change	Present and RFA	Climate change is anticipated to alter precipitation patterns and increase temperature and the frequency and intensity of wildfire over the long term, which is expected to adversely affect surface water quantity and quality in the cumulative impacts analysis area over the long term. Changes to these conditions are expected to proceed through the reasonably foreseeable future. Quantitative analysis has not been completed due to data limitations for long-term changes to those conditions in the cumulative impacts analysis area. Corresponding impacts on surface water quantity and quality in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity.

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Federal land management: **U.S. Department of the Interior –BLM**	Past, present, and RFA	Approximately 3 percent (50 square miles) of the cumulative impacts analysis area (1,500 square miles) is BLM land. The 2015 MCFO Approved Resource Management Plan (ARMP) includes a goal for water resources to maintain or enhance the beneficial uses of surface water and groundwater with objectives to support natural surface water flow regimes and to protect water resources from point-source and non-point-source pollution. The ARMP also includes the following management decisions related to water resources: • BLM activities conducted will meet or exceed Montana water quality standards. • Surface-disturbing activities are allowed in 100-year floodplains with specialized design features to minimize impacts on the functionality and resiliency of the floodplain in compliance with Executive Order 11988. • Surface-disturbing activities that do not benefit the functionality of the perennial or intermittent stream, lake, pond, or reservoir are allowed with specialized design features to ensure that all state water quality standards are met and that all beneficial uses remain fully supported. • Surface-disturbing activities are allowed within state-designated Source Water Protection Areas with specialized design features to minimize impacts on surface or groundwater quality. • Surface water impoundments are allowed with measures designed to maintain water quality, and riparian and watershed functionality and resiliency. • Oil and gas leasing is open and surface occupancy and use is prohibited on 100-year floodplains (NSO). • Oil and gas leasing is open and surface occupancy and use is prohibited on perennial or intermittent streams, lakes, ponds, and reservoirs. • Oil and gas leasing is open and surface occupancy and use is prohibited within state-designated Source Water Protection Areas. The 2024 MCFO Final EIS and RMP Amendment indicates that Federal coal would not be available for leasing within the MCFO planning area, except for in the existing Rosebud Mine that is within the cumulative impacts analysis area, and that: • Perennial streams are unacceptable for further consideration for coal leasing; therefore, there would be no impacts on those areas. • 100-year floodplains and alluvial valley floors are unsuitable for coal mining without exception. • All aquatic resources were removed from consideration for further coal leasing in the selected alternative. • Coal mines must comply with all state mining requirements, which include the Cumulative Hydrologic Impact Assessment. Under the 2024 MCFO Final EIS and RMP Amendment, Federal coal would not be available for leasing within the MCFO planning area, except for in the existing Rosebud Mine (for related cumulative impacts analysis, see discussion in this table below under “Water uses and discharges: Rosebud Mine”). Other actions on BLM-managed Federal lands in the near vicinity of the project area must be completed in compliance with the amended RMP and include the following: vegetation management, fire management, forestry, livestock grazing, recreation (trails and travel management), road maintenance, BLM-authorized rights-of-way for powerlines and pipelines, administration of coal leases and mineral material sites, land withdrawals, and land sales and exchanges. Of those actions, livestock grazing may contribute measurable impacts on surface water quality within the cumulative impacts analysis area, which would be long-term and adverse with an unidentified range of intensity (see discussion in this table above specific to livestock grazing under “Agriculture”).

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Water uses and discharges: **Rosebud Power Plant**	Past, present, and RFA	The Rosebud Power Plant uses deep groundwater wells as a source of water supply, which does not affect surface water resources in the cumulative impacts analysis area. The power plant, under the facility's MPDES Permit MT-0031780, can discharge surface water from a storm water control pond to an unnamed ephemeral tributary to the East Fork Armells Creek that is within the cumulative impacts analysis area. Any effluent discharge must meet effluent limitations and conditions specified in the MPDES Permit. Since the permit was issued in January 2016, there have been no recorded discharges of effluent from the facility (EPA 2024i). Any potential future discharge would likely result in minor flow increases in the unnamed tributary without adverse effects on surface water hydrology or water quality in the cumulative impacts analysis area.
Water uses and discharges: **Colstrip Power Plant**	Past, present, and RFA	The Yellowstone River diversion point associated with the 69 cfs water right dedicated to municipal and industrial purposes near Colstrip (e.g., the Colstrip Power Plant's industrial supply and the city of Colstrip's municipal supply) is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam. Based on USGS streamflow data at Forsyth (USGS 2024), Montana, the 69 cfs municipal/industrial water right represents a small percentage of flow in the river (see analysis and narrative in **Section 4.7.3.3, Indirect Impacts, Surface Water Hydrology**). The diversion currently withdraws an average of 0.7 percent of the estimated Yellowstone River flows, with a slightly higher (1.0) and lower (0.4) proportion of the total flow withdrawn in dry and wet years, respectively. The proportional impact of the water withdrawals on peak flows was 0.1 to 0.2 percent. In February, typically the month in which the Yellowstone River has the lowest flows on average, the water withdrawals would result in a 1.0 to 1.8 percent decrease in flows depending on the year type. The impact of the diverted water in June, the wettest month on average, would be a decrease in streamflow of 0.3 percent or less. When the single individual day with the lowest flow within the period of record from 2000 through 2023 was analyzed, the water withdrawal accounted for 3 percent of the estimated total flow in the Yellowstone River, upstream of the diversion point. Based on these analyses, streamflow in the Yellowstone River is minimally impacted by the water withdrawals for the Colstrip Power Plant, with each flow metric in average, dry, or wet years decreasing by less than 2 percent. The amount of water diverted cannot be differentiated from the natural variability in flow observed from day to day. The municipal/industrial water supply diverted from the Yellowstone River as described above is piped at a rate of up to 69 cfs to Castle Rock Lake near East Fork Armells Creek. Approximately 180 acre-feet per year (0.25 cfs) of water seeps continuously from Castle Rock Lake (DEQ 2016), contributing to a negligible increase in flow of East Fork Armells Creek. Raw water is conveyed from the lake to the Colstrip Power Plant's holding tanks and then treated and distributed for process use to the boilers, cooling towers as makeup water, bottom-ash systems, and scrubbers. Most of the facility's process water is used in the cooling-water systems. The power plant does not use any local surface or groundwater for its supply, and its closed-loop process system ensures that none of the process water is discharged to surface or groundwater. Historical operations of the power plant are expected to continue through the reasonably foreseeable future. Therefore, there are no corresponding impacts on local surface and groundwater resources. A local borrow area associated with the power plant is permitted (MPDES Permit MTR106638) for discharges of storm water from construction activities to Cow Creek in the Rosebud Creek watershed. No violations of corresponding effluent limitations have been identified since permit records began in 2021 (EPA 2024i). Corresponding impacts on surface water hydrology and quality in the cumulative impacts analysis area would be negligible.
Water uses and discharges: **Rosebud Mine, other coal mines in southeastern Montana, and gravel quarries**	Past, present, and RFA	**<u>Rosebud Mine</u>** Past and current coal mining activities at the Rosebud Mine (Areas A through E) are in various stages of operation, reclamation, or closure that affect surface water quantity and quality in the following watersheds: • Rosebud Creek watershed due to mining in Areas B, D, and E • East Fork Armells Creek watershed due to mining in Areas A, B, C, and D • West Fork Armells Creek watershed due to mining in Area C • Lee Coulee watershed due to mining in Area B (including AM5) • Richard Coulee watershed due to mining in Area B (AM5) • Cow Creek watershed due to mining in Areas D and E

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
		• Pony Creek and Spring Creek watersheds due to mining in Area D • Stocker Creek watershed due to mining in Areas A and C As described in the cumulative impacts section of the 2018 Final EIS for Area F, corresponding short-term and long-term adverse impacts on surface water quantity and quality include: • Removal of tributaries during mining • Changes to spring flows from groundwater drawdown • Changes to stream flows from groundwater drawdown and from filling of channels with more permeable unconsolidated materials postmining • Changes to surface water quantity from disturbance of the watershed and stream channels and from MPDES discharges and mine pit dewatering to streams • Changes to surface water quality from MPDES discharges and mine pit dewatering to streams and from changes in groundwater quality and runoff from mine roads and facilities • Changes to storm runoff from retention of runoff in sediment control ponds • Changes to the hydrologic balance from changes in topography postmining **Section 4.7.3.3, Indirect Impacts, Surface Water Hydrology** summarizes potential indirect effects from project area mining activities on Yellowstone River surface water hydrology, which would be negligible. Possible future coal mining and prospecting proposed by Westmoreland Rosebud would have similar impacts on surface water quantity and quality as described above for Rosebud Mine Areas A through E. Quantitative analysis has not been completed for future coal mining and prospecting because these actions are speculative at this time. Westmoreland Rosebud has three MPDES Permits that regulate point-source discharges of pollutants from various areas of the Rosebud Mine including MT-0031828 (Area F), MT-0023965 (Areas A through D), and MT-0032042 (Area B AM5). MPDES Permit MT-0031828 provides effluent limits for 55 outfalls to Trail Creek, McClure Creek, Robbie Creek, Donley Creek, and Black Hank Creek watersheds. MPDES Permit MT-0023965 provides effluent limits for 153 outfalls to East Fork Armells Creek, Stocker Creek, Lee Coulee, West Fork Armells Creek, Black Hank Creek, Donley Creek, Cow Creek, Spring Creek, and Pony Creek. MPDES Permit MT-0032042 provides effluent limits for 18 outfalls to Lee Coulee and Richard Coulee, which are both tributaries to Rosebud Creek. Discharges must meet effluent numeric and narrative limits to protect surface water quality and uses. In the past 10 years (2014-2024), effluent limitation exceedances were restricted to outfalls with discharges to East Fork Armells Creek, which included two violations (2020 and 2023) for total suspended solids and one violation (2017) for total iron (EPA 2024i). **<u>Other Coal Mines in Southeastern Montana</u>** The Big Sky Mine, located south of Rosebud Mine Area B, was operated by Peabody Energy from 1984 to 2003 and is now fully graded and revegetated. Past coal mining and reclamation activities at the Big Sky Mine affected surface water quantity and quality for the Lee Coulee, Miller Coulee, and Rosebud Creek watersheds, which are located within the cumulative impacts analysis area, as follows: • Removal of tributaries during mining • Changes to spring flows from groundwater drawdown • Changes to stream flows from groundwater drawdown and from filling of channels with more permeable unconsolidated materials postmining • Changes to surface water quantity from disturbance of the watershed and stream channels and from MPDES discharges and mine pit dewatering to streams • Changes to surface water quality from MPDES discharges and mine pit dewatering to streams and from changes in groundwater quality and runoff from mine roads and facilities • Changes to storm runoff from retention of runoff in sediment control ponds • Changes to the hydrologic balance from changes in topography postmining Impacts from the Big Sky Mine on surface water quantity and quality in the Lee Coulee, Miller Coulee, and Rosebud Creek watersheds would be similar to impacts from the Rosebud Mine Areas A through E (see previous section above).

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
		Gravel Quarries The cumulative impacts analysis area includes eight active gravel quarries with operating permits through DEQ's Opencut Mining Program, five of which are for mining scoria by Westmoreland Rosebud (used on road surfaces within the Rosebud Mine) that are authorized under Westmoreland Rosebud's existing Rosebud Mine operating permits. Historical levels of gravel quarrying activities are expected to continue through the reasonably foreseeable future. If located near a stream channel, the gravel quarries may contribute to cumulative impacts on surface water quantity (from excess precipitation runoff) and on surface water quality (from erosion, sedimentation, or inadvertent spills or releases of hazardous or deleterious substances such as petroleum products). Gravel quarry permits include a mining and reclamation plan specifying that surface and groundwater will be given appropriate protection from deterioration of water quality and quantity that could be caused by mining and reclamation activities. Quantitative analysis has not been completed due to data limitations for historical gravel quarry operations and any reported surface water discharges, spills, or releases in the cumulative impacts analysis area. Impacts from gravel quarries on surface water quality within the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity.
Water uses and discharges: **Colstrip Water Treatment Plant**	Past, present, and RFA	The Colstrip Water Treatment Plant supplies potable water to the city of Colstrip. The municipal water supply is sourced from the Yellowstone River from where it is piped to Castle Rock Lake near East Fork Armells Creek and then conveyed from the lake to the treatment plant. Impacts on surface water flow hydrology from the treatment plant's portion of diversions in the Yellowstone River within the cumulative impacts analysis area would be negligible (see discussion in this table above under "Water uses and discharges: Colstrip Power Plant"). Backwash from the potable water treatment plant is discharged back to Castle Rock Lake under the facility's MPDES Permit MT-0030422. There were no violations of effluent limitations over the past nine years (since September 2015), before which there were 52 effluent limit violations over eight years (between December 2007 and September 2015), with 16 violations for dissolved aluminum and 36 violations for total suspended solids (EPA 2024i). Laboratory tests associated with the 16 historical violations for dissolved aluminum included a range of concentrations from 0.13 mg/L to 12.3 mg/L (as compared to the effluent limitation of 0.12 mg/L). Laboratory tests associated with the 36 historical violations for suspended solids included a range of average concentrations from 51 mg/L to 113 mg/L (as compared to the average effluent limitation of 50 mg/L). These historical water quality violations have adversely affected the water quality of Castle Rock Reservoir, indicating a possible corresponding water quality impact in the cumulative impacts analysis area that is short-term, negligible to moderate, and adverse. The city of Colstrip is authorized to discharge from its wastewater treatment plant to East Fork Armells Creek pursuant to its MPDES Discharge Permit MT-0022373. The treatment plant operates at about 200,000 gallons per day, about one-third of the stated capacity (DEQ 2015d). There were no violations of effluent limitations over the past 17 years (since the earliest records were available in January 2007), and records indicate there was no discharge from the facility since January 2012 (EPA 2024i), but during historical operations, the treated effluent has caused increases in East Fork Armells Creek stream flow. Historical discharge rates and volumes are expected to continue through the reasonably foreseeable future. Quantitative analysis has not been completed due to data limitations for historical stream flow in East Fork Armells Creek. Impacts from wastewater treatment plant discharges on surface water hydrology within the cumulative impacts analysis area would be long-term and beneficial.

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Water uses and discharges: **Irrigation – golf course**	Past, present, and RFA	The nine-hole public golf course located adjacent to East Fork Armells Creek uses irrigation water to maintain the greens that is sourced from Colstrip's municipal water supply, which is piped from the Yellowstone River. Impacts on surface water flow hydrology from the golf course's portion of diversions in the Yellowstone River within the cumulative impacts analysis area would be negligible (see discussion in this table above under "Water uses and discharges: Colstrip Power Plant"). Historical levels of golf course irrigation activities are expected to continue through the reasonably foreseeable future. The portion of the irrigation water that is not consumed by evaporation and vegetative transpiration eventually reenters East Fork Armells Creek through surface water and groundwater return flows. The irrigation return flows can contain elevated levels of contaminants (nutrients, herbicides, and insecticides if used) that can adversely affect the water quality of the stream by contributing to non-point-source pollution of surface water resources. Quantitative analysis has not been completed due to data limitations for historical irrigation return flows and for the use and the potential presence of the contaminants of concern in the cumulative impacts analysis area. Corresponding impacts on surface water quality in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity.
Water uses and discharges: **Agricultural diversions**	Past, present, and RFA	The cumulative effects analysis area includes the Yellowstone River from the Cartersville Dam downstream to the confluence with the Tongue River. There are approximately 100 active surface water irrigation rights on the Yellowstone River within the cumulative effects analysis area with a cumulative maximum diversion potential of approximately 1,400 cfs (DNRC 2024). Approximately 70 of these water rights (1,100 cfs cumulative maximum diversion potential) are dedicated exclusively for irrigation purposes, including the largest three of those water rights (425 cfs, 144 cfs, and 109 cfs). The Yellowstone River diversion point associated with the 69 cfs water right dedicated to municipal and industrial purposes near Colstrip (e.g., city of Colstrip municipal supply and Colstrip Power Plant industrial supply) is downstream of the confluence with Armells Creek and upstream of the Cartersville Dam. Based on nearly five decades of USGS streamflow data at Forsyth, Montana (USGS 2024), average daily flow in the river during the irrigation season (May through September) ranged from 1,950 cfs (August 2001) to 97,000 cfs (May 1978) with an average daily flow of about 7,600 cfs during the month of August when river flow is usually at its lowest and irrigation activities are near their most active. The 1,100 cfs cumulative maximum irrigation diversion potential represents a wide percentage range of the average daily flow in the river during the irrigation season, from 1 percent at maximum recorded flow to 56 percent at minimum recorded flow and 14 percent at average flow in August. Historical levels of irrigation activities are expected to continue through the reasonably foreseeable future. Therefore, impacts on surface water flow hydrology from agricultural diversions in the Yellowstone River within the cumulative impacts analysis area would be long-term, negligible to moderate, and adverse.

Table 5.3-6. Water Resources – Surface Water: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Wildland fire and prescribed burns	Past, present, or RFA	Four wildland fires have historically occurred in the vicinity of the Rosebud Mine with a wide range of affected acreage: • In 2012, the McClure Creek Fire and Donley Creek Fire burned a total of 221 acres around the southern boundary of Rosebud Mine Areas B, C, and F. • In 2012, the Chalky Fire burned 131,000 acres south of Area B, including the majority of the AM5 area. • In 2021 (July), the Poverty Flats Fire burned 75,000 acres east of the project area in Big Horn County. • In 2021 (August), the Richard Spring Fire burned 171,130 acres near the Rosebud Mine, including nearly the entirety of the project area. Wildland fires can affect surface water hydrology through increased speed and volume of surface water runoff due to changes in land surface properties like decreased vegetative cover and increased water repellency, which can lead to flooding in the affected drainages. These conditions can affect surface water quality through increased erosion that can move debris, ash, sediment, nutrients, metals, and other pollutants from the land surface into stream drainages. Wildland fires can also destroy organic soil matter (such as vegetative roots) that helps hold it in place, thereby reducing the soil's ability to absorb and retain water and increasing the potential for soil erosion, mudslides, and landslides. Quantitative analysis has not been completed due to data limitations for the geographical extents of the historical wildland fires, the post-fire flood conditions, and the potential presence of the contaminants of concern in the cumulative impacts analysis area. Wildland fires are expected to continue through the reasonably foreseeable future. Therefore, impacts from wildland fires on surface water hydrology and surface water quality within the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity.

5.3.7 Water Resources – Groundwater

Cumulative effects on groundwater have been updated from those that were described in **Section 5.3.7** of the 2018 Final EIS, beginning on page 686; this section now incorporates information from the *Cumulative Hydrologic Impact Analysis for Area F* (DEQ 2019b), which is referred to as the CHIA. The analysis area for cumulative groundwater impacts comprises all of the Rosebud Mine, including areas previously and presently mined (**Figure 5.2-1**).

A review of groundwater level data from the various Rosebud Mine permit areas indicates that groundwater drawdown resulting from mine dewatering and removal of the Rosebud Coal does not extend any significant distance from each specific mined area. Groundwater drawdown does overlap between adjacent mine areas with little to no overlap between groundwater basins. For example, Area F is located within the West Fork Armells Creek groundwater basin, and therefore there is no interaction between the impacts on groundwater from Area B (as modified by AM5) and impacts from Area F. A possible action that could have cumulative impacts on project area groundwater conditions is continued mining in Area C, which is also located in the West Fork Armells Creek groundwater basin. Groundwater drawdown due to mining in Area C would overlap with drawdown created by mining in the project area. Monitoring well WR-231, screened in the project area Rosebud Coal, has shown groundwater declines of 10 to 15 feet in the southeastern portion of the project area, likely due to past and current mining in Area C. Westmoreland Rosebud did not mine any coal in Area C in 2023 (Westmoreland Rosebud 2024a). Because the total drawdown during mining would be limited by the depth of the Rosebud Coal and the coal would eventually be removed from the project area, there would not be any long-term cumulative impacts of overlapping drawdown cones from the two mined areas for what was previously the Rosebud Coal. It is likely there would be long-term (more than 50 years postmining) cumulative residual drawdown of between 5 and 10 feet in the McKay Coal in the southeast portion of the project area, extending into Area C.

Modeled drawdown in the Rosebud and McKay Coals conducted as part of the Alternative 2 analysis included approved past, ongoing, and future mining of Area A, B, and C and therefore quantitatively assessed the cumulative impacts for drawdown at end of mining (**Figures 108** and **109** of the 2018 Final EIS). The model is calibrated by an iterative process of comparing model results to measured water levels in monitoring wells, then adjusting model parameters to create a closer match. The calibrated steady-state model is then used to simulate the mining progress using a transient simulation, which adds in mining passes year by year according to the actual history of mining for the past and the permitted mining plan for the future. After each pass is mined, the model parameters are changed in that area to represent the spoil. The results of the transient simulation are the groundwater levels for each year from the 1970s to the end of mining. A 50-year simulation models the postmining recovery period. The water levels for each year are subtracted from the pre-mining water level to give the drawdown, or reduction in water levels due to mining. As reported in the CHIA (DEQ 2019b), drawdown caused by mining in western portion of Area C will overlap with drawdown from Area F to cumulatively create greater drawdown near the shared boundary between the two mine areas. Spoil groundwater from a small area at the westernmost end of the western portion of Area C is predicted to flow northwest, through a portion of Area F, where it will have cumulative impacts on groundwater quality with Area F spoil groundwater. Additionally, postmining water quality impacts of Area C and Area F spoil groundwater on alluvial groundwater have cumulative impacts in the West Fork Armells Creek alluvial groundwater downgradient from Robbie Creek, although as described in Section 9.6.3.6 of the CHIA, Area C impacts are predicted to not be measurable at the confluence.

Areas A, B, D, and E, where past and present mining has occurred, are too distant to affect groundwater levels in the project area or to overlap off-site groundwater drawdown. Any impacts on water quality from resaturating spoil in the other mine areas, including any mine expansion, would be seen in East Fork

Armells Creek or in tributaries to Rosebud Creek. Any potential cumulative impact on project area water quality would occur downstream of the confluence of the East and West Forks of Armells Creek. However, at that distance from the mined areas, any effect on baseflow water quality would be long-term but have negligible adverse impacts. There would not be any cumulative groundwater quality impacts from project area operations within the Rosebud Creek watershed.

Other past, present, and future mining activities in southeastern Montana, as described in **Table 5.2-1**, are too distant to have any cumulative impact with respect to groundwater level changes in the project area.

5.3.8 Water Resources – Water Rights

Cumulative effects on water rights would be similar to those described in **Section 5.3.8** of the 2018 Final EIS, beginning on page 687. However, similar to the surface water discussion, this discussion has been supplemented to include a discussion of surface water rights within a larger analysis area. The cumulative impacts analysis area for water rights includes the watersheds in which either direct or indirect impacts on water rights may be expected to occur, including the Sarpy Creek, Armells Creek, and Rosebud Creek watersheds and the reach of the Yellowstone River between the Cartersville Dam and the confluence with the Tongue River.

Related past, current, and future actions (described in **Table 5.2-1**) that would affect groundwater rights include:

- Past, present, and future mine activities in the analysis area
- The use of groundwater for agricultural purposes, particularly livestock watering

Other mine activities and agricultural use of groundwater resulting in groundwater drawdown in area wells may result in long-term, negligible to major, adverse impacts on existing groundwater rights. Water for livestock is the most common use of spring and shallow groundwater in the cumulative hydrologic impact area. As part of the CHIA (DEQ 2019b), groundwater and spring users were identified within 3 miles downgradient and 1 mile in all other directions of Area F, and where the cumulative hydrologic impact area extended further from the mine, the boundaries of the water user search area was extended to include all of the cumulative hydrologic impact area. This represents a larger search area than summarized for Alternative 4, which limited the area to the analysis area (i.e. the model-predicted drawdown area). Therefore, Table 8-2 and 8-3 of the CHIA (DEQ 2019b) also contain additional cumulative analysis of water rights impacts for spring and groundwater that incorporate impacts related to Area C.

Table 5.3-7 summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect surface water resources and, consequently, surface water rights in the analysis area.

Table 5.3-7. Water Resources – Surface Water Rights: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Impacts from agricultural activities on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quantity and quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Air emissions and associated land uses/disturbance: **Colstrip Power Plant and Rosebud Power Plant**	Past, present, and RFA	Impacts from the Colstrip Power Plant's and Rosebud Power Plant's air emissions on surface water rights in the cumulative impacts analysis area would be short-term and long-term, negligible to moderate, and adverse, consistent with corresponding surface water quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Climate change	Present and RFA	Impacts from climate change on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quantity and quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.

Table 5.3-7. Water Resources – Surface Water Rights: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Federal land management: **U.S. Department of the Interior –BLM**	Past, present, and RFA	Impacts from Rosebud Mine activities under BLM management on surface water rights in the cumulative impacts analysis area would include short-term and long-term adverse impacts, consistent with corresponding surface water quantity and quality impacts described in **Section 5.3.6, Water Resources – Surface Water**. Impacts from livestock grazing activities on lands under BLM management on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Water uses and discharges: **Colstrip Power Plant**	Past, present, and RFA	Impacts from the Colstrip Power Plant's portion of diversions in the Yellowstone River on surface water rights in the cumulative impacts analysis area would be negligible, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**. Impacts from Castle Rock Lake's seepage in East Fork Armells Creek on surface water rights in the cumulative impacts analysis area would be negligible, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**. There would be no impacts from the Colstrip Power Plant's operations on local surface water rights in the cumulative impacts analysis area, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**. Impacts from the Colstrip Power Plant's borrow area's Cow Creek storm water discharges on surface water rights in the cumulative impacts analysis area would be negligible, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**.
Water uses and discharges: **Rosebud Mine, other coal mines in southeastern Montana, and gravel quarries**	Past, present, and RFA	Impacts from Rosebud Mine and Big Sky Mine activities on surface water rights in the cumulative impacts analysis area would include short-term and long-term adverse impacts, consistent with corresponding surface water quantity and quality impacts described in **Section 5.3.6, Water Resources – Surface Water**. Impacts from gravel quarry activities on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Water uses and discharges: **Colstrip Water Treatment Plant**	Past, present, and RFA	Impacts from the Colstrip Water Treatment Plant's portion of diversions in the Yellowstone River on surface water rights in the cumulative impacts analysis area would be negligible, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**. Impacts from Colstrip's Wastewater Treatment Plant's East Fork Armells Creek discharges on surface water rights in the cumulative impacts analysis area would be long-term and beneficial, consistent with corresponding surface water quantity impacts described in **Section 5.3.6, Water Resources – Surface Water**.

Table 5.3-7. Water Resources – Surface Water Rights: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Water uses and discharges: **Irrigation – golf course**	Past, present, and RFA	Impacts from the nine-hole public golf course's portion of diversions in the Yellowstone River on surface water rights in the cumulative impacts analysis area would be negligible, consistent with the corresponding description provided in **Section 5.3.6, Water Resources – Surface Water**. Impacts from the nine-hole public golf course's East Fork Armells Creek irrigation return flows on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Water uses and discharges: **Agricultural diversions**	Past, present, and RFA	Impacts from agricultural diversions on the Yellowstone River on surface water rights in the cumulative impacts analysis area would be long-term, negligible to moderate, and adverse, consistent with corresponding surface water quantity impacts described in **Section 5.3.6, Water Resources – Surface Water**.
Wildland fire and prescribed burns	Past, present, and RFA	Impacts from wildland fires on surface water rights in the cumulative impacts analysis area would be long-term and adverse with an unidentified range of intensity, consistent with corresponding surface water quantity and quality impacts described in **Section 5.3.6, Water Resources – Surface Water**.

5.3.9 Vegetation

Cumulative effects on vegetation would be similar to those described in **Section 5.3.9** of the 2018 Final EIS, beginning on page 688. The analysis area for evaluation of cumulative impacts on vegetation includes all permit areas of the Rosebud Mine, including past and ongoing mining areas, and the region surrounding the Rosebud Mine (**Figure 5.2-1**). **Table 5.3-8** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect vegetation in the analysis area.

Table 5.3-8. Vegetation: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Agricultural development in the area consists mostly of cropland, pastureland, and grazing lands. Continued agricultural use would alter vegetation in areas adjacent to the mine and increase introduced species and noxious weeds to the area.
Alternative energy and transmission development and infrastructure	Past, present, and RFA	Alternative energy and transmission development and infrastructure projects in the analysis area include the Clearwater Wind project, the Clearwater to Colstrip Transmission Line project, and the North Plains Connector Power Transmission Line. These projects would result in surface disturbance that would affect vegetation, and loss of vegetation due to the proposed expansion of the project area would contribute to the adverse impacts of vegetation loss from past and future land disturbance associated with construction of alternative energy and transmission development.
Rosebud Mine (other permit areas) and other mines (coal and gravel)	Past, present, and RFA	Past and current coal and gravel mining and reclamation by Westmoreland and coal mining by other companies in southeast Montana could affect vegetation in ways similar to those described for the project area. Mining activity through 2023 has disturbed 19,062 acres at the Rosebud Mine. Past surface disturbances at the Rosebud Mine and other mines are summarized and quantified to the extent practicable in **Table 2.2-3** and **Table 5.2-1**. These actions are expected to continue in the foreseeable future and could have adverse impacts on vegetation. Westmoreland Rosebud plans to avoid mining through many drainage bottoms in the project area (all alternatives). Preservation of these drainage bottoms would create islands of native plants and seed sources within the project area and would reduce the impact on wetland and woody draw communities. Because this approach would be a change from the mining practices in other permit areas of the Rosebud Mine, the project area would be expected to have different impacts on vegetation than past mining activities (in other permit areas). Past and current coal-mining activities have altered the vegetation communities in the region. Vegetation cover and diversity in disturbed areas have decreased. The temporary loss of vegetation, reduction in vegetation diversity, and changes in species composition during mining activities in the project area would contribute to regional cumulative impacts on vegetation. Area F would contribute short-term, moderate, adverse cumulative impacts on vegetation from removal of vegetation for mining activities. Area F would also contribute long-term, minor, adverse cumulative impacts on vegetation due to decreased vegetation vigor and diversity and due to the potential for changes to vegetation communities from the reduced amount of surface and groundwater in the area. Overall, when combined with other past, present, and reasonably foreseeable future actions, Area F (all alternatives) would have a long-term, minor to moderate, adverse impact on vegetation.

Table 5.3-8. Vegetation: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Coal combustion	Past, present, and RFA	Development of the power plants resulted in loss of vegetation due to land disturbances. Loss of vegetation due to the proposed expansion of the project area would contribute to the adverse impacts of vegetation loss from past and future land disturbance associated with construction of infrastructure. Trace-metal, SO_2, and NO_2 deposition in the analysis area from past and present combustion of Rosebud Mine coal at the Colstrip and Rosebud Power Plants may have adverse impacts on vegetation within a 32-km radius around the power plants (see Section **4.3**, **Air Quality** and **Section 4.24, Soil**). Deposition of trace metals, SO_2, and NO_2 continue to have long-term, minor, adverse cumulative vegetation impacts (due to soil impacts).
Federal land management – BLM and Forest Service	Past, present, and RFA	BLM-authorized actions in the near vicinity of the project area, such as rights-of-way for powerlines and pipelines, coal leases, mineral material sites, land withdrawals, and land sales and exchanges, may result in vegetation loss from new infrastructure development. However, BLM's MCFO RMP includes implementation of conservation measures and protection of wetland and riparian areas for BLM-authorized projects, resulting in a beneficial contribution to vegetation in those areas. Cumulative impacts resulting from these Federal land management activities were considered in the 2018 Final EIS (see **Section 5.3.9**). Since that time, the BLM has issued an SEIS for the MCFO RMP and indicated selection of Alternative D, which would disallow new leasing of the Federal coal estate in the MCFO planning area. Without the opportunity to develop new coal leases, there would be no additional impacts on vegetation related to coal leasing. Actions on the Custer Gallatin Forest that could impact vegetation include management actions such as controlled burns, which would result in beneficial effects on vegetation.
Wildland fire	Past, present, and RFA	Wildland fire affects vegetation through plant mortality, loss of seed sources, and altering of vegetation communities (including community structure and vegetation patterns). Past wildland fires altered or eliminated vegetation composition in the burn areas and likely reduced tree and shrub cover within those areas. Wildland fires can potentially increase introduced or noxious weed species if a seed source for those invasive species is present. Wildland fires can also remove existing invasive species and allow for an increase in native species or new vegetation communities, such as that of the conifer/sumac complex present in the project area. Fires also can add nutrients to the soil for vegetation and kill insect pests that may be killing native vegetation. Fires are part of the natural ecosystem, and many native plant communities are accustomed to periodic fires. Periodic wildland fires could contribute both beneficial and adverse cumulative impacts on vegetation.
Climate change	Past, present, and RFA	Climate change is anticipated to increase the frequency and intensity of wildfire, alter precipitation patterns, and increase temperature, which is expected to impact vegetation resources. Climate change may also contribute to exacerbating the potential impacts of the proposed project on these resources.

5.3.10 Wetlands and Riparian Zones

Cumulative effects on wetlands would be similar to those described in **Section 5.3.10** of the 2018 Final EIS, beginning on page 690. The analysis area for evaluation of cumulative impacts on wetlands includes all permit areas of the Rosebud Mine, including past and ongoing mining areas, and the region surrounding the Rosebud Mine (**Figure 5.2-1**). **Table 5.3-9** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect wetlands in the analysis area.

Table 5.3-9. Wetlands: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Agricultural development in the area consists mostly of cropland, pastureland, and grazing lands. Past livestock grazing has destabilized stream channels and disturbed spring and wetland areas. Continued agricultural development would alter wetlands adjacent to the mine and decrease the functions and values of surrounding wetlands.
Alternative energy and transmission development and infrastructure	Past, present, and RFA	Alternative energy and transmission development and infrastructure projects in the analysis area include the Clearwater Wind project, the Clearwater to Colstrip Transmission Line project, and the North Plains Connector Power Transmission Line. These projects would result in surface disturbance that could affect wetlands. Wetland impacts due to the proposed expansion of the project area would contribute to the adverse impacts of wetland loss from past and future land disturbance associated with construction of alternative energy and transmission development. Impacts from these activities are described qualitatively due to a lack of available data.
Rosebud Mine (other permit areas) and other coal mines	Past, present, and RFA	Past and current coal mining and reclamation at the Rosebud Mine, Absaloka Mine, and Big Sky Mine have likely affected wetlands in ways similar to those described for the Proposed Action (see **Section 4.11, Wetlands and Riparian Zones**). These actions are expected to continue into the foreseeable future and would have adverse impacts on wetlands. Expansion of the Rosebud Mine Area B (pursuant to approved AM5) will have direct long-term impacts on 1.93 acres of wetlands and indirect impacts on 3.13 acres of freshwater ponds and 0.40 acre of downstream wetlands shown on NWI mapping. A wetland mitigation plan is being implemented as Area B is mined to restore wetland functions and values in Area B. Alternative 4 would contribute long-term adverse cumulative impacts on wetlands that would range from minor to moderate. This would occur due to changes in or loss of hydrology, which may adversely affect wetlands. Alternative 4 would also contribute short-term and long-term adverse cumulative impacts on wetlands due to surface disturbances. Overall, when combined with other past, present, and reasonably foreseeable future actions, Alternative 4 would have a long-term, minor to moderate, adverse cumulative effects on wetlands.
Gravel quarry operations	Past, present, and RFA	Gravel quarry operations may have resulted in wetland loss due to land disturbances. Loss of wetlands due to the proposed expansion of the project area would contribute to the adverse impacts of vegetation loss from past and future land disturbance associated with gravel mining. Impacts from these activities are described qualitatively due to lack of available data on past impacts on wetlands from gravel quarries in the analysis area.

Table 5.3-9. Wetlands: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Water use and discharge	Past, present, and RFA	Water uses and discharges have the potential to affect wetlands in the analysis area. Water is discharged from a storm-water control pond at the Rosebud Power Plant to an unnamed ephemeral tributary to the East Fork Armells Creek. The city of Colstrip is authorized to discharge from its wastewater treatment plant to East Fork Armells Creek pursuant to its MPDES discharge permit. As described in **Section 3.7, Water Resources – Surface Water**, there have been no recent effluent violations from the wastewater treatment plant to the creek, but the treated effluent causes changes in stream flow and water quality. The nine-hole public golf course is located adjacent to East Fork Armells Creek about a mile downstream of the city of Colstrip. Water used to maintain the greens infiltrates into the creek, likely causing undefined changes in water level and water quality. Changes in water flows could result in changes to wetland habitat along creek banks and result in a reduction of wetland functions or may provide water to support and/or expand wetland functions.
Wildland fire	Past, present, and RFA	Past and future fires, both wildland fire and prescribed burns, have affected and will affect wetlands mainly through alteration or reduction of wetland habitat, depending on the severity of the fire. During the 2012 wildland fire season, the McClure Creek and Donley Creek fires burned 221 acres on and around the southern boundary of the Rosebud Mine Areas B, C, and F, potentially affecting wetland habitat.
Climate change	Past, present, and RFA	Climate change is anticipated to increase the frequency and intensity of wildfire, alter precipitation patterns, and increase temperature, which is expected to impact wetland resources. Future climate change may result in changes in timing of runoff in streams in the western United States, including a reduction in flows in summer that may result in loss of riparian forests and wetlands region-wide. Changes in water flows may result in changes to wetland habitat along creek banks and result in a reduction of wetland functions. Climate change may also contribute to exacerbating the potential impacts of the proposed project on these resources. Impacts from climate change are described qualitatively due to uncertainty about the timing and magnitude of these impacts.

5.3.11 Fish and Wildlife Resources

Cumulative effects on fish and wildlife would be similar to those described in **Section 5.3.11** of the 2018 Final EIS, beginning on page 691. The analysis area for evaluation of cumulative impacts on fish and wildlife includes all permit areas of the Rosebud Mine, including past and ongoing mining areas, and the region surrounding the Rosebud Mine (**Figure 5.2-1**). **Table 5.3-10** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect fish and wildlife in the analysis area.

Table 5.3-10. Fish and Wildlife: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Agricultural development in the area consists mostly of cropland, pastureland, and grazing lands. Continued agricultural development would alter habitat in areas adjacent to the mine. Wildlife is often displaced when native habitat is converted to cropland or pastureland. Grazing also affects wildlife habitat because livestock compete with native herbivores such as deer and elk. Loss of wildlife habitat and displacement of wildlife due to mining operations in the project area would contribute to regional cumulative impacts on wildlife habitat and populations.
Alternative energy and transmission development and infrastructure	Past, present, and RFA	Alternative energy and transmission development and infrastructure projects in the analysis area include the Clearwater Wind project, the Clearwater to Colstrip Transmission Line project, and the North Plains Connector Power Transmission Line. These projects would result in surface disturbance that could affect fish and wildlife habitat. Impacts on fish and wildlife from the proposed expansion of the project area would contribute to the adverse impacts of habitat loss from past and future land disturbance associated with construction of alternative energy and transmission development. Impacts from these activities are described qualitatively due to a lack of available data.
Actions by Federal land management agencies	Past, present, and RFA	BLM-authorized actions in the near vicinity of the project area, such as rights-of-way for powerlines and pipelines, coal leases, mineral material sites, land withdrawals, and land sales and exchanges, may result in habitat loss and fragmentation from new infrastructure development. However, BLM's ARMP also includes implementation of conservation and habitat protection of wetland and riparian areas. Displacement of wildlife from ongoing energy and mineral development and other actions on federally managed lands in the analysis area in combination with the Proposed Action may increase competition in available habitat containing sensitive resources.
Hunting	Past, present, and RFA	Regulated hunting generally does not significantly impact wildlife populations. Many state and Federal agencies use hunting as a management tool to control populations, reduce the spread of disease, produce maximum yield for hunters, reduce intra- and inter-species competition, and reduce damage caused by overpopulation of a species (Conover 2001). Hunting is allowed on inactive areas of the Rosebud Mine. Most large game that are hunted in the area (deer, elk, and pronghorn) appear to have relatively stable populations and have not been reduced in the past by hunting pressure (ICF International (ICF) 2013). Under the Proposed Action, some wildlife would be displaced. The possible shift of movement patterns, especially for large game, may affect the yield from hunting.

Table 5.3-10. Fish and Wildlife: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas) and other mines (coal and gravel)	Past, present, and RFA	Past and current coal mining and reclamation at the Rosebud Mine, Absaloka Mine, and Big Sky Mine have likely affected fish and wildlife in ways similar to those described for the Proposed Action (see **Section 4.12, Fish and Wildlife Resources**). Infrastructure associated with mining including roads and fencing further divides habitat and creates barriers to wildlife movement. Railroad construction results in surface disturbance, increased human presence during construction, and habitat fragmentation. Loss of wildlife habitat and displacement of wildlife due to mining operations in the project area would contribute to habitat losses and displacement impacts from past and future land disturbance associated with construction of infrastructure. Mining activity through 2023 has disturbed 19,062 acres at the Rosebud Mine. Past, present, and RFA mining activities in Area B AM5 would impact 2,658 acres of wildlife habitat. Past surface disturbances at the Rosebud Mine are summarized in **Table 2.2-3**. Disturbances at other mines are summarized and quantified to the extent practicable in **Table 5.2-1**. These actions are expected to continue into the foreseeable future and would have adverse impacts on wildlife and wildlife habitat. Alternative 4 would contribute long-term adverse cumulative impacts on wildlife that would range from minor to moderate. This would occur due to changes in or loss of hydrology, which may adversely affect fish and wildlife habitat. Alternative 4 would also contribute short-term and long-term adverse cumulative impacts on wildlife habitat due to surface disturbances. Overall, when combined with other past, present, and reasonably foreseeable future actions, Alternative 4 would have a long-term, minor to moderate, adverse cumulative effects on fish and wildlife habitat.
Power plant operations and rail transport	Past, present, and RFA	Power plant operation (coal combustion) and rail transport have resulted in habitat loss or fragmentation due to land disturbances. Railroad construction results in surface disturbance, increased human presence during construction, and habitat fragmentation. Loss of wildlife habitat and displacement of wildlife due to mining operations in the project area would contribute to habitat losses and displacement impacts from past and future land disturbance associated with construction of infrastructure.
Wildland fire	Past, present, and RFA	Wildland fire affects wildlife mainly through alteration of habitat. The severity of the impacts on wildlife depends on the extent of habitat change from fire. Fires in forested areas usually cause more drastic alterations to habitat and associated fauna than those that occur in grasslands (Smith 2000). Certain studies suggest that direct mortality from fires is relatively low. Large, mobile animals and birds are capable of fleeing rather quickly. Smaller species may seek refuge under debris or in burrows (Kennedy and Fontaine 2009). Smith (2000) suggests that fire “reorganizes” animal communities because of alteration of habitat. Following some fires, generalist species may recolonize the burn area or move to adjacent unburned habitats. Generalist species may simply move to another habitat type that was not affected (e.g., breeding shrubland birds may move to grassland habitat) (Smith 2000). Some predators and raptors may benefit from fires exposing potential prey. Past wildland fires likely changed or eliminated habitat components in the burn areas and may have prevented or altered use by certain species. Periodic wildland fires would contribute both positive and negative cumulative impacts on regional wildlife.

Table 5.3-10. Fish and Wildlife: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Climate change	Past, present, and RFA	Climate change is anticipated to increase the frequency and intensity of wildfire, alter precipitation patterns, and increase temperature, which is expected to impact fish and wildlife habitat. Future climate change may result in changes in timing of runoff in streams in the western United States, including a reduction in flows in summer that may result in changes to habitat for species that rely on aquatic, riparian, or wetland habitats region-wide. Changes in precipitation patterns, increased drought and extreme weather events, and increased frequency of wildland fires may result in long-term changes to terrestrial wildlife habitat. Climate change may also contribute to exacerbating the potential impacts of the proposed project on these resources. Impacts from climate change are described qualitatively due to uncertainty about the timing and magnitude of these impacts.

5.3.12 Special Status Species

Cumulative effects on special status species would be similar to those described in described in **Section 5.3.12** of the 2018 Final EIS, beginning on page 693. The analysis area for evaluation of cumulative impacts on special status species is the same as described for indirect effects (**Figure 3.13-3**). **Table 5.3-11** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect fish and wildlife in the analysis area.

Table 5.3-11. Special Status Species: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Agricultural development in the area consists mostly of cropland, pastureland, and grazing lands. Continued agricultural development would alter habitat in areas adjacent to the mine. Wildlife is often displaced when native habitat is converted to cropland or pastureland. Grazing also affects wildlife habitat because livestock compete with native herbivores such as deer and elk. Loss of wildlife habitat and displacement of special status species due to mining operations in the project area would contribute to regional cumulative impacts on special status wildlife and plant species habitat and populations.
Alternative energy and transmission development and infrastructure	Past, present, and RFA	Alternative energy and transmission development and infrastructure projects in the analysis area include the Clearwater Wind project, the Clearwater to Colstrip Transmission Line project, and the North Plains Connector Power Transmission Line. These projects would result in surface disturbance that could affect habitat for special status species. Impacts on special status species from the proposed expansion of the project area would contribute to the adverse impacts of habitat loss from past and future land disturbance associated with construction of alternative energy and transmission development. Impacts from these activities are described qualitatively due to a lack of available data.
Actions by Federal land management agencies	Past, present, and RFA	BLM-authorized actions in the near vicinity of the project area, such as rights-of-way for powerlines and pipelines, coal leases, mineral material sites, land withdrawals, and land sales and exchanges, may result in habitat loss and fragmentation from new infrastructure development. However, the BLM's ARMP also includes implementation of conservation and habitat protection of wetland and riparian areas and for the greater sage-grouse, resulting in a beneficial contribution to species that inhabit wetlands and riparian habitat, and to grasslands and shrublands associated with greater sage-grouse habitat. Displacement of natural resources, including special status species, from ongoing energy and mineral development and other actions on federally managed lands in the analysis area and the project area may increase competition in available habitat containing sensitive resources.

Table 5.3-11. Special Status Species: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas) and other mines (coal and gravel)	Past, present, and RFA	Past and current coal mining and reclamation at the Rosebud Mine, Absaloka Mine, and Big Sky Mine have likely affected fish and wildlife in ways similar to those described for the Proposed Action (see **Section 4.13, Special Status Species**). Infrastructure associated with mining including roads and fencing further divides habitat and creates barriers to wildlife movement. Railroad construction results in surface disturbance, increased human presence during construction, and habitat fragmentation. Loss of habitat and displacement of special status species due to mining operations in the project area would contribute to habitat losses and displacement impacts from past and future land disturbance associated with construction of infrastructure. Mining activity through 2023 has disturbed 19,062 acres at the Rosebud Mine. Past, present, and RFA mining activities in Area B AM5 would impact 2,658 acres of habitat for special status species. Past surface disturbances at the Rosebud Mine are summarized in **Table 2.2-3**. Disturbances at other mines are summarized and quantified to the extent practicable in and **Table 5.2-1**. These actions are expected to continue into the foreseeable future and would have adverse impacts on special status species and their habitat. Alternative 4 would contribute long-term adverse cumulative impacts on special status species that would range from minor to moderate. This would occur due to changes in or loss of hydrology, which may adversely affect habitat for special status species. Alternative 4 would also contribute short-term and long-term adverse cumulative impacts on special status species due to surface disturbances. Overall, when combined with other past, present, and reasonably foreseeable future actions, Alternative 4 would have long-term, minor to moderate, adverse cumulative effects on special status species and their habitat.
Power plant operations and rail transport	Past, present, and RFA	Power plant operation (coal combustion) and rail transport have resulted in habitat loss or fragmentation due to land disturbances. Railroad construction results in surface disturbance, increased human presence during construction, and habitat fragmentation. Loss of habitat and displacement of special status species due to mining operations in the project area would contribute to habitat losses and displacement impacts from past and future land disturbance associated with construction of infrastructure.
Water use and discharges	Past, present, and RFA	Changes in surface water flow and water quality from water use and discharges from the Rosebud and Colstrip Power Plants, the Rosebud Mine, and agricultural activities could affect aquatic special status species. Potential effects on special status species such as pallid sturgeon could include altered spawning movements and behavior, changes in sediment transport and resulting formation and maintenance of aquatic habitat, and changes in turbidity, which could affect feeding efficiency and vulnerability to predators. Changes in stream flows could also result in lower temperatures, changes in dissolved oxygen, and changes in pollutant concentrations. Continued diversion of 69 cfs from the Yellowstone River due to Colstrip Power Plant operations would contribute to cumulative effects on special status species, but the effects are not expected to be discernable.

Table 5.3-11. Special Status Species: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Wildland fire	Past, present, and RFA	Wildland fire affects special status species mainly through alteration of habitat. The severity of the impacts on special status species depends on the extent of habitat change from fire. Fires in forested areas usually cause more drastic alterations to habitat and associated fauna than those that occur in grasslands (Smith 2000). Certain studies suggest that direct mortality from fires is relatively low. Large, mobile animals and birds are capable of fleeing rather quickly. Smaller species may seek refuge under debris or in burrows (Kennedy and Fontaine 2009). Smith (2000) suggests that wildland fire "reorganizes" animal communities because of alteration of habitat. Following some fires, generalist species may recolonize the burn area or move to adjacent unburned habitats. Some special status predators and raptors may benefit from fires exposing potential prey. Past fires likely changed or eliminated habitat components in the burn areas and may have prevented or altered use by certain species. Periodic wildland fires would contribute both positive and negative cumulative impacts on regional special status species.
Climate change	Past, present, and RFA	Climate change is anticipated to increase the frequency and intensity of wildfire, alter precipitation patterns, and increase temperature, which is expected to impact habitat for special status species. Future climate change may result in changes in timing of runoff in streams in the western United States, including a reduction in flows in summer that may result in changes to habitat for species that rely on aquatic, riparian, or wetland habitats region-wide. Changes in precipitation patterns, increased drought and extreme weather events, and increased frequency of wildland fires may result in long-term changes to terrestrial special status species habitat. Climate change may also contribute to exacerbating the potential impacts of the proposed project on these resources. Impacts from climate change are described qualitatively due to uncertainty about the timing and magnitude of these impacts.

5.3.13 Cultural and Historic Resources

Cumulative effects on cultural and historic resources would be similar to those described in **Section 5.3.13** of the 2018 Final EIS, beginning on page 695. The analysis area for evaluation of cumulative impacts on cultural and historical resources includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure 5.2-1**). **Table 5.3-12** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect cultural and historic resources in the analysis area.

Table 5.3-12. Cultural and Historic Resources: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Past, present, and reasonably foreseeable agricultural development of surrounding lands has the potential to result in ground disturbances and may affect the integrity of buried archaeological sites as well as known and unknown historic properties.
Rosebud Mine (other permit areas)	Past, present, and RFA	Past, ongoing, and future mining within the Rosebud Mine may result in adverse cumulative impacts on historic properties. Ground disturbances from mining activities may uncover buried archaeological sites and adversely affect known and unknown historic properties. Other potential future development of the Rosebud Mine would also cause ground disturbances, potentially resulting in long-term moderate cumulative impacts on historic properties. Any actions would be subject to Section 106 compliance and the stipulations of the Programmatic Agreement (PA) to consider potential impacts on historic properties. Mining within the project area would have long-term, moderate, and adverse cumulative impacts, but these adverse impacts would be resolved through treatment proposed under the Memorandum of Agreement and through continued Section 106 compliance as stipulated in the PA (**Appendix H** in the 2018 Final EIS).
Wildland fire	Past, present, and RFA	Past and future wildland fires in and around the project area have had and will continue to have the potential to destroy historic artifacts and properties, resulting in cumulative impacts on cultural resources.

5.3.14 Socioeconomic Conditions

Cumulative effects on socioeconomics have been updated from those described in **Section 5.3.14** of the 2018 Final EIS, beginning on page 696, to incorporate a new IMPLAN analysis completed for the SEIS (**Appendix 4**). The analysis area for evaluation of cumulative impacts on socioeconomic resources includes Rosebud, Treasure, and Big Horn Counties (**Figure 3.15-1**). **Table 5.3-13** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect socioeconomic resources in the analysis area.

Table 5.3-13. Socioeconomics: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Past and ongoing mining at the Rosebud Mine has resulted in the loss of potential agricultural lands and economic productivity associated with agriculture. This loss impacts local farmers and ranchers relying on agriculture as a source of livelihood. However, this loss of potential agricultural lands is temporary, as mined areas are reclaimed and returned to postmining land use. For example, reclaimed areas are available for grazing as soon as the vegetation is established and a management unit is large enough to support appropriate numbers of livestock. This reclamation process helps restore agricultural productivity, which is vital for the local economy. In the near future, as more reclaimed lands become available for grazing and other agricultural uses, these communities can regain and potentially enhance their agricultural productivity, mitigating some of the economic disruptions caused to agriculture by mining activities.
Rosebud Mine (other permit areas)	Past, present, and RFA	Renewable energy development could offer additional opportunities for EJ populations and serve as mitigation for the direct and indirect disproportionate loss of economic activities associated with reduced activities at the mine. Projects like the Clearwater Wind Project, which began operations in November 2022 and can produce up to 750 megawatts, provide substantial job creation during both construction and operational phases. These projects diversify the local economy, reducing reliance on coal mining, lessening the negative economic effects on businesses both related and unrelated to energy development, and generate revenue that can be reinvested into local infrastructure, schools, and social services. Moreover, renewable energy projects contribute to environmental and health benefits by reducing pollution and GHG emissions, leading to improved air quality and health outcomes for EJ populations. The development of renewable energy also aligns with sustainable development goals, ensuring long-term economic and environmental resilience. By creating new employment opportunities, fostering economic diversification, and improving community investments, renewable energy projects can significantly enhance the socio-economic conditions and quality of life for EJ communities, particularly those adversely affected by the decline in mining activities.
Colstrip Power Plant	Past, present, and RFA	The retirement of Colstrip Power Plant Units 1 and 2 in January 2020 occurred earlier than anticipated in the 2018 Final EIS, resulting in reduced power generation and associated revenues for the local economy. Units 3 and 4 are anticipated to operate through at least 2042, however, and will continue to contribute cumulatively to the local economy. As described in Section 5.2, operations of the Colstrip Power Plant and the Rosebud Power Plant (combined) support 361 local jobs and $403 million in annual economic output (BBC 2024b).
Rosebud Power Plant	Past, present, and RFA	The Rosebud Power Plant has and will continue to contribute to the local economy, although this facility burns a much smaller proportion of the Rosebud Mine project area coal. The plant will continue to provide a cumulative beneficial economic contribution to the local economy.

Table 5.3-13. Socioeconomics: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Alternative Energy and Transmission Development and Infrastructure	Present, and RFA	A number of alternative energy and transmission development projects are in the planning stages and would contribute to the local economy based on alternative energy production. Renewable energy development could offer additional opportunities for local communities and serve as mitigation for the direct and indirect disproportionate loss of economic activities associated with reduced activities at the mine. These projects can provide substantial job creation during both construction and operational phases. These projects can also diversify the local economy, reducing reliance on coal mining, lessening the negative economic effects on businesses both related and unrelated to energy development, and generate revenue that can be reinvested into local infrastructure, schools, and social services. In addition, the Westmoreland Rosebud transmission line will enable the mine to export coal from the site to other outside power plant facilities, which would enable Westmoreland Rosebud to ship coal from the Colstrip facility to other power generation facilities around the country or world, contributing to the financial stability and overall revenues of the mine and surrounding communities.
Federal land management – BLM	Past, present, and RFA	The BLM determined that additional leasing of Federal coal is not necessary based on the current analysis in the SEIS and that operating mines in the planning area have existing leases with sufficient coal reserves to maintain existing mine production levels until 2035 for Spring Creek Mine and 2060 for Rosebud Mine. This leads to the assumption that the Rosebud Mine will have a consistent source of revenue as one of two mines with existing leases and sufficient coal reserves.

5.3.15 Environmental Justice

Cumulative effects on environmental justice communities were described in **Section 5.3.15** of the 2018 Final EIS, beginning on page 697, based on an IMPLAN analysis that considered socioeconomic impacts before and after retirement of Colstrip Units 1 and 2. As described in **Chapter 1**, Units 1 and 2 were retired in January 2020. Since the socioeconomic conditions have changed, a new IMPLAN analysis (BBC 2024b) was prepared for the SEIS (**Appendix 4**). The analysis area for cumulative impacts on environmental justice includes both the socioeconomic cumulative impacts analysis area (Rosebud, Treasure, and Big Horn Counties) and the Northern Cheyenne and Crow Indian Reservations (**Figure 3.15-1**). **Table 5.3-14** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect environmental justice communities.

Actions (e.g., air quality, climate change, water use and discharge, etc.) that would contribute to environmental justice cumulative impacts related to public health are discussed in depth above in **Section 5.3.4, Public Health and Safety.** Cumulative impacts on the public health of environmental justice populations would result from the same past, present, and reasonably foreseeable future actions that would impact the public health of the overall population (**Table 5.3-4)**. The environmental health and community well-being of environmental justice populations would be impacted in the same ways as the general population in the analysis area. Impacts would range from short- to long-term and from negligible to major. Alternative 4 (and to lesser extents, Alternatives 1 and 5) would contribute to negligible to moderate impacts.

The environmental justice populations in the area would bear a disproportionate portion of cumulative impacts, as they generally have fewer economic resources and are more vulnerable to adverse impacts on environmental health and well-being (see **Section 5.3.4, Public Health and Safety**). As discussed in **Section 4.16**, environmental justice populations are less likely to be mobile than the general population. They may not have resources to access local public health resources, to travel outside of the area for services, or to avoid adverse environmental health effects.

The BLM's analysis of environmental justice impacts in the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a) is generally consistent with the findings described in **Section 5.3.15, Environmental Justice.** The MCFO SEIS found that Big Horn and Rosebud County both met the threshold to be considered environmental justice communities due to significant percentages of minority, indigenous, and low-income populations. According to the 2021 Census Bureau data used in the 2024 MCFO SEIS, Treasure County was found to only meet the low-income threshold, however, in this SEIS the most recent 2022 American Community Survey data was analyzed, the low-income population only makes up 9 percent of the community, well below the state average. The 2018 Final EIS and 2024 MCFO EIS analyses both identify the retirement of Colstrip Units 1 and 2 and ongoing Rosebud Mine activities as leading to a 30 percent reduction in coal production, revenue, and employment (see **Section 4.15**). This reduction disproportionately affects EJ populations by increasing unemployment, reducing household income, and heightening poverty levels. Both analyses agree that these impacts will lead to decreased funding for community institutions and essential social services, increased health risks due to higher air pollution levels, and reduced access to jobs and economic opportunities, significantly affecting the well-being of the Northern Cheyenne and Crow Indian Reservations.

Indirect and induced economic output (as defined in **Section 4.15, Socioeconomic Conditions**) would be reduced in the analysis area by about 27 percent, while indirect jobs would be reduced by about 12 percent (BBC 2024). The environmental justice populations in all three counties would bear a disproportionate adverse impact from the indirect economic losses associated with the decrease in the mine's production. Businesses that are both related and unrelated to mine operations within the communities in the three counties may experience economic impacts from decreased clientele due to loss of jobs and wages and to negative population growth. Indirect adverse impacts on these communities would be similar to the direct impacts discussed above on environmental justice populations in Rosebud County, including increases in unemployment and poverty rates and decreases in funding for and access to community institutions and social services. The economies in these counties, however, are less dependent on the mine and the power plants and, therefore, would not be impacted as severely when mine production decreased.

Table 5.3-14. Environmental Justice: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, Present, and RFA	Past and ongoing mining at the Rosebud Mine has resulted in the loss of potential agricultural lands and economic productivity associated with agriculture. This loss impacts environmental justice (EJ) communities, particularly those relying on agriculture as a source of livelihood. However, this loss of potential agricultural lands is temporary, as mined areas are reclaimed and returned to postmining land use. For example, reclaimed areas are available for grazing as soon as the vegetation is established and a management unit is large enough to support appropriate numbers of livestock. This reclamation process helps restore agricultural productivity, which is vital for the economic stability of EJ communities. In the near future, as more reclaimed lands become available for grazing and other agricultural uses, these communities can regain and potentially enhance their agricultural productivity, mitigating some of the economic disruptions caused to agriculture by mining activities.
Alternative Energy and Transmission Development and Infrastructure	Present, and RFA	Renewable energy development could offer additional opportunities for EJ populations and serve as mitigation for the direct and indirect disproportionate loss of economic activities associated with reduced activities at the mine. Projects like the Clearwater Wind Project, which began operations in November 2022 and can produce up to 750 megawatts, provide substantial job creation during both construction and operational phases. These projects diversify the local economy, reducing reliance on coal mining, lessening the negative economic effects on businesses both related and unrelated to energy development, and generate revenue that can be reinvested into local infrastructure, schools, and social services. Moreover, renewable energy projects contribute to environmental and health benefits by reducing pollution and GHG emissions, leading to improved air quality and health outcomes for EJ populations. The development of renewable energy also aligns with sustainable development goals, ensuring long-term economic and environmental resilience. By creating new employment opportunities, fostering economic diversification, and improving community investments, renewable energy projects can significantly enhance the socio-economic conditions and quality of life for EJ communities, particularly those adversely affected by the decline in mining activities.

Table 5.3-14. Environmental Justice: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (Other Permit Areas) and other coal mines	Past, Present, and RFA	As described in the 2018 Final EIS, Lujan Settlement includes provisions for employment of Northern Cheyenne: Westmoreland Rosebud must "make reasonable efforts to hire 50 percent of all New Employees in Colstrip Operations from Tribal Referrals Tribe members at the Rosebud Mine." Currently, 23 percent of the mine's labor force are Native Americans, including about 14 percent of the workforce that are members of the Northern Cheyenne Tribe (BBC 2024b). Overall production from the Rosebud Mine has decreased since the issuance of the 2018 Final EIS (see discussions in Chapters 1 and 2). Environmental justice populations in the analysis area, particularly the Northern Cheyenne Tribe, bear a disproportionate adverse impact from indirect economic losses associated with any decrease in the mine's production. Businesses that are both related and unrelated to mine operations within the communities in the three counties may experience economic impacts from decreased clientele due to loss of jobs and wages and to negative population growth. Indirect adverse impacts on these communities would be similar to the direct impacts discussed above on environmental justice populations in Rosebud County, including increases in unemployment and poverty rates and decreases in funding for and access to community institutions and social services. The economies in these counties, however, are less dependent on the mine and the power plants and, therefore, would not be impacted as severely when mine production decreased. Sources of revenue from the Rosebud Mine that fund community institutions and essential social services would be reduced, both as direct and indirect impacts of the mine's decreased production. These institutions would likely experience decreased funding as a result of lower employment rates, lower wages, and loss of tax revenue from the mine operation. About a quarter of Rosebud County's employment is in social services, education, and health care. Negative population growth and a smaller labor force with lower wages may result in a reduction of services available to environmental justice populations.
Operation of the power plants	Past, Present, and RFA	Operations of the Colstrip and Rosebud generating stations support an additional 361 local jobs and $403 million in annual economic output (BBC 2024b). The retirement of Colstrip Units 1 and 2 resulted in a reduction of 150 employees at the Colstrip Power Plant, from 400 in 2017 to 250 in 2024, leading to a 30 percent reduction in coal production, revenue, and employment at the Rosebud Mine. This reduction impacted 320 Rosebud Mine workers, including 14 percent Northern Cheyenne Tribe members and 9 percent other Native Americans, resulting in increased unemployment and reduced household income, as well as lessened employment opportunities (BBC 2024b).Continued and future operations at Colstrip contribute to strengthening the economy (local, state, and Federal) but have the potential to worsen health outcomes due to emissions of HAPs and PM, leading to respiratory diseases, cancer, and cardiovascular issues. These pollutants disproportionately impact EJ communities, which face existing vulnerabilities and limited healthcare access. Future operations are expected to perpetuate these trends, with ongoing emissions exacerbating health disparities and increasing exposure to climate change impacts such as extreme weather events and degraded air quality.
Federal lands management - BLM	Past, Present, and RFA	The BLM recently analyzed impacts to environmental justice communities in the *Miles City Field Office Final Supplemental Environmental Impact Statement and Resource Management Plan Amendment* (BLM 2024a). Under Alternative D (the chosen alternative), the BLM would not issue new leases for the Federal coal estate in the MCFO planning area. Therefore, there would be no GHG emissions impacts (or associated social costs) from coal mining, transportation, and downstream combustion due to pending Federal lease applications or potential future subsequent Federal leases (BLM 2024a); these GHG emission impacts often disproportionately impact environmental justice communities.

5.3.16 Visual Resources

Cumulative effects on visual resources would be similar to those described in **Section 5.3.16** of the 2018 Final EIS, beginning on page 699. The analysis area for evaluation of cumulative impacts on visual resources includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure 5.2-1**). **Table 5.3-15** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect visual resources in the analysis area.

Table 5.3-15. Visual Resources: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Mining has resulted in increased visual contrast on the landscape including changes in the color of the landscape from removal of vegetation and exposure of soil, as well as changes to the contour of the landscape.
Wildland fire	Past, present, and RFA	Wildland fire has impacted visual resources south of the project area in the past by burning the shrubs, grasses, and trees in the area and leaving large swaths of blackish charred areas (about 221 acres) with some burned stumps remaining in the present and future. The visual impacts from wildland fires would continue until the burned areas have become naturally revegetated over the next several years. In combination with the impacts on visual resources from other active mining areas and wildland fires in the analysis area, all SEIS alternatives would have a short-term minor contribution to cumulative impacts.

5.3.17 Recreation

Cumulative effects on recreation would be similar to those described in **Section 5.3.17** of the 2018 Final EIS, beginning on page 700. The analysis area for evaluation of cumulative impacts on recreation includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure** 5.2-1). **Table 5.3-16** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect recreation in the analysis area.

Table 5.3-16. Recreation: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Within the permit areas of the Rosebud Mine, there would be short-term cumulative impacts on wildlife land uses and associated hunting opportunities (depending on timing of mining and reclamation). Mining in the project area may reduce active mining that is occurring on other permit areas of the Rosebud Mine; however, those permit areas may not be completely reclaimed at the time the project area is mined, leading to additional loss of wildlife habitat and areas associated with hunting opportunities until vegetation is established on reclaimed mine areas. The conversion of the project area to full-scale mining is unlikely to contribute to long-term cumulative impacts on recreation in the area. After reclamation, the project area would revert to wildlife use and potential hunting by permission. Recreational use in the areas surrounding the Rosebud Mine is unlikely to change substantially given the existing land ownership pattern. The areas surrounding but outside the permit boundary of the Rosebud Mine could continue to be made available (or be made available in the future) for hunting with landowner permission.
Wildland fire	Past, present, and RFA	Wildland fire has impacted visual resources and land use (potentially impacting wildlife use and recreation) south of the project area in the past by burning the shrubs, grasses, and trees in the area and leaving large swaths of blackish charred areas (about 221 acres) with some burned stumps remaining in the present and future. The visual impacts from wildland fires would continue until the burned areas have become naturally revegetated over the next several years. In combination with the impacts on visual resources from other active mining areas and wildland fires in the analysis area, all SEIS alternatives would have a short-term minor contribution to cumulative impacts.

5.3.18 Paleontology

Cumulative effects on paleontology would be similar to those described in **Section 5.3.18** of the 2018 Final EIS, beginning on page 701. The analysis area for evaluation of cumulative impacts on paleontological resources includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure 5.2-1**). **Table 5.3-17** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect paleontology resources in the analysis area.

Table 5.3-17. Paleontology: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Past and ongoing mining at the Rosebud Mine has resulted in cumulative impacts on the overall geologic formations in the region, which have the potential to contain significant paleontological resources. Mining in the project area and possible future mining of other sites at the Rosebud Mine would result in additional cumulative surface and subsurface disturbance to geologic materials that have the potential to contain significant paleontological resources. Because the Fort Union Formation is classified as Class 4 (geologic units containing a high occurrence of significant fossils) and these geologic units would be lost, mining within the project area boundary would contribute to major long-term cumulative impacts on paleontological resources.

5.3.19 Access and Transportation

Cumulative effects on access and transportation would be similar to those described in **Section 5.3.19** of the 2018 Final EIS, beginning on page 702. The analysis area for cumulative impacts on access and transportation includes the project area, existing permit areas of the Rosebud Mine (which include the existing haul road and access roads), county roads (e.g., Castle Rock Road and Horse Creek Road), the section of State Highway 39 between the Rosebud Mine and the Rosebud Power Plant, and the Rosebud and Colstrip Power Plants, plus an approximate 0.5-mile buffer area around the power plants (**Figure 5.2-1**). **Table 5.3-18** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect access and transportation in the analysis area.

Table 5.3-18. Access and Transportation: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Depending on the timing of mining in the project area and other Rosebud Mine permit areas, traffic volumes may be cumulatively greater within the analysis area. Westmoreland Rosebud's coal mining in other permit areas, such as Area B, will consist of construction of new roads, road-decommissioning activities, road reconstruction, and implementation of Best Management Practices. The reasonably foreseeable actions and the project could have short-term negligible cumulative impacts by increasing traffic volumes near access roads. However, any additional traffic would not adversely affect the level of service on roads within the analysis area or lead to congestion.
Other activities	Past, present, and RFA	Many other reasonably foreseeable actions, including alternative/renewable energy infrastructure, gravel mining, recreation, and airport use and operations, would use the same regional transportation system as the project area. Depending on the timing of mining in the project area and other Rosebud Mine permit areas, traffic volumes may be cumulatively greater within the analysis area.

5.3.20 Solid and Hazardous Waste

Solid and hazardous waste cumulative effects would be similar to those described in **Section 5.3.20** of the 2018 Final EIS, beginning on page 703. The analysis area for evaluation of cumulative impacts related to solid and hazardous waste includes all permit areas of the Rosebud Mine, including past and ongoing mining areas, the Rosebud Power Plant, the Colstrip Power Plant and off-site storage areas where coal-combustion residuals (CCR) from the Colstrip Power Plant are stored, the Rosebud County Landfill where solid waste would be sent, and the disposal area where hazardous wastes generated would reside. **Figure 5.2-1** encompasses the analysis area. **Table 5.3-19** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect solid and hazardous waste in the analysis area.

Table 5.3-19. Solid and Hazardous Waste: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Mining of coal at the Rosebud Mine has contributed to the generation of solid and hazardous waste. Mining of coal within the project area would add to the total amount of solid and hazardous waste already generated and would also add to the total amount of CCR already generated and stored at the power plants. Although bottom ash would not be used in the project area, a portion of the bottom ash from burning of project area coal would likely be used in other permit areas of the mine in the construction of parking facilities, as a sanding agent for ramp and haul roads during periods of poor road conditions due to weather, and as tank and culvert bedding.
Coal combustion	Past, present, and RFA	Solid or hazardous waste as a result of Alternatives 4 and 5 would have a short-term, negligible, and adverse cumulative impact on the landfill and disposal areas receiving solid or hazardous waste from the mine. This is due to the relatively small quantities of these wastes generated relative to past and future amounts received at the disposal areas from other permit areas of the Rosebud Mine. Cumulative impacts as a result of Alternatives 4 and 5 from the use of CCR at the Rosebud Mine would be short-term, negligible, and adverse due to the small quantities used, the monitoring conducted that recognizes adverse impacts, and the reclamation that would be conducted in areas where CCR was used. Cumulative impacts as a result of Alternatives 4 and 5 from the combustion of project area coal and the storage of the associated CCR at the power plants and associated storage facilities would be short-term, negligible, and adverse due to the relatively small proportion of project area coal generated CCR relative to the total amount of CCR already generated at the power plants from non–project area coal.

5.3.21 Noise

Noise cumulative effects would be similar to those described in **Section 5.3.21** of the 2018 Final EIS, beginning on page 704. The analysis area for cumulative impacts on noise includes the city of Colstrip, existing permit areas of the Rosebud Mine, the project area, and a buffer area to the north, south, west, and east that includes portions of Rosebud, Treasure, and Big Horn Counties, including the Colstrip and Rosebud Power Plants (**Figure 5.2-1**). **Table 5.3-20** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect noise levels in the analysis area.

Table 5.3-20. Noise: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Rosebud Mine (other permit areas)	Past, present, and RFA	Existing coal mining and/or reclamation of Areas A, B, and C have contributed to the cumulative noise level in the area surrounding the Rosebud Mine. While mining in the project area would result in noise impacts on the immediate area, operations are not expected to contribute cumulatively to regional noise due to the distance from these activities.
Coal combustion	Past, present, and RFA	The only continuous noise source in proximity to any residences is the Colstrip and Rosebud Power Plants. The nearest residences to the Colstrip Power Plant are in Colstrip and are 1,500 feet west of the two cooling towers and 2,500 feet west of the center of the Colstrip Power Plant. This results in an estimated noise level of 57 A-weighted decibels (dBA) (Bradley 1985) at these residences when continuously operating. This estimate is consistent with noise-level measurements conducted at a similar coal-fired power plant (Hankard 2015). Therefore, noise as a result of any of the SEIS alternatives would have moderate long-term cumulative impacts on the Colstrip residences directly west of the Colstrip Power Plant, long-term minor cumulative impacts on the other residences in Colstrip, and long-term negligible cumulative impacts on residences more than 2 miles away.
Other sources	Past, present, and RFA	All other cumulative noise sources (e.g., Rosebud County airstrip, alternative/renewable energy infrastructure, mining operations, etc.) are substantially distant from residences and would have short- and long-term negligible cumulative impacts on noise under any of the SEIS alternatives.

5.3.22 Land Use

Land use cumulative effects would be similar to those described in **Section 5.3.22** of the 2018 Final EIS, beginning on page 705. The analysis area for evaluation of cumulative impacts on land use includes all permit areas of the Rosebud Mine, including past and ongoing mining areas (**Figure 5.2-1**). **Table 5.3-21** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect land use in the analysis area.

Table 5.3-21. Land Use: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	As described in the 2018 Final EIS in **Section 3.23**, agriculture (primarily grazing) is the dominant land use in the areas surrounding the Rosebud Mine. These land uses are unlikely to change substantially given that the existing land uses are well-established. Exceptions include alternative energy development in the vicinity of Colstrip; many such projects are being completed on formal industrial areas, such as Area D, but there could be cumulative losses to agricultural land uses as transmission lines are constructed and wind turbines are erected. The areas surrounding but outside the permit boundary of the Rosebud Mine could continue to be grazed or used by the landowners for agricultural purposes.
Rosebud Mine (other permit areas)	Past, present, and RFA	Within the permit areas of the Rosebud Mine, there would be short-term minor cumulative impacts on agriculture and wildlife land uses (depending on the timing of activities). Mining in the project area is intended to reduce the active mining that is occurring on other permit areas of the Rosebud Mine; however, those permit areas may not be completely reclaimed at the time the project area would be developed, leading to additional loss of wildlife habitat and active grazing areas until vegetation is established on reclaimed mine areas. The conversion of the project area to full-scale mining is unlikely to contribute to long-term cumulative impacts on land use in the area. After reclamation, the project area would revert back to grazing and agricultural uses.
Federal land management – BLM and Forest Service	Past, present, and RFA	Land use impacts resulting from Federal land management activities were considered in the 2018 Final EIS (see **Section 5.3.4**). Since that time, the BLM has issued an SEIS for the MCFO RMP and indicated selection of Alternative D, which would disallow new leasing of the Federal coal estate in the MCFO planning area. Without the opportunity to develop new coal leases, there would be no additional impacts on land use.
Energy and mineral development	Past, present, and RFA	Alternative energy development in the region could result in cumulative land use changes (see discussion above under “Agriculture”), either conversion of agricultural lands to transmission line corridors and wind farms or redevelopment of already disturbed sites, such as the Area D permit area to uses for or in support of alternative energy production.

5.3.23 Soil

Soil cumulative effects would be similar to those described in **Section 5.3.23** of the 2018 Final EIS, beginning on page 706. The cumulative impacts analysis area for soil is the 32-km-radius area described for indirect impacts in **Section 3.24, Soil**. **Table 5.3-22** summarizes the related past, present, or reasonably foreseeable actions (described and quantified where possible in **Table 5.2-1**) that have directly or indirectly affected or will affect soil in the analysis area.

Table 5.3-22. Soil: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Agriculture	Past, present, and RFA	Cumulative impacts from past agricultural operations where the surface soil is disturbed by tillage have increased erosion rates, especially during times when there is no crop cover protecting the soil from erosion. Most of this farmland is located along the major drainages (Rosebud, Armells, and Sarpy Creeks) within the analysis area. Cumulative impacts on soil from agricultural operations are a function of the agricultural practices and the number of years the practices have been utilized. If the amount of soil erosion has been severe and ongoing for many years, the cumulative impact on soil would be long-term, moderate, and adverse. But with standard agricultural practices that protect the soil surface from erosion, the cumulative impact on soil likely would be long-term, minor, and adverse. Agricultural operations are expected to continue for the reasonably foreseeable future with the same types of impacts.
Airport	Past, present, and RFA	The construction of the Rosebud County Airport contributed to soil erosion within the analysis area, but pre-construction erosion rates likely returned once vegetation stabilized the soil surface. This adverse impact on soil was short-term and minor.
Rosebud Mine (other permit areas)	Past, present, and RFA	Past and present actions of soil salvage, stockpiling, and replacement at the Rosebud Mine have increased erosion rates and reduced soil productivity in comparison to undisturbed portions of the mine site. Soil erosion rates have a short-term minor adverse cumulative impact on soil and begin to return to natural conditions in a couple of years once vegetation stabilizes reclaimed areas, something that is already occurring in many of the reclaimed areas at the Rosebud Mine. Reduction of soil productivity is a minor but long-term adverse cumulative impact, likely requiring decades to return to natural conditions.
Other mines (coal, gravel, etc.)	Past	Cumulative impacts on soil from another active coal mine, the Absaloka Mine, a currently active surface coal mine, and from one inactive surface coal mine, the Big Sky Mine, both within the analysis area have increased erosion rates and reduced soil productivity, resulting in similar impact types as those from the Rosebud Mine. Soil-handling operations at several gravel quarries within the analysis area may also contribute to cumulative impacts on soil, but on a smaller scale. Foreseeable future actions that would have adverse cumulative impacts on soil include those current coal-mining activities and gravel quarries.

Table 5.3-22. Soil: Summary of Cumulative Effects.

Action	Past, Present, or RFA	Cumulative Effects
Coal combustion	Past, present, and RFA	Trace-metal deposition from past and present combustion of Rosebud Mine coal at the Colstrip and Rosebud Power Plants may have adverse impacts on soil resources within a 32-km radius around the power plants. The Colstrip Power Plant, which contributes significantly more trace metals through coal combustion than the Rosebud Power Plant (see **Section 4.3**, **Air Quality**), has been in operation since the mid-1970s. The modeling results of combustion of project area coal at the Colstrip Power Plant have demonstrated that impacts on soil resources from selenium deposition are adverse, long-term, and minor within the analysis area, and deposition from the other trace metals is likely negligible within the analysis area (see **Section 4.24**, **Soil**). The combustion of Rosebud Mine coal likely has had and will continue to have similar cumulative impacts on soil resources. Retirement of Colstrip Power Plants Units 1 and 2 has decreased the level of trace-metal deposition from the power plants from what was previously considered in the 2018 Final EIS. Selenium deposition would continue to have long-term, minor, adverse cumulative impacts on soil. Of the other trace metals at the current deposition rates, mercury deposition would require the fewest years to exceed either the plant or soil invertebrate soil-screening level, which would be over 1,400 years. Therefore, deposition of the other trace metals would continue to have negligible impacts. Acid deposition resulting from coal combustion would also likely decrease, but similar impacts on soil would continue. Like trace-metal deposition, acid deposition from past and present combustion of coal from Areas A, B, C, D, and E at the Colstrip and Rosebud Power Plants, as well as future combustions of Area B coal, may have adverse impacts on soil throughout the region. Modeling of SO2 and NOx gas emissions from the power plants has estimated that these gases have a long-range transport (see Section 3.3.1.2, Air Quality in the 2018 EIS for a discussion of transport distances). The magnitude of the cumulative impacts is a function of soil chemistry and bedrock. More alkaline soil, having acid-buffering capacity, is less susceptible to acid deposition, whereas more acidic soil, having little or no acid-buffering capacity, is more sensitive to acid deposition (see **Section 4.24**, **Soil**). Modeling SO2 and NO2, however, has shown cumulative concentrations are below NAAQS and MAAQS (see **Section 5.3.2.2, Cumulative Impacts on Air Quality** in the 2018 Final EIS). Given this, cumulative impacts on soil with and without acid-buffering capacity would be long-term, minor, and adverse.
Federal land management – BLM	Past, present, and RFA	BLM has authorized actions in the near vicinity of the project area, such as rights-of-way for powerlines and pipelines, coal leases (past), mineral material sites, land withdrawals, oil and gas leases, and land sales and exchanges. Many of these activities have involved soil removal, and some have likely involved soil stockpiling and replacement. These operations have likely increased soil erosion and reduced soil productivity and were considered in the 2018 Final EIS (see **Section 5.3.22**). Since that time, the BLM has issued an SEIS for the MCFO RMP and indicated selection of Alternative D, which would disallow new leasing of the Federal coal estate in the MCFO planning area. Without the opportunity to develop new coal leases, there would be no additional impacts on soil related to leasing of the Federal coal estate.

CHAPTER 6. COORDINATION AND CONSULTATION

This chapter provides a summary of the formal consultation processes that occurred during the preparation of this Supplemental Environmental Impact Statement (SEIS). This chapter also provides a list of the interdisciplinary team members that prepared and contributed to this SEIS and provides the distribution list for this SEIS. For information on coordination and consultation completed previously, please see Chapter 6 in the 2018 Final EIS, beginning on page 709.

6.1 CONSULTATION PROCESSES

6.1.1 Public Comment Process

Public involvement processes for the original EIS, including the opportunity to submit public comments during the two formal scoping periods and on the Draft EIS, are described in **Section 1.5, Public Outreach** of the 2018 Final EIS beginning on page 22 and summarized in this SEIS in **Section 1.5, Public Outreach**.

The Office of Surface Mining Reclamation and Enforcement (OSMRE) is accepting public comments on this draft SEIS for a 45-day comment period beginning the date that the Environmental Protection Agency's Notice of Availability was published in the *Federal Register*. Notice of the comment period was also provided on the OSMRE website (https://www.osmre.gov/laws-and-regulations/nepa/projects) and in legal notices published in the *Billings Gazette* and the *Forsyth Independent Press*. Details on how to submit comments and attend the public comment meeting are included in the cover letter for this SEIS.

6.1.2 Section 7 Consultation Process with the U.S. Fish and Wildlife Service

The Endangered Species Act (ESA) provides a means for conserving the ecosystems upon which threatened and endangered species depend and a program for the conservation of such species. The ESA directs all Federal agencies to participate in conserving these species. Specifically, Section 7(a)(1) of the ESA charges Federal agencies to aid in the conservation of listed species, and Section 7(a)(2) requires the agencies to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats. Section 7 of the ESA (16 USC § 1531 et seq.) outlines the procedures for Federal interagency cooperation to conserve federally listed species and designated critical habitats; Federal agencies are required to confer with the U.S. Fish and Wildlife Service (USFWS) on any agency action that is likely to jeopardize the continued existence of any species proposed for listing or result in the adverse modification of critical habitat proposed to be designated.

Four federally listed species potentially occur near or are affected by projects in the analysis area, as shown in **Table 6.1-1**.

Table 6.1-1. Federally Endangered Species Potentially Occurring in the Analysis Area.

Common Name	Scientific Name	Status* Federal/State	General Habitat Affinity	Habitat in Analysis Area
Mammals				
Northern long-eared bat	*Myotis septentrionalis*	T	Winter hibernation occurs in caves; summer roosts occur under loose tree bark or in tree cavities. Rarely roosts in structures.	Yes
Fish				
Pallid sturgeon	*Scaphirhynchus albus*	E	Large turbid rivers, including accessible reaches of the Yellowstone River, with diverse habitat and natural hydrographs.	Yes
Insects				
Monarch butterfly	*Danaus plexippus*	C	Requires milkweed (*Asclepias* spp.) as larval host plants; meadow and riparian habitats support spring/summer breeding and late-season migration.	Yes
Western regal fritillary	*Argynnis idalia occidentalis*	PT	Tallgrass prairies, including dry upland, mesic, and wet areas. Requires violet species (*Viola* sp.) as a larval host plant. The range of western regal fritillary only overlaps the action area in a small area at the southern edge of the action area.	Yes

*E = Endangered; T = Threatened; C = Candidate; PT=Proposed Threatened.
Source: USFWS 2024a.

The Section 7 consultation that previously occurred for this project is described in **Section 6.1.2** of the 2018 Final EIS, beginning on page 709. When work began on the SEIS in 2022, OSMRE contacted the USFWS Ecological Services Montana Field Office in Helena to discuss the project. In December 2022, OSMRE staff and contractors met with USFWS staff to discuss the need to prepare a Biological Assessment (BA) for the project. A USFWS IPaC search was conducted to identify federally listed species that could potentially exist within the project area on June 10, 2024.

On May 22, 2024, OSMRE staff and contractors held a virtual BA strategy meeting to discuss the Proposed Action and potential impacts for the SEIS with USFWS staff. Discussions indicated that the BA prepared for the project should address northern long-eared bat, pallid sturgeon, and monarch butterfly, since other listed and candidate species are not likely to occur in the action area.

ERO Resources Corporation and GEI, on behalf of OSMRE, prepared a BA. OSMRE submitted the draft BA to the USFWS for consultation on August 19, 2024, and a revised BA on October 8, 2024 (OSMRE 2024). The BA determined that the project may affect, but is not likely to adversely affect, the northern long-eared bat and the pallid sturgeon, would not contribute to a trend toward Federal listing of the monarch butterfly, and would not jeopardize the continued existence of the western regal fritillary.

6.1.3 Section 106 and Tribal Consultation Processes

Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended and its implementing regulations under 36 Code of Federal Regulations 800 require all Federal agencies to consider effects of Federal actions on cultural resources eligible for or listed in the National Register of Historic Places (NRHP). To comply with Section 106, Federal agencies are required to consult with interested parties, including Native American tribes who claim cultural affiliation with the affected lands to maintain government-to-government consultation responsibilities.

Traditional cultural properties (TCPs) are protected under Section 106 of the NHPA as historic properties, and when applicable, they have additional protections under the American Indian Religious Freedom Act of 1978 and the Native American Grave Protection and Repatriation Act of 1990. A TCP may be eligible for listing in the NRHP. Examples of TCPs include but are not limited to locations where Native Americans have performed ceremonies, traditional locations for resource gathering, and rural community land use patterns such as farming and ranching (see **Section 3.14, Cultural and Historic Resources**).

Section 106 consultation previously occurred for this project as described in **Section 3.14, Cultural and Historic Resources**. Adverse effects on potential historic properties as a result of mining in the project area would be resolved through the executed Programmatic Agreement (PA) entered into by Western Energy, the State Historic Preservation Office, the Montana Department of Environmental Quality (DEQ), the Bureau of Land Management (BLM), and OSMRE. The PA is in **Appendix H** of the 2018 Final EIS. The PA provides for continuing compliance with Section 106 of the NHPA over the life of mining operations. The PA also includes stipulations to address unanticipated discoveries during mining operations.

Tribal consultation that previously occurred for this project is described in **Section 6.1.3** of the 2018 Final EIS, beginning on page 711. For this SEIS, OSMRE reinitiated formal tribal consultation with the Northern Cheyenne, Fort Peck Assiniboine and Sioux Tribes, and Crow Tribes. Consultation was reinitiated through letters sent to each of the potentially impacted tribes on September 20, 2024.

6.1.4 Federal, State, and Local Agencies

OSMRE consulted the following agencies during the development of this SEIS:

- Advisory Council on Historic Preservation
- DEQ (see **Section 6.2.1, Montana Department of Environmental Quality**)
- Montana Natural Heritage Program
- Montana State Historic Preservation Officer (see S**ection 6.1.3, Section 106 and Tribal Consultation Processes**)
- BLM (see **Section 6.2.3, Bureau of Land Management**)
- Environmental Protection Agency
- USFWS (see **Section 6.1.2, Section 7 Consultation Process with the U.S. Fish and Wildlife Service**)

6.2 PREPARERS AND CONTRIBUTORS

The following sections list the names and credentials of the agency and third-party consultants that prepared this SEIS. For the list of preparers and contributors to the 2018 Final EIS, please see **Section 6.2** in that document.

6.2.1 Montana Department of Environmental Quality

DEQ was not involved in the preparation of the SEIS. As needed, OSMRE requested data and other information from DEQ to prepare this SEIS. For the names and credentials of the DEQ preparers of the 2018 Final EIS, please see **Section 6.2.1** in that document.

6.2.2 Office of Surface Mining Reclamation and Enforcement

The following table provides the names and credentials of OSMRE preparers of the SEIS. For the names and credentials of the OSMRE preparers of the 2018 Final EIS, please see **Section 6.2.2** in that document.

Name	Responsibilities	Education	Experience (Years)
Calle, Marcelo	Project Supervision/ Manager, Program Support Division, Western Region	B.A. Anthropology B.S. Watershed	16
Iliff, Jeremy	Archaeologist, Federal Operations Branch	B.A. Anthropology	18
Martinez Hernandez, Roberta	Project Coordination (2024 –Present)/Natural Resource Specialist	B.S. Engineering M.S. Environmental Engineering	13
Shaeffer, Elizabeth	Project Supervision/ Program Manager, Field Operations Branch	B.S. Land Use Planning, Environment and Resources	15
Trent, Erica	Section 7 Coordinator	B.S. Biology	13

6.2.3 Bureau of Land Management

The following table provides the names and credentials of BLM preparers of the SEIS. For the names and credentials of the BLM preparers of the 2018 Final EIS, please see **Section 6.2.3** in that document.

Name	Responsibilities	Education	Experience (Years)
Tessa Wallace	BLM, Cooperating Agency	B.S. Geology B.S. Ecology M.S. Geology	16

6.2.4 EIS Consultant Team

The following table provides the names and credentials of third-party consultant preparers of the SEIS. For the names and credentials of third-party consultant preparers of the 2018 Final EIS, please see **Section 6.2.4** in that document.

Name/Firm	Responsibilities	Education	Experience
Brown, Matt Confluence Water	Surface Water and Water Rights	M.S. Civil Engineering B.S. Civil Engineering	26
Butler, Steve ERO Resources Corporation	Fish and Wildlife, Special Status Species, Vegetation, and Wetlands	M.E.M. Water and Air Resources B.S. Biology	27
Corsi, Emily ERO Resources Corporation	Assistant Project Manager; Senior NEPA Specialist: Chapters 1 and 2 and various resource-sections, including Air Quality, Climate and Climate Change, Land Use, and Soil	M.S. Natural Resources Conservation B.A. Politics	18
Croll, Kathy ERO Resources Corporation	Cultural Resources and Paleontology	Ph.D. Anthropology M.A. Anthropology B.S. Social Science	26
DenHerder, Nicole ERO Resources Corporation	Project Manager; Principal NEPA Specialist: various resource-sections, including Socioeconomics, Visual Resources, Access and Transportation, and Noise	Masters of Environmental Policy and Management B.S. Communication	26
Ficke, Ashley GEI Consultants	Fisheries	Ph.D. Fishery Biology M.S. Fish, Wildlife, and Conservation B.S. Fish and Wildlife Biology	24
Hodges, Wendy ERO Resources Corporation	Geographic Information Systems	Masters of Environmental Policy and Management B.S. Natural Science	17
Conklin, Don GEI Consultants	Fisheries	M.S. Water Resource Management	40
Jeavons, Doug BBC Research & Consulting	Socioeconomics Modeling and GHG Social Costs	M.A. Economics	28
Lynch, Jennifer GEI Consultants	Fisheries	M.S. Environmental Science	20
Olmsted, Brian ERO Resources Corporation	Topography, Geology, Groundwater, Water Rights, and Solid and Hazardous Waste	M.S. Geochemistry B.S. Geology	18
Panlilio, Autumn ERO Resources Corporation	NEPA Specialist: Public Health and Safety, Environmental Justice, and Recreation	Masters of Environment Bachelors of Environmental Studies	2
Perreault, Lili ERO Resources Corporation	NEPA Specialist	Ph.D. Forestry and Environmental Resources M.S. Biology B.S. Environmental Science	5
Troyer, Lizzie ERO Resources Corporation	Technical Editor	M.S. Interdisciplinary Ecology B.A. Biology	7
Wall, Kay ERO Resources Corporation	Technical Editor	B.A. Behavioral Science	33

6.3 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS EIS HAVE BEEN DISTRIBUTED

Montana DEQ Headquarters (Lee Metcalf Building)
1520 East 6th Avenue
Helena, MT 59620-0901
Between the hours of 8:00 AM and 5:00 PM Monday through Friday (Closed Saturday and Sunday)

BLM Miles City Field Office
111 Garryowen Road
Miles City, MT 59301
Between the hours of 7:45 AM and 4:30 PM Monday through Friday (Closed Saturday and Sunday)

Rosebud County Library
201 North 9th Avenue
Forsyth, MT 59327-0007
Between the hours of 11:00 AM and 7:00 PM Monday through Thursday; 11:00 AM to 5:00 PM Friday; 10:00 AM to 1:00 PM Saturday(Closed Sunday)

OSMRE, Western Region
1999 Broadway, Suite 3320
Denver, CO 80202
Between the hours of 8:00 AM and 4:00 PM Monday through Friday (Closed Saturday and Sunday)

BLM State Office, Billings, MT
5001 Southgate Drive
Billings, MT 59101
Between the hours of 8:00 AM and 4:00 PM Monday through Friday (Closed Saturday and Sunday)

CHAPTER 7. REFERENCES

Only references used in the preparation of the SEIS are provided here. Please refer to Chapter 7 in the 2018 Final EIS for the references used in preparation of that document.

AP News. 2021. Montana Coal Mine Closes Amid Decline in Demand. February 5. Available from: https://apnews.com/general-news-eafaa5fa987add5a3e9c59f6b2b49a9d.

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Appendix 1 – Acronyms, Abbreviations, Analysis Definitions, and Glossary

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Acronyms and Abbreviations

AADT	annual average daily traffic
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AHR	Annual Hydrology Report
AML	abandoned mine lands
AMM	abandoned mine methane
AMPD	U.S. Environmental Protection Agency Clean Air Markets Program Data
AMRF	Abandoned Mine Reclamation Fund
AOC	Administrative Order of Consent
AQS	Air Quality Service
AR5	Fifth Assessment Report of the IPCC
ARM	Administrative Rules of Montana
ARMP	Approved Resource Management Plan
asl	above sea level
ASLM	Assistant Secretary for Land and Minerals Management
AUM	animal unit month
AVF	alluvial valley floor
BACT	Best Available Control Technology
BGEPA	Bald and Golden Eagle Protection Act of 1940
BLM	Bureau of Land Management
BLM-MT/DK	Bureau of Land Management Montana/Dakotas
BLS	U.S. Department of Labor, Bureau of Labor Statistics
BMP	Best Management Practices
BP	before present
BTCA	best technology currently available
BTU	British thermal units
CAA	Clean Air Act
CAMx	Comprehensive Air Quality Model with Extensions
CAP	criteria air pollutant
CASTNET	Clean Air Status and Trends Network
CCAC	Climate Change Advisory Committee
CCR	coal combustion residuals
CCUS	carbon capture, utilization, and storage
CDC	Center for Disease Control
CELP	Colstrip Energy Limited Partnership
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Contingency and Emergency Response Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second

cf/t	cubic feet per short ton
CH_4	methane
CHIA	cumulative hydrologic impacts assessment
CMM	coal mine methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COPC	chemicals of potential concern
CPRD	Colstrip Park and Recreation District
CSAPR	Cross-State Air Pollution Rule
CWA	Clean Water Act
dB	decibel
dBA	decibel (A-weighted)
DEQ	Montana Department of Environmental Quality
DNRC	Montana Department of Natural Resources and Conservation
DOI	U.S. Department of the Interior
DPM	diesel particulate matter
dv	deciview
DV	design value
EA	Environmental Assessment
EC	electrical conductivity
ECOS	Environmental Conservation Online
Eco-SSL	ecological soil screening level
EHP	effluent holding pond
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ELG	effluent limit guidelines
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERA	ecological risk assessment
ERO	Resources Corporation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FGDM	flue gas desulfurization material
FLIGHT	Facility Level Information on Greenhouse Gases Tool
FLPMA	Federal Land Policy and Management Act
FR	Federal Register
FWP	Montana Fish, Wildlife and Parks
FY	fiscal year
GHG	greenhouse gas

GIS	geographic information systems
gpm	gallons per minute
Gt	gigatons
Guidelines	Clean Water Act Section 404(b)(1) Guidelines
GWIC	groundwater information center
GWP	Global Warming Potential
HAP	hazardous air pollutant
HFC	hydrofluorocarbon
Hg	mercury
HHRA	human health risk assessment
HI	hazard index
HVTL	high voltage transmission line
HWC	Hazardous Waste Coordinator
ICMM	International Council on Mining and Metals
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPaC	USFWS Information, Planning, and Conservation System
IPCC	Intergovernmental Panel on Climate Change
kg/ha	kilograms per hectare
kV	kilovolt
L_{dn}	day-night average noise level
L_{eq}	equivalent noise level
LANL	Los Alamos National Laboratory
LBM	lease by modification
LOAEL	lowest observed adverse effect level
LQG	Large Quantity Generator
m/s	meters per second
MAAQS	Montana Ambient Air Quality Standards
MAQP	Montana Air Quality Permit
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MCFO	Miles City Field Office
MDA	Montana Department of Agriculture
MDHHS	Montana Department of Health and Human Services
MDN	Mercury Deposition Network
MDSL	Montana Department of State Lands
MDT	Montana Department of Transportation
MEGAN	Model of Emissions of Gases and Aerosols in Nature
MEIC	Montana Environmental Information Center
MEPA	Montana Environmental Policy Act
MFSA	Major Facility Siting Act
mg/kg	milligrams per kilogram

mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
MLA	Mineral Leasing Act
MMT	million metric tons
MMtCO_2e	million metric tons of carbon dioxide equivalent
MNHP	Montana Natural Heritage Program
MOA	memorandum of agreement
MOU	Memorandum of Understanding
MP	milepost
MPDD	Mining Plan Decision Document
MPDES	Montana Pollutant Discharge Elimination System
mph	miles per hour
MQAP	Montana Quality Assurance Plan
MSGWG	Montana Sage-Grouse Working Group
MSHA	Mine Safety and Health Administration
MSU	Montana State University
MSUMRA	Montana Strip and Underground Mine Reclamation Act
MT	Montana
MW	megawatts
MWAM	Montana Department of Transportation Wetland Assessment Method
MYED	Mid Yellowstone Electric Cooperative Inc.
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NCA	National Climate Assessment
NCAR	National Center for Atmospheric Research
NCCV	National Climate Change Viewer
ND	normalized difference
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NLEB	northern long-eared bat
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NHPA	National Historic Preservation Act
NRC	National Research Council
NRHP	National Register of Historic Places
NSR	New Source Review
NTN	National Trends Network
NWR	National Wildlife Refuge

O_3	ozone
OEA	Office of Environmental Analysis
OSAT	Ozone Source Apportionment Technology
OSHA	Occupational Safety and Health Administration
OSMRE	Office of Surface Mining Reclamation and Enforcement
PA	Programmatic Agreement
PAP	Permit Application Package
PCI	per-capita income
PD	Preliminary Determination
PFC	perfluorocarbon
PFYC	Potential Fossil Yield Classification
PHC	probable hydrologic consequences
PM	particulate matter
PLS	pure live seed
PMT	postmining topography
ppb	parts per billion
PPE	personal protective equipment
PPL	Colstrip Power Plant
ppm	parts per million
ppt	parts per trillion
PSAT	Particulate Source Apportionment Technology
PSD	Prevention of Significant Deterioration
PTE	potential to emit
QA	quality assurance
QC	quality control
RCP	representative concentration pathway
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RRA	Resource Recovery Act
RRPP	Resource Recovery and Protection Plan
RMP	Resource Management Plan
SAR	sodium adsorption ratio
scf	standard cubic feet
SC-GHG	social cost of greenhouse gases
SCORP	Montana State Comprehensive Outdoor Recreation Plan
SEDCAD	Sediment, Erosion, Discharge by Computer Aided Design
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SHWMP	Solid and Hazardous Waste Management Plan
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977

SOC	Species of Concern
SO_2	sulfur dioxide
SPCCMP	Spill Prevention Control and Counter Measure Plan
SSL	soil screening level
STEP	stage two evaporation pond
TBTU	trillion British thermal units
TCLP	Toxicity Characteristic Leaching Procedure
TCP	traditional cultural property
THC	total hydrocarbon
TMDL	Total Maximum Daily Load
TRI	Toxic Release Inventory
TRRC	Tongue River Railroad Company Inc.
TRV	toxicity reference value
TSDF	treatment, storage, and disposal facility
UCL	Upper Confidence Limit
UDP	Unanticipated Discovery Plan
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	USDA Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWPHI	University of Wisconsin Population Health Institute
VER	valid existing rights
VOC	volatile organic compound
VRM	Visual Resource Management
Water Rights Bureau	Montana Department of Natural Resources and Conservation, Water Resources Division, Montana Water Rights Bureau
W/m^2	watts per square meter
WCI	Western Climate Initiative
WEPP	USDA Water Erosion Prediction Project
WGIII	Working Group III
WRAP	Western Regional Air Partnership
WRI	World Resources Institute
$\mu g/m^3$	micrograms per cubic meter
µS/cm	microSiemens/centimeter

Analysis Definitions

The following terms were used in this SEIS to describe the nature of impacts associated with each alternative. These definitions were formulated through the review of existing laws (such as NEPA), policies, and guidelines, and with assistance from resource specialists.

Direct, Indirect, and Cumulative Impacts: Impacts can be direct, indirect, or cumulative.

Direct impacts are caused by an action and occur at the same time and place as the action.

Indirect impacts under NEPA are caused by the action and occur later in time or farther away in distance but are still reasonably foreseeable.

Cumulative impacts under NEPA are the effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable future actions. Cumulative impacts are disclosed in **Chapter 5**.

Duration: For this EIS, impact duration is described as short-term or long-term; generally, these are defined as follows (exceptions occur for Cultural and Historic Resources, Geology, and Paleontology):

- Short-term impact/effect – a change that within a short period would no longer be detectable as the resource is returned to its pre-mine condition, appearance, or use. In this EIS a "short period" is defined as the length of the Area F bond liability period (see **Chapter 1** for a description of the bond liability period).
- Long-term impact/effect – a change in a resource or its condition that does not immediately return the resource to pre-mine condition, appearance, or productivity; long-term impacts would apply to changes in condition that continue beyond the bond liability period but would be expected to eventually return to pre-mine condition, or would meet SMCRA or MSUMRA requirements.

Impact Intensity and Thresholds of Change: Intensity of impacts and the thresholds of change for the intensity of impacts vary by resource and are defined in a table at the beginning of each resource section. There may be no impact, adverse impacts, or beneficial impacts (defined below). In general, the intensity of adverse and beneficial impacts may be negligible, minor, moderate, or major. The thresholds of change for the intensity of impacts are also defined differently for each resource. With the exception of Climate Change, Water Resources – Surface Water, and Special Status Species, these "Impact and Intensity Thresholds" are not reproduced in this SEIS but are provided in the 2018 Final EIS at the beginning of each **Chapter 4** resource section.

Type: Impacts can be beneficial or adverse. Beneficial impacts are those that create a positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition. Adverse impacts are those that move the resource away from a desired condition or detract from its appearance or condition.

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Appendix 2 – Social Cost of Greenhouse Gases (BBC analysis)

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MEMORANDUM

To: Nicole DenHerder, ERO Resources Corporation

From: Doug Jeavons, BBC Research & Consulting

Re: Social Cost of Green House Gasses Analysis for the Area F SEIS

Date: Revised October 28, 2024

For the Westmoreland Rosebud Mine Area F Supplemental EIS, BBC Research & Consulting (BBC) examined the social cost of greenhouse gas emissions under the SEIS alternatives. This technical memorandum describes the analysis and results.

Background

The social cost of carbon (SCC), more accurately referred to as the social cost of greenhouse gases, is a measure that is intended to capture, in current monetary terms, the long-term damage done by each ton of greenhouse gas emissions. As described by the Environmental Protection Agency (EPA):

"The measure is meant to be a comprehensive estimate of climate change damages and includes, among other things: changes in net agricultural productivity, human health, property damages from increased flood risk and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning."[1]

[1] EPA Fact Sheet: Social Cost of Carbon. December 2016.

Federal agencies have been estimating the SCC since an Interagency Work Group was convened by the Council of Economic Advisors and the Office of Management and Budget in 2009 for that purpose.[2] Subsequently, an Interagency Work Group (IWG) was convened under Executive Order 13990 to develop updated estimates of the social cost from emissions of carbon dioxide CO_2) methane (CH_4) and nitrous oxide (N_2O).[3] The IWG published those estimates in February 2021.[4]

Most recently, the Environmental Protection Agency (EPA) published new estimates of the social cost of greenhouse gasses in 2023.[5] On October 16, 2024, the Department of Interior's Director of Policy Analysis and its Chief Economist issued an informational memorandum recommending the use of the EPA's estimates as the best available science at this time.[6]

This analysis incorporates the 2023 EPA estimates of the social cost of greenhouse gases.

Discount rates and other factors. Like other measures of the present value of a stream of future monetary costs or benefits, the SCC uses discount rates to convert values in future years to their current economic value. Discount rates are intended to reflect the concept that, all else equal, more immediate costs have a higher present value than projected costs further in the future. The EPA estimates used in this analysis were developed under the following discount rates: 2.5 percent, 2.0 percent and 1.5 percent.

The estimated annual costs per ton also differ depending on the year when the gases are emitted. In general, future emission years have higher estimated costs due to factors such as population growth and the increase in the accumulated amount of greenhouse gases in the atmosphere.

EPA Estimates of the Social Cost of Greenhouse Gas Emissions

The 2023 EPA report published three estimates of the present value of the social cost of greenhouse gas emissions for each of the three primary greenhouse gases – carbon dioxide, methane and nitrous oxide. The three estimates reflect the three different discount rates used in the analysis.

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[2] Ibid.

[3] Fourteen federal agencies participated in the IWG, including the Department of the Interior and the Environmental Protection Agency.

[4] *Technical Support Document: Social Cost of Carbon, Methane and Nitrous Oxide Interim Estimates Under Executive Order 13990.* February 2021.

[5] "EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances." Published under the heading Supplementary Material for the Regulatory Impact Analysis for the Final Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review." November 2023.

[6] Informational Memorandum. DOI Comparison of Available Estimates of Social Cost of Greenhouse Gases. Jacob Malcom, Director, Office of Policy Analysis and Kawa Ng, DOI Chief Economist. October 16, 2024.

Table 1 presents the estimated current social costs for each ton of carbon dioxide emitted from 2020 through 2039.

Table 1. Estimated Current Social Cost per ton of CO_2 Emissions (2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$120	$190	$240
2021	$122	$194	$254
2022	$124	$198	$268
2023	$126	$202	$282
2024	$128	$206	$296
2025	$130	$210	$310
2026	$132	$214	$324
2027	$134	$218	$338
2028	$136	$222	$352
2029	$138	$226	$366
2030	$140	$230	$380
2031	$143	$234	$385
2032	$146	$238	$390
2033	$149	$242	$395
2034	$152	$246	$400
2035	$155	$250	$405
2036	$158	$254	$410
2037	$161	$258	$415
2038	$164	$262	$420
2039	$167	$266	$425

Source: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. November 2023.

Table 2 presents the estimated current social costs for each ton of methane emitted from 2020 through 2039.

Table 2. Estimated Current Social Cost per ton of CH_4 Emissions (2020 dollars)

	Discount Rate		
Emissions Year	**2.5% Average**	**2.0% Average**	**1.5% Average**
2020	$1,300	$1,600	$2,300
2021	$1,360	$1,680	$2,390
2022	$1,420	$1,760	$2,480
2023	$1,480	$1,840	$2,570
2024	$1,540	$1,920	$2,660
2025	$1,600	$2,000	$2,750
2026	$1,660	$2,080	$2,840
2027	$1,720	$2,160	$2,930
2028	$1,780	$2,240	$3,020
2029	$1,840	$2,320	$3,110
2030	$1,900	$2,400	$3,200
2031	$1,980	$2,490	$3,300
2032	$2,060	$2,580	$3,400
2033	$2,140	$2,670	$3,500
2034	$2,220	$2,760	$3,600
2035	$2,300	$2,850	$3,700
2036	$2,380	$2,940	$3,800
2037	$2,460	$3,030	$3,900
2038	$2,540	$3,120	$4,000
2039	$2,620	$3,210	$4,100

Source: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. November 2023.

Table 3 presents the estimated current social costs for each ton of nitrous oxide emitted from 2020 through 2039.

Table 3. Estimated Current Social Cost per ton of N_2O Emissions (2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$35,000	$54,000	$87,000
2021	$36,000	$55,200	$88,300
2022	$37,000	$56,400	$89,600
2023	$38,000	$57,600	$90,900
2024	$39,000	$58,800	$92,200
2025	$40,000	$60,000	$93,500
2026	$41,000	$61,200	$94,800
2027	$42,000	$62,400	$96,100
2028	$43,000	$63,600	$97,400
2029	$44,000	$64,800	$98,700
2030	$45,000	$66,000	$100,000
2031	$46,000	$67,300	$102,000
2032	$47,000	$68,600	$104,000
2033	$48,000	$69,900	$106,000
2034	$49,000	$71,200	$108,000
2035	$50,000	$72,500	$110,000
2036	$51,000	$73,800	$112,000
2037	$52,000	$75,100	$114,000
2038	$53,000	$76,400	$116,000
2039	$54,000	$77,700	$118,000

Source: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. November 2023.

Estimated Direct Annual Emissions from Rosebud Mining Operations and Indirect Annual Emissions from Combustion of Rosebud Coal at Colstrip and Rosebud Generating Stations and Workforce Commuting

To calculate the estimated SCC for the various alternatives examined in the SEIS, the current annual costs per ton of CO_2, CH_4 and N_2O emissions shown in tables 1 through 3 are multiplied by the projected annual emissions from the project area under each SEIS alternative. Direct emissions include all emissions from mining operations. Indirect emissions include emissions from combustion of coal mined at the Rosebud Mine at the Colstrip and Rosebud generating facilities. Indirect emissions also include emissions generated by workers commuting to the Rosebud Mine and the two generating facilities.

The Colstrip Power Plant currently consists of two large generating units (Units 3 and 4), each with a rated capacity of about 740 megawatts. Units 1 and 2 at Colstrip were recently retired from service.[7] The Rosebud Power Plant is a much smaller generating facility designed to burn low-British thermal unit (Btu) waste coal from Rosebud mining operations.[8]

[7] Talen Energy. https://www.talenenergy.com/plant/colstrip-steam-electric-station/

[8] Colstrip Energy Limited Partnership. CCR Rule Compliance Data and Information. Rosebud Powerplant. Colstrip, MT. https://celpccr.com/https://celpccr.com/.

Table 4 presents the estimated annual direct emissions from Rosebud Mine operations for each of the three primary greenhouse gasses. These emissions also include activities such as coal crushing, hauling and conveying. Production from Area F would be a subset of these total emissions. Further detail regarding these emission projections is provided in SEIS Section 4.4 Climate and Climate Change.

Table 4. Projected Annual Direct Greenhouse Gas Emissions from Rosebud Mining Operations (tons per year)

Emissions Year	CO_2	CH_4	N_2O
2020	1,863	134	0.0045
2021	8,385	604	0.1013
2022	37,266	2,685	0.4500
2023	37,266	2,685	0.4500
2024	37,266	2,685	0.4500
2025	37,266	2,685	0.4500
2026	37,266	2,685	0.4500
2027	37,266	2,685	0.4500
2028	37,266	2,685	0.4500
2029	37,266	2,685	0.4500
2030	37,266	2,685	0.4500
2031	37,266	2,685	0.4500
2032	37,266	2,685	0.4500
2033	37,266	2,685	0.4500
2034	37,266	2,685	0.4500
2035	37,266	2,685	0.4500
2036	37,266	2,685	0.4500
2037	37,266	2,685	0.4500
2038	37,266	2,685	0.4500
2039	14,906	1,074	0.1800

Source: Personal communication from Emily Corsi, Senior Environmental Planner/Associate, ERO Resources Corporation, July 2024.

Table 5 presents the estimated annual indirect emissions from combustion of Rosebud coal at the Colstrip and Rosebud generating facilities. Combustion of coal mined from Area F would be a subset of these emissions. Further detail regarding these emission projections is also provided in SEIS Section 4.4 Climate and Climate Change.

Table 5. Projected Annual Indirect Greenhouse Gas Emissions from Combustion of Rosebud Coal (tons per year)

Emissions Year	CO_2	CH_4	N_2O
2020	11,090,132	1,313	192
2021	11,090,132	1,313	192
2022	11,090,132	1,313	192
2023	11,090,132	1,313	192
2024	11,090,132	1,313	192
2025	11,090,132	1,313	192
2026	11,090,132	1,313	192
2027	11,090,132	1,313	192
2028	11,090,132	1,313	192
2029	11,090,132	1,313	192
2030	11,090,132	1,313	192
2031	11,090,132	1,313	192
2032	11,090,132	1,313	192
2033	11,090,132	1,313	192
2034	11,090,132	1,313	192
2035	11,090,132	1,313	192
2036	11,090,132	1,313	192
2037	11,090,132	1,313	192
2038	11,090,132	1,313	192
2039	11,090,132	1,313	192

Source: Personal communication from Emily Corsi, Senior Environmental Planner/Associate, ERO Resources Corporation, July 2024.

Table 6 presents the estimated annual indirect emissions from workers commuting to the Rosebud Mine, the Rosebud Power Plant and the Colstrip Power Plant. Emissions from workforce commuting are expressed in terms of CO_2 equivalent tons per year (CO_{2e}). Further detail regarding these emission projections is also provided in SEIS Section 4.4 Climate and Climate Change.

Table 6. Projected Annual Indirect Greenhouse Gas Emissions from Workers Commuting to Rosebud Mine and Power Plant and Colstrip Power Plant (tons per year)

Emissions Year	CO_2e
2020	4,753
2021	4,753
2022	4,753
2023	4,753
2024	4,753
2025	4,753
2026	4,753
2027	4,753
2028	4,753
2029	4,753
2030	4,753
2031	4,753
2032	4,753
2033	4,753
2034	4,753
2035	4,753
2036	4,753
2037	4,753
2038	4,753
2039	4,753

Source: Personal communication from Emily Corsi, Senior Environmental Planner/Associate, ERO Resources Corporation, July 2024.

Estimated Social Cost of Carbon from Rosebud Mining, Combustion of Rosebud Coal and Workforce Commuting

The estimated social cost of carbon emissions from mining coal at the Rosebud Mine is the product of the projected emissions (tables 4, 6 and 6) and the estimated social cost per ton of those emissions by pollutant (tables 1 through 3). At the bottom of each of the following tables, the total estimated social cost of emissions is summarized for each SEIS alternative, including Alternative 1: No Action (which assumes mining ceases after 2025), Alternative 4: Proposed Action (which assumes mining ceases after 2039) and Alternative 5: Partial Mining Alternative (which assumes mining ceases after 2030).

Table 7 presents the estimated direct social cost from emissions created by Rosebud mining, including emissions of carbon dioxide, methane and nitrous oxide. Mining from Area F would produce a portion of these emissions.

As summarized at the bottom of the table, the total estimated direct social cost of carbon emissions under the No Action Alternative ranges from $37 million to $76 million, depending on the discount rate. It should be noted, however, that about 76 percent of the costs under the No Action Alternative are due to mining which will have already occurred by the end of the current year (2024).

The largest components of the direct social cost of carbon under the Proposed Action are from carbon dioxide emissions (50 to 61 percent depending on the discount rate), followed by methane emissions (39 to 50 percent of the total cost). The social costs of nitrous oxide emissions are relatively minimal due to the comparatively low level of projected direct emissions of that pollutant.

The total estimated direct social cost of carbon emissions under the Proposed Action ranges from $187 million to $392 million, depending on the discount rate. The total estimated direct social cost of carbon emissions under Alternative 5 (the Partial Mining Alternative) ranges from $87 million to $182 million.

Table 7. Projected Annual Direct Social Cost of Carbon Emissions from Rosebud Mining (including CO_2, CH_4 and N_2O - 2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$398,000	$569,000	$756,000
2021	$1,848,000	$2,647,000	$3,582,000
2022	$8,450,000	$12,130,000	$16,686,000
2023	$8,686,000	$12,494,000	$17,450,000
2024	$8,922,000	$12,858,000	$18,214,000
2025	$9,159,000	$13,223,000	$18,978,000
2026	$9,395,000	$13,587,000	$19,742,000
2027	$9,631,000	$13,952,000	$20,506,000
2028	$9,867,000	$14,316,000	$21,270,000
2029	$10,103,000	$14,680,000	$22,034,000
2030	$10,339,000	$15,045,000	$22,798,000
2031	$10,666,000	$15,436,000	$23,254,000
2032	$10,993,000	$15,827,000	$23,710,000
2033	$11,320,000	$16,219,000	$24,165,000
2034	$11,647,000	$16,610,000	$24,621,000
2035	$11,974,000	$17,001,000	$25,077,000
2036	$12,301,000	$17,393,000	$25,532,000
2037	$12,628,000	$17,784,000	$25,988,000
2038	$12,955,000	$18,175,000	$26,444,000
2039	$5,313,000	$7,427,000	$10,760,000
2020-2025 (NAA)	$37,463,000	$53,921,000	$75,666,000
2020-2039 (PA)	$186,595,000	$267,373,000	$391,569,000
2020-2030 (Alt 5)	$86,798,000	$125,501,000	$182,017,000

Source: BBC Research & Consulting, 2024.

Table 8 presents the estimated <u>indirect</u> social cost from emissions created by combustion of Rosebud coal, including emissions of carbon dioxide, methane and nitrous oxide.

As summarized at the bottom of the table, the total estimated indirect social cost of carbon emissions from coal combustion are at least two orders of magnitude (100 times) larger than the estimated direct social cost of carbon emissions from mining shown previously in Table 7. Estimated indirect costs under the No Action Alternative range from $8 billion to $18 billion, depending on the discount rate. As discussed regarding the direct costs estimates presented previously, over 80 percent of the costs under the No Action Alternative are due to coal combustion which will have already occurred by the end of the current year (2024).

In contrast to the direct social costs of carbon from mining, the largest component of the indirect social cost of carbon is from carbon dioxide emissions (over 99 percent of the total costs). The indirect social costs from emissions of methane and nitrous oxide make up one percent or less of the total estimated indirect social costs.

The total estimated indirect social cost of carbon emissions under the Proposed Action ranges from about $32 billion to $79 billion, depending on the discount rate. The total estimated indirect social cost of carbon emissions under Alternative 5 (the Partial Mining Alternative) ranges from $16 billion to $38 billion.

Table 8. Projected Annual Indirect Social Cost of Carbon Emissions from Combustion of Rosebud Coal (including CO_2, CH_4 and N_2O – 2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$1,339,243,000	$2,119,594,000	$2,681,356,000
2021	$1,361,694,000	$2,164,290,000	$2,836,985,000
2022	$1,384,145,000	$2,208,986,000	$2,992,615,000
2023	$1,406,596,000	$2,253,682,000	$3,148,244,000
2024	$1,429,047,000	$2,298,378,000	$3,303,874,000
2025	$1,451,498,000	$2,343,074,000	$3,459,504,000
2026	$1,473,949,000	$2,387,770,000	$3,615,133,000
2027	$1,496,400,000	$2,432,466,000	$3,770,763,000
2028	$1,518,851,000	$2,477,162,000	$3,926,393,000
2029	$1,541,302,000	$2,521,858,000	$4,082,022,000
2030	$1,563,753,000	$2,566,554,000	$4,237,652,000
2031	$1,597,321,000	$2,611,282,000	$4,293,618,000
2032	$1,630,888,000	$2,656,010,000	$4,349,584,000
2033	$1,664,455,000	$2,700,738,000	$4,405,550,000
2034	$1,698,023,000	$2,745,467,000	$4,461,516,000
2035	$1,731,590,000	$2,790,195,000	$4,517,482,000
2036	$1,765,158,000	$2,834,923,000	$4,573,448,000
2037	$1,798,725,000	$2,879,652,000	$4,629,413,000
2038	$1,832,293,000	$2,924,380,000	$4,685,379,000
2039	$1,865,860,000	$2,969,108,000	$4,741,345,000
2020-2025 (NAA)	$8,372,223,000	$13,388,004,000	$18,422,578,000
2020-2039 (PA)	$31,550,791,000	$50,885,569,000	$78,711,876,000
2020-2030 (Alt 5)	$15,966,478,000	$25,773,814,000	$38,054,541,000

Source: BBC Research & Consulting, 2024.

Table 9 presents the estimated indirect social cost of carbon from workforce commuting to the Rosebud Mine, the Rosebud Power Plant and the Colstrip Power Plant. Total indirect social costs of carbon from commuting range from about $3.6 to $7.8 million under the No Action Alternative, $13.4 to $33.5 million under the Proposed Action, and about $6.8 million to $16.2 million under Alternative 5 (the Partial Mining Alternative).

Table 9. Projected Annual Indirect Social Cost of Carbon Emissions from Workforce Commuting (2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$570,000	$903,000	$1,141,000
2021	$580,000	$922,000	$1,207,000
2022	$589,000	$941,000	$1,274,000
2023	$599,000	$960,000	$1,340,000
2024	$608,000	$979,000	$1,407,000
2025	$618,000	$998,000	$1,474,000
2026	$627,000	$1,017,000	$1,540,000
2027	$637,000	$1,036,000	$1,607,000
2028	$646,000	$1,055,000	$1,673,000
2029	$656,000	$1,074,000	$1,740,000
2030	$665,000	$1,093,000	$1,806,000
2031	$680,000	$1,112,000	$1,830,000
2032	$694,000	$1,131,000	$1,854,000
2033	$708,000	$1,150,000	$1,878,000
2034	$723,000	$1,169,000	$1,901,000
2035	$737,000	$1,188,000	$1,925,000
2036	$751,000	$1,207,000	$1,949,000
2037	$765,000	$1,226,000	$1,973,000
2038	$780,000	$1,245,000	$1,996,000
2039	$794,000	$1,264,000	$2,020,000
2020-2025 (NAA)	$3,564,000	$5,703,000	$7,843,000
2020-2039 (PA)	$13,427,000	$21,678,000	$33,535,000
2020-2030 (Alt 5)	$6,795,000	$10,980,000	$16,209,000

Source: BBC Research & Consulting, 2024.

The final table in this report presents the estimated total social costs of carbon from the SEIS alternatives, combining the direct social costs presented in Table 7 and the indirect social costs presented in Tables 8 and 9. About 99 percent of the total social costs are due to the indirect costs from coal combustion. As shown in Table 10, the estimated total social costs of carbon range from about $8.4 billion to $18.5 billion under the No Action Alternative (though over 80 percent of those costs will have already been incurred by the end of 2024). The estimated total social costs of carbon under the Proposed Action range from about $32 billion to $79 billion. The estimated total social costs of carbon under the Partial Mining Alternative (Alternative 5), range from about $16 billion to about $38 billion.

Table 10. Projected Annual Total Social Cost of Carbon Emissions for Rosebud Mining Alternatives (combining direct costs and indirect costs – 2020 dollars)

	Discount Rate		
Emissions Year	**2.5%**	**2.0%**	**1.5%**
2020	$1,340,211,000	$2,121,066,000	$2,683,252,000
2021	$1,364,122,000	$2,167,859,000	$2,841,775,000
2022	$1,393,185,000	$2,222,057,000	$3,010,575,000
2023	$1,415,881,000	$2,267,136,000	$3,167,035,000
2024	$1,438,578,000	$2,312,215,000	$3,323,495,000
2025	$1,461,274,000	$2,357,295,000	$3,479,955,000
2026	$1,483,971,000	$2,402,374,000	$3,636,416,000
2027	$1,506,668,000	$2,447,454,000	$3,792,876,000
2028	$1,529,364,000	$2,492,533,000	$3,949,336,000
2029	$1,552,061,000	$2,537,612,000	$4,105,796,000
2030	$1,574,758,000	$2,582,692,000	$4,262,256,000
2031	$1,608,666,000	$2,627,830,000	$4,318,702,000
2032	$1,642,575,000	$2,672,830,000	$4,375,147,000
2033	$1,676,484,000	$2,718,108,000	$4,431,592,000
2034	$1,710,393,000	$2,763,246,000	$4,488,038,000
2035	$1,744,301,000	$2,808,385,000	$4,544,483,000
2036	$1,778,210,000	$2,853,523,000	$4,600,929,000
2037	$1,812,119,000	$2,898,662,000	$4,657,374,000
2038	$1,846,028,000	$2,943,801,000	$4,713,820,000
2039	$1,871,967,000	$2,977,799,000	$4,754,125,000
2020-2025 (NAA)	$8,413,251,000	$13,447,628,000	$18,506,087,000
2020-2039 (PA)	$31,750,816,000	$51,174,617,000	$79,136,977,000
2020-2030 (Alt 5)	$16,060,073,000	$25,910,293,000	$38,252,767,000

Source: BBC Research & Consulting, 2024.

Summary

This technical memorandum has presented the estimated direct, indirect and total social costs of carbon emissions (CO_2, CH_4 and N_20) from mining at the Rosebud coal mine and combustion of Rosebud coal at the Colstrip Power Plant and the Rosebud Power Plant, as well as the indirect social costs of carbon from workers commuting to the mine and the two power plants. The estimated social costs combine projected emissions data from SEIS Section 4.4 Climate and Climate Change with estimated social costs per ton by pollutant published by the Environmental Protection Agency in 2023. All monetary estimates are presented in year 2020 dollars.

Annual direct social costs of carbon emissions from Rosebud mining range from $37 million to $76 million for the No Action Alternative, from $187 to $392 million for the Proposed Action and from $87 million to $182 million for Alternative 5, the Partial Mining Alternative. The majority of the social costs of carbon from mining are due to methane emissions, followed by carbon dioxide emissions. Nitrous oxide emissions are comparatively small and represent a small portion of the estimated direct social costs.

The estimated indirect social costs of carbon emissions from combustion of coal mined at Rosebud are much larger than the estimated direct social costs from mining – at least two orders of magnitude greater. Indirect social costs of carbon from workforce commuting are relatively small by comparison. Unlike the direct social costs from mining, the indirect social costs from coal combustion are dominated by the costs of carbon dioxide emissions.

Combining the direct and indirect social cost of carbon estimates, the total social costs are estimated at between $8 billion and $19 billion for the No Action Alternative – though most of those costs have already been incurred between year 2000 and year 2024. The total social costs of the Proposed Action are estimated at between $32 billion and $79 billion. The total social costs of the Partial Mining Alternative (Alternative 5) are estimated at between $16 billion and $38 billion.

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Appendix 3 – Water Quality Tables

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Baseline Surface Water Quality Tables

Streams

Table 1. Water Quality of Robbie Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	6	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	6	6	0.017	0.0255	**0.142**	NS	0.75	0.087
Aluminum, total (mg/L)	6	6	0.020	0.0425	0.321	NS	NS	NS
Ammonia, as N (mg/L)[1]	6	1	0.0073	0.0073	0.0142	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	6	5	0.000314	0.000479	0.001	NS	NS	NS
Arsenic, total (mg/L)	6	5	0.000518	0.000927	0.001	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	6	6	94	589	693	NS	NS	NS
Boron, diss (mg/L)	6	6	0.070	0.48	0.64	NS	NS	NS
Boron, total (mg/L)	6	6	0.070	0.58	0.78	NS	NS	NS
Cadmium, diss (mg/L)	6	0	0.0000658	0.000180	0.000294	NS	NS	NS
Cadmium, total (mg/L)[2]	6	1	0.0000923	0.000138	0.000287	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	6	6	27	177	200	NS	NS	NS
Carbonate Alkalinity (mg/L)	6	4	1	23.5	57	NS	NS	NS
Chloride (mg/L)	6	6	3	22	27	NS	NS	NS
Chromium, diss (mg/L)	0	0	-	-	-	NS	NS	NS
Chromium, total (mg/L)[2]	0	0	-	-	-	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	6	2	0.000358	0.000358	0.00135	NS	NS	NS
Copper, total (mg/L)[2]	6	2	0.000319	0.000488	**0.051**	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	6	6	0.0495	0.20	0.30	4	NS	NS
Hydroxide alkalinity (mg/L)	6	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	6	6	0.017	0.045	0.14	NS	NS	NS
Iron, total (mg/L)	6	6	0.10	0.15	0.49	NS	NS	1
Laboratory Conductivity (µS/cm)	6	6	549	3,200	3,540	NS	NS	NS
Laboratory pH (s.u.)	6	6	8.1	8.4	8.5	NS	NS	NS
Lead, diss (mg/L)	6	0	0.0000332	0.0000349	0.0000365	NS	NS	NS
Lead, total (mg/L)[2]	6	1	0.0000627	0.0000627	0.000124	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	6	6	36	352	378	NS	NS	NS
Manganese, diss (mg/L)	6	6	0.046	0.137	0.786	NS	NS	NS
Manganese, total (mg/L)	6	6	0.054	0.180	0.744	NS	NS	NS
Mercury, diss (mg/L)	0	0	-	-	-	NS	NS	NS

Table 1. Water Quality of Robbie Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Mercury, total (mg/L)	0	0	-	-	-	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	6	3	0.000763	0.000995	0.0030	NS	NS	NS
Nickel, total (mg/L)[2]	6	5	0.000774	0.0025	0.0050	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	6	1	0.0066	0.0066	0.10	10	NS	NS
Orthophosphate as P (mg/L)	0	0	-	-	-	NS	NS	NS
Potassium, diss (mg/L)	6	6	9.0	13	16	NS	NS	NS
Selenium, diss (mg/L)	6	2	0.00028	0.00055	0.00088	NS	NS	NS
Selenium, total (mg/L)	6	3	0.000379	0.000504	0.000521	0.05	0.02	0.005
Sodium, diss (mg/L)	6	6	17	200	228	NS	NS	NS
Sodium Absorption Ratio	6	6	0.50	1.94	2.28	NS	NS	NS
Sulfate (mg/L)	6	6	172	1,765	1,890	NS	NS	NS
Total Alkalinity (mg/L)	6	6	94	618	716	NS	NS	NS
Total Dissolved Solids (mg/L)	6	6	370	3,125	3,210	NS	NS	NS
Total Hardness (mg/L)	6	6	216	1,930	2,020	NS	NS	NS
Total Nitrogen (mg/L)	6	6	0.37	0.73	1.37	NS	NS	NS
Total Phosphate (mg/L)	6	6	0.020	0.025	0.35	NS	NS	NS
Total Suspended Sediments (mg/L)	8	8	2.0	5.0	31	NS	NS	NS
Turbidity (NTU)	0	0	-	-	-	NS	NS	NS
Vanadium, diss (mg/L)	6	2	0.000828	0.000828	0.00348	NS	NS	NS
Vanadium, total (mg/L)	6	1	0.000914	0.00213	0.00323	NS	NS	NS
Zinc, diss (mg/L)	6	0	0.00307	0.00307	0.00477	NS	NS	NS
Zinc, total (mg/L)[2]	6	6	0.0028	0.0081	0.019	7.4	Hardness Dependent	Hardness Dependent

Data collected between March 2019 and July 2020 for locations CG-101 and CG-102.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. The Aquatic Life Standard for Copper was exceeded once for CG-101 during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 2. Water Quality of Donley Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	12	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	12	12	0.00323	**0.18**	**1.3**	NS	0.75	0.087
Aluminum, total (mg/L)	12	12	0.00617	1.0	9.92	NS	NS	NS
Ammonia, as N (mg/L)[1]	12	8	0.0073	0.29	**14.9**	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	12	10	0.000299	0.000848	0.0010	NS	NS	NS
Arsenic, total (mg/L)	12	11	0.000518	0.00108	0.0090	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	12	12	37	207	341	NS	NS	NS
Boron, diss (mg/L)	12	10	0.0257	0.10	0.68	NS	NS	NS
Boron, total (mg/L)	12	12	0.0269	0.11	0.85	NS	NS	NS
Cadmium, diss (mg/L)	12	2	0.0000658	0.000106	0.000348	NS	NS	NS
Cadmium, total (mg/L)[2]	12	5	0.0000772	0.000159	0.000496	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	12	12	7.0	33	227	NS	NS	NS
Carbonate Alkalinity (mg/L)	12	5	1	1	41	NS	NS	NS
Chloride (mg/L)	12	12	0.637	7.5	19	NS	NS	NS
Chromium, diss (mg/L)	1	1	0.000456	0.000456	0.000456	NS	NS	NS
Chromium, total (mg/L)[2]	1	1	0.00543	0.00543	0.00543	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	12	8	0.000358	0.0017	0.0070	NS	NS	NS
Copper, total (mg/L)[2]	12	9	0.000319	0.0050	**0.031**	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	12	9	0.0398	0.132	0.30	4	NS	NS
Hydroxide alkalinity (mg/L)	12	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	12	12	0.00502	0.196	0.830	NS	NS	NS
Iron, total (mg/L)	12	12	0.040	**1.46**	**18**	NS	NS	1
Laboratory Conductivity (µS/cm)	12	12	86	877	4,870	NS	NS	NS
Laboratory pH (s.u.)	13	13	7.2	7.89	8.7	NS	NS	NS
Lead, diss (mg/L)	12	7	0.0000332	0.000208	0.00090	NS	NS	NS
Lead, total (mg/L)[2]	12	8	0.0000627	0.00137	**0.0165**	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	12	12	2.0	36.5	365	NS	NS	NS
Manganese, diss (mg/L)	12	11	0.00122	0.0397	0.247	NS	NS	NS
Manganese, total (mg/L)	12	12	0.0080	0.074	0.532	NS	NS	NS
Mercury, diss (mg/L)	1	0	0.000023	0.000023	0.000023	NS	NS	NS
Mercury, total (mg/L)	1	0	0.000023	0.000023	0.000023	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	12	7	0.000763	0.00118	0.0050	NS	NS	NS

Table 2. Water Quality of Donley Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	12	11	0.000967	0.00293	0.0220	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	12	7	0.0066	0.13	1.78	10	NS	NS
Orthophosphate as P (mg/L)	1	1	0.657	0.657	0.657	NS	NS	NS
Potassium, diss (mg/L)	12	12	6.0	15	100	NS	NS	NS
Selenium, diss (mg/L)	12	10	0.000135	0.000696	0.0020	NS	NS	NS
Selenium, total (mg/L)	12	11	0.000225	0.000806	0.0020	0.05	0.02	0.005
Sodium, diss (mg/L)	12	10	0.508	47	605	NS	NS	NS
Sodium Absorption Ratio	12	10	0.010	1.27	5.85	NS	NS	NS
Sulfate (mg/L)	12	12	0.743	236	2,770	NS	NS	NS
Total Alkalinity (mg/L)	12	12	37	207	372	NS	NS	NS
Total Dissolved Solids (mg/L)	12	12	90	750	4,450	NS	NS	NS
Total Hardness (mg/L)	12	12	26	234	2,060	NS	NS	NS
Total Nitrogen (mg/L)	12	12	0.35	1.86	18.6	NS	NS	NS
Total Phosphate (mg/L)	12	12	0.020	0.305	5.56	NS	NS	NS
Total Suspended Sediments (mg/L)	66	66	2.0	97	1,080	NS	NS	NS
Turbidity (NTU)	1	1	43.2	43.2	43.2	NS	NS	NS
Vanadium, diss (mg/L)	12	8	0.000651	0.001099	0.00241	NS	NS	NS
Vanadium, total (mg/L)	12	8	0.000914	0.00323	0.03	NS	NS	NS
Zinc, diss (mg/L)	12	5	0.00197	0.00580	0.024	NS	NS	NS
Zinc, total (mg/L)[2]	12	9	0.00225	0.0138	0.077	7.4	Hardness Dependent	Hardness Dependent

Data collected between May 2016 and June 2023 for locations CG-106, SW-89, SW-90, and SW-200.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. The Aquatic Life Standard for Ammonia was exceeded twice for SW-90 during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. The Aquatic Life Standard for Copper was exceeded twice for SW-90 and SW-200 during the monitoring period. The Aquatic Life Standard for Lead was exceeded three times for SW-90 and SW-200 during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 3. Water Quality of Black Hank Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	3	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	3	3	0.066	**0.114**	**0.599**	NS	0.75	0.087
Aluminum, total (mg/L)	3	3	0.162	0.339	2.04	NS	NS	NS
Ammonia, as N (mg/L)[1]	3	2	0.0073	0.0435	0.0816	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	3	3	0.000325	0.000389	0.000661	NS	NS	NS
Arsenic, total (mg/L)	3	3	0.000343	0.000647	0.002	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	3	3	42	52.4	68	NS	NS	NS
Boron, diss (mg/L)	3	3	0.0254	0.0282	0.03	NS	NS	NS
Boron, total (mg/L)	3	3	0.030	0.040	0.0486	NS	NS	NS
Cadmium, diss (mg/L)	3	0	0.00004	0.0000658	0.000106	NS	NS	NS
Cadmium, total (mg/L)[2]	3	1	0.0000923	0.0000949	0.00025	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	3	3	9.0	15.8	27	NS	NS	NS
Carbonate Alkalinity (mg/L)	3	0	1	1	1	NS	NS	NS
Chloride (mg/L)	3	3	1.0	2.0	2.08	NS	NS	NS
Chromium, diss (mg/L)	1	1	0.000327	0.000327	0.000327	NS	NS	NS
Chromium, total (mg/L)[2]	1	1	0.000811	0.000811	0.000811	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	3	3	0.000823	0.00147	0.002	NS	NS	NS
Copper, total (mg/L)[2]	3	3	0.00271	0.0030	**0.0060**	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	3	1	0.00834	0.035	0.0451	4	NS	NS
Hydroxide alkalinity (mg/L)	3	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	3	3	0.070	0.0861	0.43	NS	NS	NS
Iron, total (mg/L)	3	3	0.21	0.502	**3.1**	NS	NS	1
Laboratory Conductivity (µS/cm)	3	3	100	295	377	NS	NS	NS
Laboratory pH (s.u.)	3	3	7.6	7.96	8.0	NS	NS	NS
Lead, diss (mg/L)	3	1	0.0000365	0.000125	0.000295	NS	NS	NS
Lead, total (mg/L)[2]	3	2	0.0000627	0.000401	**0.0028**	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	3	3	3.0	14.3	15	NS	NS	NS
Manganese, diss (mg/L)	3	3	0.011	0.013	0.0139	NS	NS	NS
Manganese, total (mg/L)	3	3	0.016	0.025	0.067	NS	NS	NS
Mercury, diss (mg/L)	1	0	0.000023	0.000023	0.000023	NS	NS	NS
Mercury, total (mg/L)	1	0	0.000023	0.000023	0.000023	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	3	1	0.000764	0.000995	0.00133	NS	NS	NS

Table 3. Water Quality of Black Hank Creek Surface Water.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	3	2	0.000774	0.00132	0.003	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	3	3	0.060	0.223	0.25	10	NS	NS
Orthophosphate as P (mg/L)	1	1	0.234	0.234	0.234	NS	NS	NS
Potassium, diss (mg/L)	3	3	9.49	10	14	NS	NS	NS
Selenium, diss (mg/L)	3	0	0.000125	0.000171	0.00076	NS	NS	NS
Selenium, total (mg/L)	3	1	0.00021	0.000521	0.00057	0.05	0.02	0.005
Sodium, diss (mg/L)	3	3	0.552	13.6	14.0	NS	NS	NS
Sodium Absorption Ratio	3	2	0.010	0.54	0.59	NS	NS	NS
Sulfate (mg/L)	3	3	3.0	80.8	105	NS	NS	NS
Total Alkalinity (mg/L)	3	3	42	52.4	68	NS	NS	NS
Total Dissolved Solids (mg/L)	3	3	130	208	260	NS	NS	NS
Total Hardness (mg/L)	3	3	34	98.4	129	NS	NS	NS
Total Nitrogen (mg/L)	3	3	1.45	1.65	1.82	NS	NS	NS
Total Phosphate (mg/L)	3	3	0.33	0.396	0.41	NS	NS	NS
Total Suspended Sediments (mg/L)	18	18	4.0	45.5	39,900	NS	NS	NS
Turbidity (NTU)	1	1	8.07	8.07	8.07	NS	NS	NS
Vanadium, diss (mg/L)	3	2	0.000412	0.000581	0.000828	NS	NS	NS
Vanadium, total (mg/L)	3	3	0.00106	0.00122	0.00675	NS	NS	NS
Zinc, diss (mg/L)	3	0	0.00146	0.00307	0.00682	NS	NS	NS
Zinc, total (mg/L)[2]	3	3	0.0032	0.0048	0.012	7.4	Hardness Dependent	Hardness Dependent

Data collected between February 2017 and September 2023 for locations CG-100, CG-103, and CG-105.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. The Aquatic Life Standard for Copper was exceeded once for CG-100 during the monitoring period. The Aquatic Life Standard for Lead was exceeded once for CG-100 during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Ponds

Table 4. Water Quality of Pond 1.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	7	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	7	7	0.030	0.0444	**0.10**	NS	0.75	0.087
Aluminum, total (mg/L)	7	7	0.062	0.19	0.699	NS	NS	NS
Ammonia, as N (mg/L)[1]	7	2	0.0073	0.0073	0.0686	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	7	6	0.000314	0.000883	0.00204	NS	NS	NS
Arsenic, total (mg/L)	7	6	0.000518	0.0010	0.0020	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	7	7	420	457	558	NS	NS	NS
Boron, diss (mg/L)	7	7	0.547	0.72	0.87	NS	NS	NS
Boron, total (mg/L)	7	7	0.758	0.94	1.36	NS	NS	NS
Cadmium, diss (mg/L)	7	4	0.000056	0.0000658	0.000378	NS	NS	NS
Cadmium, total (mg/L)[2]	7	3	0.0000514	0.0000923	0.00075	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	7	7	288	330	366	NS	NS	NS
Carbonate Alkalinity (mg/L)	7	6	1.0	20.4	45	NS	NS	NS
Chloride (mg/L)	7	7	11	13	18	NS	NS	NS
Chromium, diss (mg/L)	0	0	-	-	-	NS	NS	NS
Chromium, total (mg/L)[2]	0	0	-	-	-	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	7	3	0.0000224	0.000358	0.00218	NS	NS	NS
Copper, total (mg/L)[2]	7	7	0.000778	0.00245	0.0075	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	7	7	0.20	0.30	0.389	4	NS	NS
Hydroxide alkalinity (mg/L)	7	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	7	5	0.000688	0.0127	0.040	NS	NS	NS
Iron, total (mg/L)	7	7	0.080	0.29	**1.52**	NS	NS	1
Laboratory Conductivity (µS/cm)	7	7	4,920	5,580	6,000	NS	NS	NS
Laboratory pH (s.u.)	7	7	8.2	8.37	8.5	NS	NS	NS
Lead, diss (mg/L)	7	3	0.00000507	0.0000365	0.00067	NS	NS	NS
Lead, total (mg/L)[2]	7	4	0.0000122	0.000073	0.00070	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	7	7	474	512	600	NS	NS	NS
Manganese, diss (mg/L)	7	6	0.00122	0.025	0.131	NS	NS	NS
Manganese, total (mg/L)	7	7	0.0207	0.094	0.155	NS	NS	NS
Mercury, diss (mg/L)	0	0	-	-	-	NS	NS	NS
Mercury, total (mg/L)	0	0	-	-	-	0.00005	0.0017	0.0009

Table 4. Water Quality of Pond 1.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, diss (mg/L)	7	5	0.000764	0.0014	0.004	NS	NS	NS
Nickel, total (mg/L)[2]	7	6	0.000574	0.0030	0.0102	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	7	2	0.0066	0.0066	0.023	10	NS	NS
Orthophosphate as P (mg/L)	0	0	-	-	-	NS	NS	NS
Potassium, diss (mg/L)	7	7	16	19.3	24	NS	NS	NS
Selenium, diss (mg/L)	7	7	0.000582	0.00106	0.00539	NS	NS	NS
Selenium, total (mg/L)	7	7	0.000937	0.0020	**0.00584**	0.05	0.02	0.005
Sodium, diss (mg/L)	7	7	441	539	637	NS	NS	NS
Sodium Absorption Ratio	7	7	3.61	4.37	4.76	NS	NS	NS
Sulfate (mg/L)	7	7	3,280	3,480	3,870	NS	NS	NS
Total Alkalinity (mg/L)	7	7	420	472	581	NS	NS	NS
Total Dissolved Solids (mg/L)	7	7	4,930	5,860	7,070	NS	NS	NS
Total Hardness (mg/L)	7	7	2,710	2,820	3,380	NS	NS	NS
Total Nitrogen (mg/L)	7	7	0.58	0.83	1.27	NS	NS	NS
Total Phosphate (mg/L)	7	7	0.00675	0.0338	0.13	NS	NS	NS
Total Suspended Sediments (mg/L)	7	7	3.0	11	89	NS	NS	NS
Turbidity (NTU)	0	0	-	-	-	NS	NS	NS
Vanadium, diss (mg/L)	7	7	0.000343	0.00167	0.00287	NS	NS	NS
Vanadium, total (mg/L)	7	5	0.000606	0.00261	0.00437	NS	NS	NS
Zinc, diss (mg/L)	7	1	0.00146	0.00146	0.00477	NS	NS	NS
Zinc, total (mg/L)[2]	7	7	0.0080	0.018	0.075	7.4	Hardness Dependent	Hardness Dependent

Data collected between April 2018 and May 2020.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 5. Water Quality of Pond 2.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	1	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	1	1	0.03	0.03	0.03	NS	0.75	0.087
Aluminum, total (mg/L)	1	1	0.153	0.153	0.153	NS	NS	NS
Ammonia, as N (mg/L)[1]	1	1	0.37	0.37	0.37	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	1	1	0.00183	0.00183	0.00183	NS	NS	NS
Arsenic, total (mg/L)	1	1	0.00184	0.00184	0.00184	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	1	1	468	468	468	NS	NS	NS
Boron, diss (mg/L)	1	1	0.583	0.583	0.583	NS	NS	NS
Boron, total (mg/L)	1	1	0.853	0.853	0.853	NS	NS	NS
Cadmium, diss (mg/L)	1	1	0.0005	0.0005	0.0005	NS	NS	NS
Cadmium, total (mg/L)[2]	1	1	0.0005	0.0005	0.0005	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	1	1	273	273	273	NS	NS	NS
Carbonate Alkalinity (mg/L)	1	1	24.5	24.5	24.5	NS	NS	NS
Chloride (mg/L)	1	1	11.8	11.8	11.8	NS	NS	NS
Chromium, diss (mg/L)	1	0	0.000253	0.000253	0.000253	NS	NS	NS
Chromium, total (mg/L)[2]	1	1	0.00161	0.00161	0.00161	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	1	1	0.00331	0.00331	0.00331	NS	NS	NS
Copper, total (mg/L)[2]	1	1	0.0036	0.0036	0.0036	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	1	0	0.004	0.004	0.004	4	NS	NS
Hydroxide alkalinity (mg/L)	1	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	1	1	0.02	0.02	0.02	NS	NS	NS
Iron, total (mg/L)	1	1	0.217	0.217	0.217	NS	NS	1
Laboratory Conductivity (µS/cm)	1	1	5,070	5,070	5,070	NS	NS	NS
Laboratory pH (s.u.)	1	1	8.33	8.33	8.33	NS	NS	NS
Lead, diss (mg/L)	1	1	0.0003	0.0003	0.0003	NS	NS	NS
Lead, total (mg/L)[2]	1	0	0.000088	0.000088	0.000088	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	1	1	436	436	436	NS	NS	NS
Manganese, diss (mg/L)	1	1	0.0669	0.0669	0.0669	NS	NS	NS
Manganese, total (mg/L)	1	1	0.11	0.11	0.11	NS	NS	NS
Mercury, diss (mg/L)	1	0	0.00003	0.00003	0.00003	NS	NS	NS
Mercury, total (mg/L)	1	0	0.00003	0.00003	0.00003	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	1	1	0.002	0.002	0.002	NS	NS	NS

Table 5. Water Quality of Pond 2.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	1	1	0.00866	0.00866	0.00866	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	1	0	0.0046	0.0046	0.0046	10	NS	NS
Orthophosphate as P (mg/L)	1	0	0.007	0.007	0.007	NS	NS	NS
Potassium, diss (mg/L)	1	1	21.3	21.3	21.3	NS	NS	NS
Selenium, diss (mg/L)	1	1	0.00187	0.00187	0.00187	NS	NS	NS
Selenium, total (mg/L)	1	1	0.00267	0.00267	0.00267	0.05	0.02	0.005
Sodium, diss (mg/L)	1	1	443	443	443	NS	NS	NS
Sodium Absorption Ratio	1	1	3.9	3.9	3.9	NS	NS	NS
Sulfate (mg/L)	1	1	3,160	3,160	3,160	NS	NS	NS
Total Alkalinity (mg/L)	1	1	492	492	492	NS	NS	NS
Total Dissolved Solids (mg/L)	1	1	5,260	5,260	5,260	NS	NS	NS
Total Hardness (mg/L)	1	1	2,480	2,480	2,480	NS	NS	NS
Total Nitrogen (mg/L)	1	1	1.38	1.38	1.38	NS	NS	NS
Total Phosphate (mg/L)	1	1	0.0375	0.0375	0.0375	NS	NS	NS
Total Suspended Sediments (mg/L)	1	1	7	7	7	NS	NS	NS
Turbidity (NTU)	1	1	5.33	5.33	5.33	NS	NS	NS
Vanadium, diss (mg/L)	1	1	0.01	0.01	0.01	NS	NS	NS
Vanadium, total (mg/L)	1	1	0.01	0.01	0.01	NS	NS	NS
Zinc, diss (mg/L)	1	0	0.000855	0.000855	0.000855	NS	NS	NS
Zinc, total (mg/L)[2]	1	0	0.00178	0.00178	0.00178	7.4	Hardness Dependent	Hardness Dependent

Data collected in June 2014.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 6. Water Quality of Pond 4.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	1	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	1	1	0.082	0.082	0.082	NS	0.75	0.087
Aluminum, total (mg/L)	1	1	0.251	0.251	0.251	NS	NS	NS
Ammonia, as N (mg/L)[1]	1	1	0.0465	0.0465	0.0465	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	1	1	0.000292	0.000292	0.000292	NS	NS	NS
Arsenic, total (mg/L)	1	1	0.000403	0.000403	0.000403	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	1	1	30	30	30	NS	NS	NS
Boron, diss (mg/L)	1	1	0.0292	0.0292	0.0292	NS	NS	NS
Boron, total (mg/L)	1	1	0.0228	0.0228	0.0228	NS	NS	NS
Cadmium, diss (mg/L)	1	0	0.0000858	0.0000858	0.0000858	NS	NS	NS
Cadmium, total (mg/L)[2]	1	0	0.0000772	0.0000772	0.0000772	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	1	1	6	6	6	NS	NS	NS
Carbonate Alkalinity (mg/L)	1	0	1	1	1	NS	NS	NS
Chloride (mg/L)	1	1	0.647	0.647	0.647	NS	NS	NS
Chromium, diss (mg/L)	0	0	-	-	-	NS	NS	NS
Chromium, total (mg/L)[2]	0	0	-	-	-	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	1	1	0.00097	0.00097	0.00097	NS	NS	NS
Copper, total (mg/L)[2]	1	0	0.000278	0.000278	0.000278	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	1	0	0.0451	0.0451	0.0451	4	NS	NS
Hydroxide alkalinity (mg/L)	1	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	1	1	0.05	0.05	0.05	NS	NS	NS
Iron, total (mg/L)	1	1	0.26	0.26	0.26	NS	NS	1
Laboratory Conductivity (µS/cm)	1	1	66	66	66	NS	NS	NS
Laboratory pH (s.u.)	1	1	7.4	7.4	7.4	NS	NS	NS
Lead, diss (mg/L)	1	0	0.0000589	0.0000589	0.0000589	NS	NS	NS
Lead, total (mg/L)[2]	1	1	0.000277	0.000277	0.000277	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	1	1	2	2	2	NS	NS	NS
Manganese, diss (mg/L)	1	1	0.011	0.011	0.011	NS	NS	NS
Manganese, total (mg/L)	1	1	0.02	0.02	0.02	NS	NS	NS
Mercury, diss (mg/L)	0	0	-	-	-	NS	NS	NS
Mercury, total (mg/L)	0	0	-	-	-	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	1	0	0.000937	0.000937	0.000937	NS	NS	NS

Table 6. Water Quality of Pond 4.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	1	0	0.00154	0.00154	0.00154	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	1	1	0.06	0.06	0.06	10	NS	NS
Orthophosphate as P (mg/L)	0	0	-	-	-	NS	NS	NS
Potassium, diss (mg/L)	1	1	7	7	7	NS	NS	NS
Selenium, diss (mg/L)	1	0	0.000095	0.000095	0.000095	NS	NS	NS
Selenium, total (mg/L)	1	0	0.000147	0.000147	0.000147	0.05	0.02	0.005
Sodium, diss (mg/L)	1	0	0.508	0.508	0.508	NS	NS	NS
Sodium Absorption Ratio	1	0	0.01	0.01	0.01	NS	NS	NS
Sulfate (mg/L)	1	1	1	1	1	NS	NS	NS
Total Alkalinity (mg/L)	1	1	30	30	30	NS	NS	NS
Total Dissolved Solids (mg/L)	1	1	60	60	60	NS	NS	NS
Total Hardness (mg/L)	1	1	23	23	23	NS	NS	NS
Total Nitrogen (mg/L)	1	1	0.48	0.48	0.48	NS	NS	NS
Total Phosphate (mg/L)	1	1	0.29	0.29	0.29	NS	NS	NS
Total Suspended Sediments (mg/L)	1	1	12	12	12	NS	NS	NS
Turbidity (NTU)	0	0	-	-	-	NS	NS	NS
Vanadium, diss (mg/L)	1	0	0.000443	0.000443	0.000443	NS	NS	NS
Vanadium, total (mg/L)	1	1	0.000947	0.000947	0.000947	NS	NS	NS
Zinc, diss (mg/L)	1	0	0.00682	0.00682	0.00682	NS	NS	NS
Zinc, total (mg/L)[2]	1	1	0.009	0.009	0.009	7.4	Hardness Dependent	Hardness Dependent

Data collected in March 2023.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 7. Water Quality of Pond 5.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	26	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	26	24	0.00316	0.0365	**0.115**	NS	0.75	0.087
Aluminum, total (mg/L)	26	25	0.00697	0.127	0.494	NS	NS	NS
Ammonia, as N (mg/L)[1]	26	18	0.005	0.0822	**1.31**	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	26	26	0.000557	0.00328	0.0090	NS	NS	NS
Arsenic, total (mg/L)	26	26	0.000639	0.004	**0.011**	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	26	25	1.0	217	381	NS	NS	NS
Boron, diss (mg/L)	26	26	0.397	0.934	2.15	NS	NS	NS
Boron, total (mg/L)	26	26	0.452	1.09	2.47	NS	NS	NS
Cadmium, diss (mg/L)	25	10	0.0000050	0.0000858	0.000936	NS	NS	NS
Cadmium, total (mg/L)[2]	25	13	0.0000514	0.000154	**0.00384**	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	26	26	93	180	300	NS	NS	NS
Carbonate Alkalinity (mg/L)	26	25	1	36.5	141	NS	NS	NS
Chloride (mg/L)	26	26	8	20.5	41.9	NS	NS	NS
Chromium, diss (mg/L)	9	4	0.000287	0.000388	0.00167	NS	NS	NS
Chromium, total (mg/L)[2]	9	4	0.00035	0.00134	0.00684	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	25	17	0.000018	0.000837	0.00278	NS	NS	NS
Copper, total (mg/L)[2]	26	20	0.000093	0.00186	0.0149	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	26	24	0.00834	0.20	1.34	4	NS	NS
Hydroxide alkalinity (mg/L)	26	1	1	1	3.09	NS	NS	NS
Iron, diss (mg/L)	25	16	0.00050	0.00502	0.148	NS	NS	NS
Iron, total (mg/L)	26	26	0.0822	0.216	**1.07**	NS	NS	1
Laboratory Conductivity (µS/cm)	26	26	3,430	5,655	11,400	NS	NS	NS
Laboratory pH (s.u.)	26	26	8.03	8.61	9.31	NS	NS	NS
Lead, diss (mg/L)	26	11	0.0000023	0.0000668	0.000488	NS	NS	NS
Lead, total (mg/L)[2]	26	10	0.0000122	0.000109	0.00361	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	26	26	234	547	1,180	NS	NS	NS
Manganese, diss (mg/L)	26	26	0.00315	0.0785	1.04	NS	NS	NS
Manganese, total (mg/L)	26	26	0.015	0.119	1.06	NS	NS	NS
Mercury, diss (mg/L)	9	1	0.0000080	0.0000080	0.000023	NS	NS	NS
Mercury, total (mg/L)	9	0	0.0000080	0.000030	0.000030	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	26	15	0.000661	0.00167	0.0040	NS	NS	NS

Table 7. Water Quality of Pond 5.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	26	14	0.000574	0.00177	0.0060	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	26	8	0.0030	0.0066	1.31	10	NS	NS
Orthophosphate as P (mg/L)	9	0	0.00616	0.022	0.022	NS	NS	NS
Potassium, diss (mg/L)	26	26	8.91	17.9	41	NS	NS	NS
Selenium, diss (mg/L)	26	26	0.000707	0.0020	0.0131	NS	NS	NS
Selenium, total (mg/L)	26	26	0.000941	0.0030	**0.0146**	0.05	0.02	0.005
Sodium, diss (mg/L)	26	26	401	792	1,760	NS	NS	NS
Sodium Absorption Ratio	26	26	4.52	6.75	10.2	NS	NS	NS
Sulfate (mg/L)	26	26	1,930	4,030	7,830	NS	NS	NS
Total Alkalinity (mg/L)	26	26	142	266	395	NS	NS	NS
Total Dissolved Solids (mg/L)	26	26	2,880	6,670	12,700	NS	NS	NS
Total Hardness (mg/L)	26	26	1,200	2,685	5,600	NS	NS	NS
Total Nitrogen (mg/L)	26	26	0.81	1.44	3.85	NS	NS	NS
Total Phosphate (mg/L)	26	26	0.0308	0.066	0.21	NS	NS	NS
Total Suspended Sediments (mg/L)	26	26	3.0	7.0	46	NS	NS	NS
Turbidity (NTU)	9	9	1.5	3.88	8.12	NS	NS	NS
Vanadium, diss (mg/L)	25	23	0.000241	0.00152	0.00397	NS	NS	NS
Vanadium, total (mg/L)	25	18	0.000164	0.00238	0.0077	NS	NS	NS
Zinc, diss (mg/L)	26	0	0.00108	0.00146	0.00682	NS	NS	NS
Zinc, total (mg/L)[2]	26	19	0.00109	0.0128	0.078	7.4	Hardness Dependent	Hardness Dependent

Data collected between May 2015 and November 2023.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. The Aquatic Life Standard for Ammonia was exceeded three times during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. The Aquatic Life Standard for Cadmium was exceeded twice during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 8. Water Quality of Pond 7.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	1	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	1	0	0.00304	0.00304	0.00304	NS	0.75	0.087
Aluminum, total (mg/L)	1	1	0.494	0.494	0.494	NS	NS	NS
Ammonia, as N (mg/L)[1]	1	1	0.0185	0.0185	0.0185	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	1	1	0.000861	0.000861	0.000861	NS	NS	NS
Arsenic, total (mg/L)	1	1	0.00132	0.00132	0.00132	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	1	1	516	516	516	NS	NS	NS
Boron, diss (mg/L)	1	1	0.788	0.788	0.788	NS	NS	NS
Boron, total (mg/L)	1	1	1.41	1.41	1.41	NS	NS	NS
Cadmium, diss (mg/L)	1	1	0.000254	0.000254	0.000254	NS	NS	NS
Cadmium, total (mg/L)[2]	1	1	0.000274	0.000274	0.000274	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	1	1	260	260	260	NS	NS	NS
Carbonate Alkalinity (mg/L)	1	0	1	1	1	NS	NS	NS
Chloride (mg/L)	1	1	25	25	25	NS	NS	NS
Chromium, diss (mg/L)	1	0	0.000287	0.000287	0.000287	NS	NS	NS
Chromium, total (mg/L)[2]	1	0	0.00035	0.00035	0.00035	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	1	1	0.000371	0.000371	0.000371	NS	NS	NS
Copper, total (mg/L)[2]	1	1	0.000989	0.000989	0.000989	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	1	1	1.05	1.05	1.05	4	NS	NS
Hydroxide alkalinity (mg/L)	1	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	1	0	0.00177	0.00177	0.00177	NS	NS	NS
Iron, total (mg/L)	1	1	0.999	0.999	0.999	NS	NS	1
Laboratory Conductivity (µS/cm)	1	1	5,920	5,920	5,920	NS	NS	NS
Laboratory pH (s.u.)	1	1	8.22	8.22	8.22	NS	NS	NS
Lead, diss (mg/L)	1	0	0.0000023	0.0000023	0.0000023	NS	NS	NS
Lead, total (mg/L)[2]	1	1	0.000469	0.000469	0.000469	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	1	1	555	555	555	NS	NS	NS
Manganese, diss (mg/L)	1	1	0.011	0.011	0.011	NS	NS	NS
Manganese, total (mg/L)	1	1	0.047	0.047	0.047	NS	NS	NS
Mercury, diss (mg/L)	1	1	0.0000081	0.0000081	0.0000081	NS	NS	NS
Mercury, total (mg/L)	1	0	0.000008	0.000008	0.000008	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	1	0	0.000661	0.000661	0.000661	NS	NS	NS

Table 8. Water Quality of Pond 7.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	1	0	0.000898	0.000898	0.000898	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	1	0	0.003	0.003	0.003	10	NS	NS
Orthophosphate as P (mg/L)	1	0	0.00616	0.00616	0.00616	NS	NS	NS
Potassium, diss (mg/L)	1	1	22.9	22.9	22.9	NS	NS	NS
Selenium, diss (mg/L)	1	1	0.000375	0.000375	0.000375	NS	NS	NS
Selenium, total (mg/L)	1	0	0.00057	0.00057	0.00057	0.05	0.02	0.005
Sodium, diss (mg/L)	1	1	489	489	489	NS	NS	NS
Sodium Absorption Ratio	1	1	3.92	3.92	3.92	NS	NS	NS
Sulfate (mg/L)	1	1	3,710	3,710	3,710	NS	NS	NS
Total Alkalinity (mg/L)	1	1	516	516	516	NS	NS	NS
Total Dissolved Solids (mg/L)	1	1	5,900	5,900	5,900	NS	NS	NS
Total Hardness (mg/L)	1	1	2,940	2,940	2,940	NS	NS	NS
Total Nitrogen (mg/L)	1	1	0.867	0.867	0.867	NS	NS	NS
Total Phosphate (mg/L)	1	1	0.0985	0.0985	0.0985	NS	NS	NS
Total Suspended Sediments (mg/L)	1	1	24.8	24.8	24.8	NS	NS	NS
Turbidity (NTU)	1	1	2.21	2.21	2.21	NS	NS	NS
Vanadium, diss (mg/L)	1	1	0.000817	0.000817	0.000817	NS	NS	NS
Vanadium, total (mg/L)	1	1	0.000968	0.000968	0.000968	NS	NS	NS
Zinc, diss (mg/L)	1	0	0.00547	0.00547	0.00547	NS	NS	NS
Zinc, total (mg/L)[2]	1	1	0.0582	0.0582	0.0582	7.4	Hardness Dependent	Hardness Dependent

Data collected in October 2016.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 9. Water Quality of Pond 8.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	21	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	21	19	0.00221	0.014	0.080	NS	0.75	0.087
Aluminum, total (mg/L)	21	21	0.021	0.1	0.505	NS	NS	NS
Ammonia, as N (mg/L)[1]	21	9	0.005	0.0274	**0.63**	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	21	21	0.000552	0.0030	0.00961	NS	NS	NS
Arsenic, total (mg/L)	21	21	0.000578	0.0030	**0.0116**	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	21	21	165	422	690	NS	NS	NS
Boron, diss (mg/L)	21	21	0.264	0.49	0.93	NS	NS	NS
Boron, total (mg/L)	21	21	0.285	0.52	1.3	NS	NS	NS
Cadmium, diss (mg/L)	21	6	0.0000352	0.0000858	0.000417	NS	NS	NS
Cadmium, total (mg/L)[2]	21	9	0.000032	0.0000949	0.000469	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	21	21	17	72	166	NS	NS	NS
Carbonate Alkalinity (mg/L)	21	21	57	92.8	254	NS	NS	NS
Chloride (mg/L)	21	21	6.4	15	37.1	NS	NS	NS
Chromium, diss (mg/L)	4	0	0.000228	0.000258	0.000287	NS	NS	NS
Chromium, total (mg/L)[2]	4	3	0.00035	0.000837	0.00145	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	21	10	0.0000224	0.000589	0.00149	NS	NS	NS
Copper, total (mg/L)[2]	21	13	0.000199	0.000829	**0.0448**	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	21	20	0.00834	0.10	0.541	4	NS	NS
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	21	20	0.00115	0.0148	0.12	NS	NS	NS
Iron, total (mg/L)	21	21	0.050	0.22	**1.06**	NS	NS	1
Laboratory Conductivity (µS/cm)	21	21	2,100	2,990	6,010	NS	NS	NS
Laboratory pH (s.u.)	21	21	8.5	8.8	9.55	NS	NS	NS
Lead, diss (mg/L)	21	9	0.0000023	0.0000621	0.000629	NS	NS	NS
Lead, total (mg/L)[2]	21	14	0.0000122	0.000171	0.00104	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	21	21	219	364	779	NS	NS	NS
Manganese, diss (mg/L)	21	21	0.00126	0.017	0.163	NS	NS	NS
Manganese, total (mg/L)	21	21	0.0080	0.0333	0.169	NS	NS	NS
Mercury, diss (mg/L)	4	0	0.0000080	0.000011	0.000023	NS	NS	NS
Mercury, total (mg/L)	4	0	0.0000080	0.000011	0.000023	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	21	15	0.000661	0.00122	0.0030	NS	NS	NS

Table 9. Water Quality of Pond 8.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	21	12	0.000574	0.00133	0.00359	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	21	0	0.0030	0.0066	0.0151	10	NS	NS
Orthophosphate as P (mg/L)	4	0	0.00616	0.00616	0.00616	NS	NS	NS
Potassium, diss (mg/L)	21	21	3.77	15.0	32.5	NS	NS	NS
Selenium, diss (mg/L)	21	10	0.000125	0.000299	0.00134	NS	NS	NS
Selenium, total (mg/L)	21	9	0.00018	0.000521	0.0030	0.05	0.02	0.005
Sodium, diss (mg/L)	21	21	117	225	411	NS	NS	NS
Sodium Absorption Ratio	21	21	1.53	2.31	3.14	NS	NS	NS
Sulfate (mg/L)	21	21	890	1,350	3,690	NS	NS	NS
Total Alkalinity (mg/L)	21	21	386	565	773	NS	NS	NS
Total Dissolved Solids (mg/L)	21	21	1,780	2,770	6,180	NS	NS	NS
Total Hardness (mg/L)	21	21	1,100	1,630	3,610	NS	NS	NS
Total Nitrogen (mg/L)	21	21	0.641	1.39	3.14	NS	NS	NS
Total Phosphate (mg/L)	21	21	0.030	0.060	0.222	NS	NS	NS
Total Suspended Sediments (mg/L)	21	21	2.0	8.4	42	NS	NS	NS
Turbidity (NTU)	4	4	2.24	3.30	8.55	NS	NS	NS
Vanadium, diss (mg/L)	21	21	0.000745	0.00214	0.00705	NS	NS	NS
Vanadium, total (mg/L)	21	17	0.000362	0.00235	0.00770	NS	NS	NS
Zinc, diss (mg/L)	21	1	0.00146	0.00307	0.00682	NS	NS	NS
Zinc, total (mg/L)[2]	21	16	0.00109	0.00608	0.0420	7.4	Hardness Dependent	Hardness Dependent

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. The Aquatic Life Standard for Ammonia was exceeded once during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. The Aquatic Life Standard for Copper was exceeded once during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 10. Water Quality of Pond 9.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Acidity (mg/L)	21	0	1	1	1	NS	NS	NS
Aluminum, diss (mg/L)	21	20	0.00316	0.0198	0.063	NS	0.75	0.087
Aluminum, total (mg/L)	21	21	0.017	0.062	0.13	NS	NS	NS
Ammonia, as N (mg/L)[1]	21	12	0.005	0.0289	0.55	NS	T/pH dependent	T/pH dependent
Arsenic, diss (mg/L)	21	21	0.00132	0.0040	0.00609	NS	NS	NS
Arsenic, total (mg/L)	21	21	0.00172	0.0050	**0.0108**	0.01	0.34	0.15
Bicarbonate Alkalinity (mg/L)	21	21	163	307	416	NS	NS	NS
Boron, diss (mg/L)	21	21	0.34	0.93	1.26	NS	NS	NS
Boron, total (mg/L)	21	21	0.388	1.18	1.58	NS	NS	NS
Cadmium, diss (mg/L)	21	7	0.0000217	0.000079	0.000386	NS	NS	NS
Cadmium, total (mg/L)[2]	21	11	0.0000463	0.0000949	0.000719	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	21	21	73.2	117	179	NS	NS	NS
Carbonate Alkalinity (mg/L)	21	19	1.0	28.2	84.6	NS	NS	NS
Chloride (mg/L)	21	21	7.97	19.1	28.8	NS	NS	NS
Chromium, diss (mg/L)	4	2	0.000228	0.000322	0.000657	NS	NS	NS
Chromium, total (mg/L)[2]	4	3	0.00035	0.00111	0.00176	0.1	Hardness Dependent	Hardness Dependent
Copper, diss (mg/L)	21	9	0.0000224	0.000444	0.00162	NS	NS	NS
Copper, total (mg/L)[2]	21	12	0.0000678	0.000509	0.00706	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	21	20	0.00834	0.20	0.839	4	NS	NS
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS	NS	NS
Iron, diss (mg/L)	21	17	0.00155	0.00442	0.07	NS	NS	NS
Iron, total (mg/L)	21	21	0.0153	0.090	0.21	NS	NS	1
Laboratory Conductivity (µS/cm)	21	21	2,090	3,710	4,850	NS	NS	NS
Laboratory pH (s.u.)	21	21	8.2	8.5	8.98	NS	NS	NS
Lead, diss (mg/L)	21	8	0.0000023	0.0000621	0.000295	NS	NS	NS
Lead, total (mg/L)[2]	21	10	0.0000030	0.000116	0.00070	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	21	21	210	467	571	NS	NS	NS
Manganese, diss (mg/L)	21	21	0.0019	0.019	0.169	NS	NS	NS
Manganese, total (mg/L)	21	21	0.017	0.0551	0.192	NS	NS	NS
Mercury, diss (mg/L)	4	0	0.0000080	0.000011	0.000023	NS	NS	NS
Mercury, total (mg/L)	4	0	0.0000080	0.000011	0.000023	0.00005	0.0017	0.0009
Nickel, diss (mg/L)	21	8	0.000661	0.000937	0.0030	NS	NS	NS

Table 10. Water Quality of Pond 9.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Nickel, total (mg/L)[2]	21	8	0.000574	0.000939	0.014	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	21	1	0.0030	0.0066	0.251	10	NS	NS
Orthophosphate as P (mg/L)	4	0	0.00616	0.00616	0.00616	NS	NS	NS
Potassium, diss (mg/L)	21	21	7.48	16.5	25	NS	NS	NS
Selenium, diss (mg/L)	21	16	0.000171	0.000467	0.00114	NS	NS	NS
Selenium, total (mg/L)	21	16	0.000247	0.000588	0.00233	0.05	0.02	0.005
Sodium, diss (mg/L)	21	21	99.2	232	342	NS	NS	NS
Sodium Absorption Ratio	21	21	1.31	2.25	2.89	NS	NS	NS
Sulfate (mg/L)	21	21	1,010	2,140	2,920	NS	NS	NS
Total Alkalinity (mg/L)	21	21	205	317	441	NS	NS	NS
Total Dissolved Solids (mg/L)	21	21	1,760	3,740	4,550	NS	NS	NS
Total Hardness (mg/L)	21	21	1,080	2,140	2,650	NS	NS	NS
Total Nitrogen (mg/L)	21	21	0.57	0.904	1.27	NS	NS	NS
Total Phosphate (mg/L)	21	21	0.0139	0.0256	0.080	NS	NS	NS
Total Suspended Sediments (mg/L)	21	20	1	4	20	NS	NS	NS
Turbidity (NTU)	4	4	1.48	2.59	3.62	NS	NS	NS
Vanadium, diss (mg/L)	21	17	0.000153	0.000828	0.00355	NS	NS	NS
Vanadium, total (mg/L)	21	12	0.000182	0.000914	0.00396	NS	NS	NS
Zinc, diss (mg/L)	21	1	0.00146	0.00307	0.049	NS	NS	NS
Zinc, total (mg/L)[2]	21	16	0.00109	0.00851	0.098	7.4	Hardness Dependent	Hardness Dependent

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; μS/cm = micro Siemens/centimeter; s.u. = standard units; NTU = nephelometric turbidity units; mg/L = milligrams per liter.
[1] Aquatic Life Standards for Ammonia are temperature and pH dependent. No exceedances occurred during the monitoring period.
[2] Aquatic Life Standards for specific parameters are hardness dependent. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Springs

Table 11. Water Quality of Spring 1.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	2	0	1	1	1	NS
Aluminum, diss (mg/L)	2	2	0.0234	0.0449	0.0664	NS
Ammonia, as N (mg/L)	2	2	0.0445	0.189	0.333	NS
Arsenic, diss (mg/L)	2	2	0.000942	0.00422	0.00749	0.01
Bicarbonate Alkalinity (mg/L)	2	2	690	749	807	NS
Boron, diss (mg/L)	2	2	0.323	0.382	0.44	NS
Cadmium, diss (mg/L)	2	2	0.0000215	0.0000693	0.000117	0.005
Calcium, diss (mg/L)	2	2	104	110	116	NS
Carbonate Alkalinity (mg/L)	2	0	1	1	1	NS
Chloride (mg/L)	2	2	11.2	11.4	11.6	NS
Copper, diss (mg/L)	2	2	0.00027	0.000302	0.000333	1.3
Fluoride (mg/L)	2	2	0.644	0.728	0.811	4
Hydroxide alkalinity (mg/L)	2	0	1	1	1	NS
Iron, diss (mg/L)	2	2	0.0574	0.789	1.52	NS
Laboratory Conductivity (µS/cm)	2	2	2,140	2,340	2,540	NS
Laboratory pH (s.u.)	2	2	8.22	8.25	8.28	NS
Lead, diss (mg/L)	2	1	0.0000023	0.0000067	0.0000111	0.015
Magnesium, diss (mg/L)	2	2	110	121	132	NS
Manganese, diss (mg/L)	2	2	0.589	0.626	0.662	NS
Nickel, diss (mg/L)	2	2	0.0030	0.00316	0.00331	0.1
Nitrate+Nitrite (mg/L)	2	0	0.0030	0.0030	0.0030	10
Potassium, diss (mg/L)	2	2	13.4	14.4	15.3	NS
Selenium, diss (mg/L)	2	2	0.000442	0.000786	0.00113	0.05
Sodium, diss (mg/L)	2	2	283	323	363	NS
Sulfate (mg/L)	2	2	468	618	767	NS
Total Alkalinity (mg/L)	2	2	691	749	807	NS
Total Dissolved Solids (mg/L)	2	2	1,560	1,610	1,660	NS
Total Hardness (mg/L)	2	2	712	773	833	NS
Vanadium, diss (mg/L)	2	2	0.00134	0.00219	0.00304	NS
Zinc, diss (mg/L)	2	0	0.00547	0.00547	0.00547	2

Data collected between July 2016 and October 2016.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 12. Water Quality of Spring 2.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	20	0	1	1	1	NS
Aluminum, diss (mg/L)	20	19	0.00316	0.025	0.144	NS
Ammonia, as N (mg/L)	20	13	0.0050	0.131	1.74	NS
Arsenic, diss (mg/L)	20	15	0.000143	0.00049	0.00174	0.01
Bicarbonate Alkalinity (mg/L)	20	20	416	464	566	NS
Boron, diss (mg/L)	20	20	0.692	1.04	1.32	NS
Cadmium, diss (mg/L)	20	7	0.000040	0.0000858	0.000577	0.005
Calcium, diss (mg/L)	20	20	153	185	228	NS
Carbonate Alkalinity (mg/L)	20	10	1.0	6.0	54	NS
Chloride (mg/L)	20	20	10.3	12.2	19.0	NS
Copper, diss (mg/L)	20	10	0.0000224	0.000526	0.00149	1.3
Fluoride (mg/L)	20	19	0.0054	0.20	0.889	4
Hydroxide alkalinity (mg/L)	20	0	1	1	1	NS
Iron, diss (mg/L)	20	20	0.00334	0.0294	0.268	NS
Laboratory Conductivity (µS/cm)	20	20	2,250	2,805	3,360	NS
Laboratory pH (s.u.)	20	20	8.0	8.3	8.5	NS
Lead, diss (mg/L)	20	6	0.0000023	0.0000633	0.000345	0.015
Magnesium, diss (mg/L)	20	20	261	323	437	NS
Manganese, diss (mg/L)	20	20	0.00491	0.0425	0.495	NS
Nickel, diss (mg/L)	20	15	0.000763	0.00170	0.004	0.1
Nitrate+Nitrite (mg/L)	20	19	0.0030	6.41	9.11	10
Potassium, diss (mg/L)	20	20	5.44	7.0	15.8	NS
Selenium, diss (mg/L)	20	20	0.00355	0.0169	0.032	0.05
Sodium, diss (mg/L)	20	20	55.5	77.7	131	NS
Sulfate (mg/L)	20	20	1,180	1,375	1,860	NS
Total Alkalinity (mg/L)	20	20	455	475	595	NS
Total Dissolved Solids (mg/L)	20	20	2,300	2,530	3,150	NS
Total Hardness (mg/L)	20	20	1,550	1,785	2,260	NS
Vanadium, diss (mg/L)	20	16	0.000353	0.000984	0.00271	NS
Zinc, diss (mg/L)	20	0	0.00146	0.00307	0.00682	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 13. Water Quality of Spring 3.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	21	0	1	1	1	NS
Aluminum, diss (mg/L)	21	19	0.00316	0.0174	0.035	NS
Ammonia, as N (mg/L)	21	21	0.0222	0.070	0.43	NS
Arsenic, diss (mg/L)	21	20	0.00033	0.00057	0.0020	0.01
Bicarbonate Alkalinity (mg/L)	21	21	498	608	694	NS
Boron, diss (mg/L)	21	21	0.0983	0.160	0.321	NS
Cadmium, diss (mg/L)	21	8	0.000040	0.0000858	0.000558	0.005
Calcium, diss (mg/L)	21	21	94.1	119	144	NS
Carbonate Alkalinity (mg/L)	21	8	1	1	72	NS
Chloride (mg/L)	21	21	3.91	5.0	8.0	NS
Copper, diss (mg/L)	21	11	0.0000224	0.000782	0.00149	1.3
Fluoride (mg/L)	21	20	0.0054	0.30	0.97	4
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS
Iron, diss (mg/L)	21	21	0.0654	0.53	5.25	NS
Laboratory Conductivity (µS/cm)	21	21	1,710	2,200	2,750	NS
Laboratory pH (s.u.)	21	21	8.0	8.21	8.6	NS
Lead, diss (mg/L)	21	7	0.0000023	0.000059	0.00040	0.015
Magnesium, diss (mg/L)	21	21	156	201	251	NS
Manganese, diss (mg/L)	21	21	0.041	0.121	0.768	NS
Nickel, diss (mg/L)	21	16	0.000763	0.00164	0.0030	0.1
Nitrate+Nitrite (mg/L)	21	9	0.0030	0.0066	0.037	10
Potassium, diss (mg/L)	21	21	6.0	7.55	9.0	NS
Selenium, diss (mg/L)	21	14	0.000095	0.000322	0.00076	0.05
Sodium, diss (mg/L)	21	21	104	149	199	NS
Sulfate (mg/L)	21	21	618	783	1,140	NS
Total Alkalinity (mg/L)	21	21	514	615	694	NS
Total Dissolved Solids (mg/L)	21	21	1,310	1,730	2,230	NS
Total Hardness (mg/L)	21	21	877	1,120	1,390	NS
Vanadium, diss (mg/L)	21	16	0.0000894	0.000528	0.00228	NS
Zinc, diss (mg/L)	21	6	0.00146	0.00438	0.010	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 14. Water Quality of Spring 4.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	21	0	1	1	1	NS
Aluminum, diss (mg/L)	21	19	0.00316	0.039	0.131	NS
Ammonia, as N (mg/L)	21	9	0.0050	0.0289	1.1	NS
Arsenic, diss (mg/L)	21	18	0.000278	0.000493	0.0020	0.01
Bicarbonate Alkalinity (mg/L)	21	21	504	566	644	NS
Boron, diss (mg/L)	21	21	0.68	0.74	1.01	NS
Cadmium, diss (mg/L)	21	9	0.0000467	0.000102	0.00107	0.005
Calcium, diss (mg/L)	21	21	283	304	335	NS
Carbonate Alkalinity (mg/L)	21	7	1	1	44	NS
Chloride (mg/L)	21	21	14.3	15.9	19.0	NS
Copper, diss (mg/L)	21	11	0.0000224	0.000904	0.00295	1.3
Fluoride (mg/L)	21	19	0.0054	0.30	2.08	4
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS
Iron, diss (mg/L)	21	18	0.00177	0.0173	0.745	NS
Laboratory Conductivity (µS/cm)	21	21	4,370	5,490	5,850	NS
Laboratory pH (s.u.)	21	21	8.0	8.25	8.4	NS
Lead, diss (mg/L)	21	8	0.0000023	0.0000621	0.000737	0.015
Magnesium, diss (mg/L)	21	21	472	508	544	NS
Manganese, diss (mg/L)	21	18	0.000214	0.0080	0.724	NS
Nickel, diss (mg/L)	21	12	0.000661	0.00132	0.00503	0.1
Nitrate+Nitrite (mg/L)	21	21	0.184	1.12	1.41	10
Potassium, diss (mg/L)	21	21	18	22	25.6	NS
Selenium, diss (mg/L)	21	21	0.00859	0.0128	0.017	0.05
Sodium, diss (mg/L)	21	21	456	515	591	NS
Sulfate (mg/L)	21	21	2,830	3,200	3,800	NS
Total Alkalinity (mg/L)	21	21	523	569	644	NS
Total Dissolved Solids (mg/L)	21	21	4,460	5,590	6,030	NS
Total Hardness (mg/L)	21	21	2,670	2,850	3,080	NS
Vanadium, diss (mg/L)	21	18	0.0000136	0.00101	0.00264	NS
Zinc, diss (mg/L)	21	2	0.00146	0.00307	0.00693	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 15. Water Quality of Spring 5.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	19	0	1	1	1	NS
Aluminum, diss (mg/L)	19	17	0.00316	0.0701	0.193	NS
Ammonia, as N (mg/L)	19	13	0.0050	0.108	3.17	NS
Arsenic, diss (mg/L)	19	17	0.000314	0.00101	0.0040	0.01
Bicarbonate Alkalinity (mg/L)	19	19	513	819	1,020	NS
Boron, diss (mg/L)	19	19	1.47	2.19	3.26	NS
Cadmium, diss (mg/L)	19	12	0.0000658	0.000213	0.0030	0.005
Calcium, diss (mg/L)	19	19	226	368	499	NS
Carbonate Alkalinity (mg/L)	19	5	1	1	49	NS
Chloride (mg/L)	19	19	11.7	29.9	56	NS
Copper, diss (mg/L)	19	15	0.0000224	0.00192	0.0070	1.3
Fluoride (mg/L)	19	16	0.0054	0.40	3.47	4
Hydroxide alkalinity (mg/L)	19	0	1	1	1	NS
Iron, diss (mg/L)	19	13	0.000688	0.00986	0.797	NS
Laboratory Conductivity (µS/cm)	19	19	6,680	10,200	13,800	NS
Laboratory pH (s.u.)	19	19	8	8.2	8.44	NS
Lead, diss (mg/L)	19	8	0.0000023	0.0000469	0.0034	0.015
Magnesium, diss (mg/L)	19	19	436	817	1,390	NS
Manganese, diss (mg/L)	19	19	0.01	0.0612	1.68	NS
Nickel, diss (mg/L)	19	11	0.000661	0.003	0.0242	0.1
Nitrate+Nitrite (mg/L)	19	18	0.0151	**35.9**	**165**	10
Potassium, diss (mg/L)	19	19	8.0	15	39.6	NS
Selenium, diss (mg/L)	19	19	0.0137	**0.062**	**0.098**	0.05
Sodium, diss (mg/L)	19	19	1,100	1,590	2,600	NS
Sulfate (mg/L)	19	19	3,980	6,470	9,810	NS
Total Alkalinity (mg/L)	19	19	550	819	1,040	NS
Total Dissolved Solids (mg/L)	19	19	6,760	11,500	14,500	NS
Total Hardness (mg/L)	19	19	2,360	4,320	6,970	NS
Vanadium, diss (mg/L)	19	16	0.000177	0.00154	0.00374	NS
Zinc, diss (mg/L)	19	4	0.00146	0.00547	0.0245	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 16. Water Quality of Spring 6.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	3	0	1	1	1	NS
Aluminum, diss (mg/L)	3	3	0.0544	0.129	6.51	NS
Ammonia, as N (mg/L)	3	2	0.0050	0.0282	0.072	NS
Arsenic, diss (mg/L)	3	3	0.00163	0.00214	0.00704	0.01
Bicarbonate Alkalinity (mg/L)	3	3	588	727	870	NS
Boron, diss (mg/L)	3	3	1.37	1.93	6.82	NS
Cadmium, diss (mg/L)	3	2	0.0000050	0.00101	0.00149	0.005
Calcium, diss (mg/L)	3	3	379	461	555	NS
Carbonate Alkalinity (mg/L)	3	0	1	1	1	NS
Chloride (mg/L)	3	3	52.9	59.4	95.7	NS
Copper, diss (mg/L)	3	1	0.000018	0.000041	0.0106	1.3
Fluoride (mg/L)	3	1	0.00834	0.00834	1.53	4
Hydroxide alkalinity (mg/L)	3	0	1	1	1	NS
Iron, diss (mg/L)	3	3	0.0101	0.681	6.41	NS
Laboratory Conductivity (µS/cm)	3	3	9,840	12,000	15,300	NS
Laboratory pH (s.u.)	3	3	8.11	8.20	8.22	NS
Lead, diss (mg/L)	3	0	0.0000023	0.0000023	0.0000040	0.015
Magnesium, diss (mg/L)	3	3	872	1,270	1,940	NS
Manganese, diss (mg/L)	3	3	0.237	0.281	6.38	NS
Nickel, diss (mg/L)	3	3	0.00445	0.0125	**6.4**	0.1
Nitrate+Nitrite (mg/L)	3	1	0.003	0.003	0.003	10
Potassium, diss (mg/L)	3	3	16.3	18	20.5	NS
Selenium, diss (mg/L)	3	3	0.000627	0.00131	0.00413	0.05
Sodium, diss (mg/L)	3	3	1,230	1,840	2,540	NS
Sulfate (mg/L)	3	3	6,150	8,670	12,200	NS
Total Alkalinity (mg/L)	3	3	588	727	870	NS
Total Dissolved Solids (mg/L)	3	3	10,600	14,800	18,400	NS
Total Hardness (mg/L)	3	3	4,530	6,390	9,380	NS
Vanadium, diss (mg/L)	3	2	0.000020	0.00115	0.00624	NS
Zinc, diss (mg/L)	3	1	0.00146	0.00547	**6.45**	2

Data collected between July 2016 and March 2017.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 17. Water Quality of Spring 7.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	21	0	1	1	1	NS
Aluminum, diss (mg/L)	21	20	0.00316	0.0184	0.193	NS
Ammonia, as N (mg/L)	21	13	0.0050	0.0289	0.428	NS
Arsenic, diss (mg/L)	21	21	0.0000804	0.00177	0.00977	0.01
Bicarbonate Alkalinity (mg/L)	21	21	532	708	932	NS
Boron, diss (mg/L)	21	21	0.0562	0.0852	0.19	NS
Cadmium, diss (mg/L)	21	4	0.0000050	0.0000703	0.000294	0.005
Calcium, diss (mg/L)	21	21	71	86.7	99.9	NS
Carbonate Alkalinity (mg/L)	21	9	1	1	91	NS
Chloride (mg/L)	21	20	0.0071	4.96	12	NS
Copper, diss (mg/L)	21	7	0.000018	0.000358	0.00195	1.3
Fluoride (mg/L)	21	21	0.10	0.20	0.585	4
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS
Iron, diss (mg/L)	21	21	0.00748	0.19	1.31	NS
Laboratory Conductivity (µS/cm)	21	21	1,140	1,500	2,090	NS
Laboratory pH (s.u.)	21	21	7.9	8.28	8.7	NS
Lead, diss (mg/L)	21	9	0.0000023	0.0000715	0.0014	0.015
Magnesium, diss (mg/L)	21	21	119	151	223	NS
Manganese, diss (mg/L)	21	21	0.010	0.11	0.286	NS
Nickel, diss (mg/L)	21	15	0.000763	0.00165	0.00492	0.1
Nitrate+Nitrite (mg/L)	21	0	0.0030	0.0066	0.0151	10
Potassium, diss (mg/L)	21	21	3.61	5.0	12.2	NS
Selenium, diss (mg/L)	21	14	0.000095	0.00076	**0.0534**	0.05
Sodium, diss (mg/L)	21	21	26	32	67	NS
Sulfate (mg/L)	21	21	116	217	438	NS
Total Alkalinity (mg/L)	21	21	556	711	992	NS
Total Dissolved Solids (mg/L)	21	21	810	988	1,540	NS
Total Hardness (mg/L)	21	21	664	846	1,150	NS
Vanadium, diss (mg/L)	21	18	0.0000136	0.00145	0.00406	NS
Zinc, diss (mg/L)	21	2	0.00146	0.00409	0.00682	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 18. Water Quality of Spring 8.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	9	0	1	1	1	NS
Aluminum, diss (mg/L)	9	9	0.00394	0.040	0.061	NS
Ammonia, as N (mg/L)	9	6	0.0073	0.0289	0.39	NS
Arsenic, diss (mg/L)	9	7	0.000314	0.000474	0.0020	0.01
Bicarbonate Alkalinity (mg/L)	9	9	129	425	498	NS
Boron, diss (mg/L)	9	9	0.58	0.71	1.01	NS
Cadmium, diss (mg/L)	9	1	0.0000658	0.000106	0.000294	0.005
Calcium, diss (mg/L)	9	9	344	370	457	NS
Carbonate Alkalinity (mg/L)	9	0	1	1	1	NS
Chloride (mg/L)	9	9	24	40	49	NS
Copper, diss (mg/L)	9	4	0.000358	0.000683	0.0050	1.3
Fluoride (mg/L)	9	8	0.0054	0.40	0.80	4
Hydroxide alkalinity (mg/L)	9	0	1	1	1	NS
Iron, diss (mg/L)	9	8	0.00286	0.03	0.32	NS
Laboratory Conductivity (µS/cm)	9	9	2,990	3,960	4,340	NS
Laboratory pH (s.u.)	9	9	7.9	8.2	8.3	NS
Lead, diss (mg/L)	9	2	0.0000332	0.0000665	0.000295	0.015
Magnesium, diss (mg/L)	9	9	272	400	468	NS
Manganese, diss (mg/L)	9	9	0.0090	0.071	0.316	NS
Nickel, diss (mg/L)	9	5	0.000764	0.000995	0.0080	0.1
Nitrate+Nitrite (mg/L)	9	9	0.51	1.71	7.93	10
Potassium, diss (mg/L)	9	9	6	12	34	NS
Selenium, diss (mg/L)	9	9	0.012	0.023	**0.053**	0.05
Sodium, diss (mg/L)	9	9	88	168	195	NS
Sulfate (mg/L)	9	9	1,870	2,400	2,660	NS
Total Alkalinity (mg/L)	9	9	129	425	498	NS
Total Dissolved Solids (mg/L)	9	9	2,950	4,150	4,620	NS
Total Hardness (mg/L)	9	9	1,980	2,590	3,060	NS
Vanadium, diss (mg/L)	9	7	0.000828	0.0012	0.00264	NS
Zinc, diss (mg/L)	9	0	0.00146	0.00307	0.00682	2

Data collected between October 2018 and March 2022.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 19. Water Quality of Spring 9.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	20	0	1	1	1	NS
Aluminum, diss (mg/L)	20	19	0.00316	0.023	0.186	NS
Ammonia, as N (mg/L)	20	16	0.0073	0.18	9.65	NS
Arsenic, diss (mg/L)	20	20	0.000998	0.00283	**0.0258**	0.01
Bicarbonate Alkalinity (mg/L)	20	20	330	490	993	NS
Boron, diss (mg/L)	20	20	0.20	0.389	0.732	NS
Cadmium, diss (mg/L)	20	6	0.000040	0.000091	0.00101	0.005
Calcium, diss (mg/L)	20	20	38.2	119	157	NS
Carbonate Alkalinity (mg/L)	20	17	1.0	18.1	183	NS
Chloride (mg/L)	20	20	2.0	6.70	34.4	NS
Copper, diss (mg/L)	20	7	0.0000224	0.000479	0.00149	1.3
Fluoride (mg/L)	20	19	0.00834	0.20	0.913	4
Hydroxide alkalinity (mg/L)	20	0	1	1	1	NS
Iron, diss (mg/L)	20	20	0.0146	0.185	2.98	NS
Laboratory Conductivity (µS/cm)	20	20	1,740	2,625	3,850	NS
Laboratory pH (s.u.)	20	20	8.2	8.4	9.22	NS
Lead, diss (mg/L)	20	9	0.0000023	0.0000589	0.000475	0.015
Magnesium, diss (mg/L)	20	20	122	185	296	NS
Manganese, diss (mg/L)	20	20	0.0191	0.438	1.23	NS
Nickel, diss (mg/L)	20	19	0.000961	0.00260	0.0102	0.1
Nitrate+Nitrite (mg/L)	20	4	0.0030	0.0066	1.32	10
Potassium, diss (mg/L)	20	20	7.83	15.0	77.1	NS
Selenium, diss (mg/L)	20	10	0.000095	0.000245	0.00658	0.05
Sodium, diss (mg/L)	20	20	171	277	459	NS
Sulfate (mg/L)	20	20	630	1,026	1,310	NS
Total Alkalinity (mg/L)	20	20	357	516	1,010	NS
Total Dissolved Solids (mg/L)	20	20	1,490	2,095	3,230	NS
Total Hardness (mg/L)	20	20	729	1,065	1,510	NS
Vanadium, diss (mg/L)	20	19	0.00066	0.00145	0.00652	NS
Zinc, diss (mg/L)	20	1	0.00146	0.00337	0.00682	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 20. Water Quality of Spring 10.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	21	0	1	1	1	NS
Aluminum, diss (mg/L)	21	18	0.00316	0.0123	0.0419	NS
Ammonia, as N (mg/L)	20	4	0.0050	0.0073	0.18	NS
Arsenic, diss (mg/L)	20	15	0.000136	0.000342	0.0011	0.01
Bicarbonate Alkalinity (mg/L)	21	21	364	429	476	NS
Boron, diss (mg/L)	21	21	0.05	0.07	0.09	NS
Cadmium, diss (mg/L)	19	6	0.000040	0.0000858	0.000521	0.005
Calcium, diss (mg/L)	21	21	56	65	70.9	NS
Carbonate Alkalinity (mg/L)	20	17	1	21.3	46	NS
Chloride (mg/L)	21	21	11	14	20	NS
Copper, diss (mg/L)	20	5	0.000018	0.000358	0.00149	1.3
Fluoride (mg/L)	21	21	0.10	0.10	0.421	4
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS
Iron, diss (mg/L)	21	21	0.013	0.085	0.827	NS
Laboratory Conductivity (µS/cm)	21	21	1,070	1,340	1,540	NS
Laboratory pH (s.u.)	21	21	8.2	8.4	8.6	NS
Lead, diss (mg/L)	20	6	0.0000023	0.0000605	0.000295	0.015
Magnesium, diss (mg/L)	21	21	110	129	159	NS
Manganese, diss (mg/L)	21	21	0.011	0.0239	0.118	NS
Nickel, diss (mg/L)	19	5	0.000763	0.000937	0.00231	0.1
Nitrate+Nitrite (mg/L)	21	9	0.0030	0.0066	0.32	10
Potassium, diss (mg/L)	21	21	4	5	6	NS
Selenium, diss (mg/L)	21	14	0.000135	0.000439	0.00207	0.05
Sodium, diss (mg/L)	21	21	40	48	57	NS
Sulfate (mg/L)	21	21	254	355	412	NS
Total Alkalinity (mg/L)	21	21	395	445	500	NS
Total Dissolved Solids (mg/L)	21	21	820	970	1,110	NS
Total Hardness (mg/L)	21	21	590	695	826	NS
Vanadium, diss (mg/L)	19	12	0.000266	0.000541	0.00224	NS
Zinc, diss (mg/L)	21	0	0.00146	0.00307	0.00682	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 21. Water Quality of Spring 11.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	14	0	1	1	1	NS
Aluminum, diss (mg/L)	14	11	0.00316	0.0149	0.157	NS
Ammonia, as N (mg/L)	14	7	0.0050	0.0204	0.23	NS
Arsenic, diss (mg/L)	14	12	0.000216	0.00059	0.000919	0.01
Bicarbonate Alkalinity (mg/L)	14	14	373	448	556	NS
Boron, diss (mg/L)	14	14	0.0899	0.165	0.22	NS
Cadmium, diss (mg/L)	14	4	0.0000588	0.000091	0.000566	0.005
Calcium, diss (mg/L)	14	14	63.4	76	89	NS
Carbonate Alkalinity (mg/L)	14	12	1	20.3	100	NS
Chloride (mg/L)	14	14	5	8.78	12	NS
Copper, diss (mg/L)	14	9	0.0000224	0.000770	0.00178	1.3
Fluoride (mg/L)	14	14	0.10	0.20	0.524	4
Hydroxide alkalinity (mg/L)	14	0	1	1	1	NS
Iron, diss (mg/L)	14	14	0.00421	0.050	0.70	NS
Laboratory Conductivity (µS/cm)	14	14	1,110	1,340	1,430	NS
Laboratory pH (s.u.)	14	14	8.2	8.4	8.8	NS
Lead, diss (mg/L)	14	2	0.0000023	0.0000605	0.000864	0.015
Magnesium, diss (mg/L)	14	14	107	130	141	NS
Manganese, diss (mg/L)	14	14	0.0031	0.084	0.806	NS
Nickel, diss (mg/L)	14	9	0.000763	0.00137	0.003	0.1
Nitrate+Nitrite (mg/L)	14	3	0.0030	0.0066	0.020	10
Potassium, diss (mg/L)	14	14	4.99	5.6	8.0	NS
Selenium, diss (mg/L)	14	11	0.000137	0.000828	0.0050	0.05
Sodium, diss (mg/L)	14	14	39.1	50.5	56	NS
Sulfate (mg/L)	14	14	277	328	364	NS
Total Alkalinity (mg/L)	14	14	393	480	572	NS
Total Dissolved Solids (mg/L)	14	14	830	980	1,050	NS
Total Hardness (mg/L)	14	14	597	734	804	NS
Vanadium, diss (mg/L)	14	10	0.000353	0.000828	0.00136	NS
Zinc, diss (mg/L)	14	1	0.00146	0.00307	0.00682	2

Data collected between March 2017 and May 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 22. Water Quality of Spring 12.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	16	0	1	1	1	NS
Aluminum, diss (mg/L)	16	13	0.00316	0.0497	0.309	NS
Ammonia, as N (mg/L)	16	12	0.0050	0.135	13.2	NS
Arsenic, diss (mg/L)	16	14	0.000223	0.0010	0.00668	0.01
Bicarbonate Alkalinity (mg/L)	16	16	337	470	915	NS
Boron, diss (mg/L)	16	16	0.55	0.80	2.06	NS
Cadmium, diss (mg/L)	16	6	0.0000656	0.0000858	0.00137	0.005
Calcium, diss (mg/L)	16	16	237	286	511	NS
Carbonate Alkalinity (mg/L)	16	8	1	2.61	94	NS
Chloride (mg/L)	16	16	24.8	46.7	120	NS
Copper, diss (mg/L)	16	12	0.000133	0.00155	0.00453	1.3
Fluoride (mg/L)	16	10	0.0054	0.10	0.20	4
Hydroxide alkalinity (mg/L)	16	0	1	1	1	NS
Iron, diss (mg/L)	16	14	0.00442	0.0586	0.994	NS
Laboratory Conductivity (µS/cm)	16	16	3,800	5,255	10,200	NS
Laboratory pH (s.u.)	16	16	8.1	8.31	8.6	NS
Lead, diss (mg/L)	16	5	0.0000023	0.0000642	0.000695	0.015
Magnesium, diss (mg/L)	16	16	453	739	1,590	NS
Manganese, diss (mg/L)	16	16	0.017	0.284	3.16	NS
Nickel, diss (mg/L)	16	12	0.000763	0.0020	0.0104	0.1
Nitrate+Nitrite (mg/L)	16	11	0.0030	1.939	**42.9**	10
Potassium, diss (mg/L)	16	16	8	13.9	68	NS
Selenium, diss (mg/L)	15	15	0.0010	0.0040	**0.121**	0.05
Sodium, diss (mg/L)	16	16	180	298	727	NS
Sulfate (mg/L)	16	16	2,310	3,625	7,430	NS
Total Alkalinity (mg/L)	16	16	337	475	995	NS
Total Dissolved Solids (mg/L)	16	16	4,020	5,785	11,500	NS
Total Hardness (mg/L)	16	16	2,470	3,770	7,660	NS
Vanadium, diss (mg/L)	15	12	0.000421	0.00128	0.00424	NS
Zinc, diss (mg/L)	16	2	0.00146	0.00512	0.0130	2

Data collected between October 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 23. Water Quality of Spring 13.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	8	0	1	1	1	NS
Aluminum, diss (mg/L)	8	8	0.014	0.023	0.056	NS
Ammonia, as N (mg/L)	8	6	0.0073	0.059	0.66	NS
Arsenic, diss (mg/L)	8	8	0.000841	0.00125	0.0030	0.01
Bicarbonate Alkalinity (mg/L)	8	8	648	676	796	NS
Boron, diss (mg/L)	8	8	0.36	0.49	1.61	NS
Cadmium, diss (mg/L)	8	1	0.0000858	0.000106	0.000573	0.005
Calcium, diss (mg/L)	8	8	119	144	221	NS
Carbonate Alkalinity (mg/L)	8	1	1	1	27	NS
Chloride (mg/L)	8	8	9.73	11.5	25.2	NS
Copper, diss (mg/L)	8	1	0.000358	0.000837	0.00457	1.3
Fluoride (mg/L)	8	8	0.20	0.20	0.903	4
Hydroxide alkalinity (mg/L)	8	0	1	1	1	NS
Iron, diss (mg/L)	8	8	0.030	0.94	5.69	NS
Laboratory Conductivity (µS/cm)	8	8	2,030	2,215	4,050	NS
Laboratory pH (s.u.)	8	8	8.0	8.1	8.3	NS
Lead, diss (mg/L)	8	3	0.0000332	0.0000924	0.000356	0.015
Magnesium, diss (mg/L)	8	8	247	269	417	NS
Manganese, diss (mg/L)	8	8	0.256	0.905	4.41	NS
Nickel, diss (mg/L)	8	7	0.000763	0.0035	0.021	0.1
Nitrate+Nitrite (mg/L)	8	0	0.0066	0.0066	0.0151	10
Potassium, diss (mg/L)	8	8	6	10	13	NS
Selenium, diss (mg/L)	8	6	0.00011	0.000279	0.000573	0.05
Sodium, diss (mg/L)	8	8	73	81.5	207	NS
Sulfate (mg/L)	8	8	718	886	1,790	NS
Total Alkalinity (mg/L)	8	8	648	683	796	NS
Total Dissolved Solids (mg/L)	8	8	1,820	1,920	3,780	NS
Total Hardness (mg/L)	8	8	1,360	1,475	2,270	NS
Vanadium, diss (mg/L)	8	6	0.000421	0.000759	0.00117	NS
Zinc, diss (mg/L)	8	0	0.00146	0.00682	0.00682	2

Data collected between June 2018 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 24. Water Quality of Spring 14.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	21	0	1	1	1	NS
Aluminum, diss (mg/L)	21	21	0.00493	0.0209	0.0370	NS
Ammonia, as N (mg/L)	20	12	0.0050	0.0309	0.27	NS
Arsenic, diss (mg/L)	19	15	0.000176	0.000361	0.00077	0.01
Bicarbonate Alkalinity (mg/L)	21	21	519	628	720	NS
Boron, diss (mg/L)	21	21	0.312	0.374	0.434	NS
Cadmium, diss (mg/L)	19	6	0.000040	0.0000962	0.000488	0.005
Calcium, diss (mg/L)	21	21	119	146	167	NS
Carbonate Alkalinity (mg/L)	21	12	1	18	61.8	NS
Chloride (mg/L)	21	21	12	13.5	64	NS
Copper, diss (mg/L)	19	6	0.0000224	0.000469	0.00149	1.3
Fluoride (mg/L)	21	21	0.2	0.2	2.5	4
Hydroxide alkalinity (mg/L)	21	0	1	1	1	NS
Iron, diss (mg/L)	21	21	0.0103	0.030	0.153	NS
Laboratory Conductivity (µS/cm)	21	21	2,430	2,780	3,110	NS
Laboratory pH (s.u.)	21	21	8.0	8.32	8.5	NS
Lead, diss (mg/L)	20	7	0.0000023	0.0000605	0.000295	0.015
Magnesium, diss (mg/L)	21	21	260	277	299	NS
Manganese, diss (mg/L)	21	21	0.012	0.093	0.192	NS
Nickel, diss (mg/L)	20	15	0.000763	0.00170	0.0030	0.1
Nitrate+Nitrite (mg/L)	21	3	0.0030	0.0066	0.080	10
Potassium, diss (mg/L)	21	21	7.17	9.0	11.6	NS
Selenium, diss (mg/L)	20	12	0.000135	0.00022	0.00076	0.05
Sodium, diss (mg/L)	21	21	153	178	201	NS
Sulfate (mg/L)	21	21	1,090	1,160	1,370	NS
Total Alkalinity (mg/L)	21	21	564	647	720	NS
Total Dissolved Solids (mg/L)	21	21	2,220	2,340	2,710	NS
Total Hardness (mg/L)	21	21	1,420	1,500	1,640	NS
Vanadium, diss (mg/L)	19	13	0.000353	0.000828	0.0040	NS
Zinc, diss (mg/L)	21	1	0.00146	0.00307	0.00682	2

Data collected between July 2016 and November 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Baseline MPDES Quality Tables

Table 25. Water Quality of Outfall 005.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	MPDES Limit	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Aluminum, diss (mg/L)	2	0	0.03	0.03	0.03	NS	NS	0.75	0.087
Aluminum, total (mg/L)	1	1	0.41	0.41	0.41	NS	NS	NS	NS
Arsenic, total (mg/L)	2	1	0.001	0.0065	**0.012**	NS	0.01	0.34	0.15
Boron, total (mg/L)	2	2	0.116	0.209	0.302	NS	NS	NS	NS
Cadmium, total (mg/L)[1]	2	1	0.00003	0.0002	0.00037	NS	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	2	2	95	155.5	216	NS	NS	NS	NS
Chloride (mg/L)	2	2	2	6.5	11	NS	NS	NS	NS
Chromium, total (mg/L)[1]	2	1	0.01	0.016	0.022	NS	0.1	Hardness Dependent	Hardness Dependent
Copper, total (mg/L)[1]	2	2	0.003	0.0135	0.024	NS	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	2	2	0.6	0.7	0.8	NS	4	NS	NS
Iron, total (mg/L)	2	2	0.449	**10.9745**	**21.5**	6	NS	NS	1
Laboratory Conductivity (µS/cm)	2	2	893	1546.5	2200	NS	NS	NS	NS
Laboratory pH (s.u.)	2	2	7.7	7.7	7.7	6.0-9.0	NS	NS	NS
Lead, total (mg/L)[1]	2	2	0.0004	0.00995	**0.0195**	NS	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	2	2	48	75.5	103	NS	NS	NS	NS
Mercury, total (mg/L)	2	2	0.000012	0.000041	**0.00007**	NS	0.00005	0.0017	0.0009
Nickel, total (mg/L)[1]	2	1	0.002	0.0115	0.021	NS	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	2	2	0.8	1.235	1.67	NS	10	NS	NS
Oil & Grease (mg/L)	2	0	1	1	1	10	NS	NS	NS
Selenium, total (mg/L)	2	2	0.002	0.0025	0.003	NS	0.05	0.02	0.005
Silver, total (mg/L)[1]	2	0	0.0002	0.0002	0.0002	NS	0.1	Hardness Dependent	NS
Sodium, diss (mg/L)	2	2	37	92.5	148	NS	NS	NS	NS
Sodium Absorption Ratio	2	2	0.77	1.425	2.08	NS	NS	NS	NS
Solids, settleable (mL/L)	2	1	0.5	**2.5**	**4.5**	0.5	NS	NS	NS
Sulfate (mg/L)	2	2	465	867.5	1270	NS	NS	NS	NS
Total Dissolved Solids (mg/L)	2	2	694	1332	1970	NS	NS	NS	NS
Total Nitrogen (mg/L)	2	2	0.8	4.2	7.6	NS	NS	NS	NS
Total Phosphate (mg/L)	2	2	0.016	0.3425	0.669	NS	NS	NS	NS
Total Suspended Sediments (mg/L)	2	2	56	**78.5**	**101**	70	NS	NS	NS

Table 25. Water Quality of Outfall 005.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	MPDES Limit	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Zinc, total (mg/L)[1]	2	1	0.008	0.036	0.064	NS	7.4	Hardness Dependent	Hardness Dependent

Data collected between June 2023 and September 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
[1]Aquatic Life Standards for specific parameters are hardness dependent. Hardness was not tested during the monitoring period; therefore, a hardness of 400 mg/L was assumed to estimate exceedances. The Aquatic Life Standard for Lead was exceeded once during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Table 26. Water Quality of Outfall 009.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	MPDES Limit	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Aluminum, diss (mg/L)	1	0	0.03	0.03	0.03	NS	NS	0.75	0.087
Aluminum, total (mg/L)	1	1	0.148	0.148	0.148	NS	NS	NS	NS
Arsenic, total (mg/L)	1	0	0.001	0.001	0.001	NS	0.01	0.34	0.15
Boron, total (mg/L)	1	1	0.122	0.122	0.122	NS	NS	NS	NS
Cadmium, total (mg/L)[1]	1	0	0.00003	0.00003	0.00003	NS	0.005	Hardness Dependent	Hardness Dependent
Calcium, diss (mg/L)	1	1	66	66	66	NS	NS	NS	NS
Chloride (mg/L)	1	1	2	2	2	NS	NS	NS	NS
Chromium, total (mg/L)[1]	1	0	0.01	0.01	0.01	NS	0.1	Hardness Dependent	Hardness Dependent
Copper, total (mg/L)[1]	1	1	0.007	0.007	0.007	NS	1.3	Hardness Dependent	Hardness Dependent
Fluoride (mg/L)	1	1	0.4	0.4	0.4	NS	4	NS	NS
Iron, total (mg/L)	1	1	0.225	0.225	0.225	6	NS	NS	1
Laboratory Conductivity (µS/cm)	1	1	817	817	817	NS	NS	NS	NS
Laboratory pH (s.u.)	1	1	7.7	7.7	7.7	6.0-9.0	NS	NS	NS
Lead, total (mg/L)[1]	1	0	0.0003	0.0003	0.0003	NS	0.015	Hardness Dependent	Hardness Dependent
Magnesium, diss (mg/L)	1	1	52	52	52	NS	NS	NS	NS
Mercury, total (mg/L)	1	0	0.000005	0.000005	0.000005	NS	0.00005	0.0017	0.0009
Nickel, total (mg/L)[1]	1	0	0.002	0.002	0.002	NS	0.100	Hardness Dependent	Hardness Dependent
Nitrate+Nitrite (mg/L)	1	1	0.98	0.98	0.98	NS	10	NS	NS
Oil & Grease (mg/L)	1	0	1	1	1	10	NS	NS	NS
Selenium, total (mg/L)	1	1	0.004	0.004	0.004	NS	0.05	0.02	0.005
Silver, total (mg/L)[1]	1	0	0.0002	0.0002	0.0002	NS	0.1	Hardness Dependent	NS
Sodium, diss (mg/L)	1	1	38	38	38	NS	NS	NS	NS
Sodium Absorption Ratio	1	1	0.84	0.84	0.84	NS	NS	NS	NS
Solids, settleable (mL/L)	1	0	0.5	0.5	0.5	0.5	NS	NS	NS
Sulfate (mg/L)	1	1	411	411	411	NS	NS	NS	NS
Total Dissolved Solids (mg/L)	1	1	585	585	585	NS	NS	NS	NS
Total Nitrogen (mg/L)	1	1	1	1	1	NS	NS	NS	NS
Total Phosphate (mg/L)	1	1	0.017	0.017	0.017	NS	NS	NS	NS
Total Suspended Sediments (mg/L)	1	1	11	11	11	70	NS	NS	NS

Table 26. Water Quality of Outfall 009.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	MPDES Limit	Human Health Standard	Aquatic Life Standard (acute)	Aquatic Life Standard (chronic)
Zinc, total (mg/L)[1]	1	0	0.008	0.008	0.008	NS	7.4	Hardness Dependent	Hardness Dependent

Data collected in June 2023.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
[1]Aquatic Life Standards for specific parameters are hardness dependent. Hardness was not tested during the monitoring period; therefore, a hardness of 400 mg/L was assumed to estimate exceedances. No exceedances occurred during the monitoring period.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed noted standards.

Baseline Ground Water Quality Tables

Table 27. Alluvium Water Quality.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	110	0	1	1	1	NS
Aluminum, diss (mg/L)	110	106	0.00817	0.0391	1.47	NS
Ammonia (mg/L)	110	63	0.005	0.0289	0.228	NS
Arsenic, diss (mg/L)	110	79	0.000035	0.00036	0.0030	0.01
Bicarbonate Alkalinity (mg/L)	110	110	309	413	710	NS
Boron, diss (mg/L)	110	110	0.30	0.43	0.86	NS
Cadmium, diss (mg/L)	110	34	0.000040	0.0000975	0.000514	0.005
Calcium, diss (mg/L)	110	110	154	202	299	NS
Carbonate Alkalinity (mg/L)	110	6	1	1	37	NS
Chloride (mg/L)	110	110	7	12.6	498	NS
Copper, diss (mg/L)	110	50	0.000018	0.000837	0.18	1.3
Fluoride (mg/L)	110	104	0.0054	0.30	**4.76**	4
Hydroxide Alkalinity (mg/L)	110	0	1	1	1	NS
Iron, diss (mg/L)	110	104	0.000688	0.040	4.24	NS
Laboratory Conductivity (µS/cm)	110	110	2,260	3,350	5,170	NS
Laboratory pH (s.u.)	110	110	7.6	8.1	8.4	NS
Lead, diss (mg/L)	110	36	0.0000023	0.000067	0.0034	0.015
Magnesium, diss (mg/L)	110	110	194	284	448	NS
Manganese, diss (mg/L)	110	97	0.000214	0.030	3.0	NS
Nickel, diss (mg/L)	110	63	0.000763	0.00141	0.0165	0.1
Nitrate+Nitrite (mg/L)	110	72	0.0030	0.115	2.31	10
Potassium, diss (mg/L)	110	110	9.0	13	22	NS
Selenium, diss (mg/L)	110	101	0.000095	0.0040	0.0265	0.05
Sodium, diss (mg/L)	110	110	159	322	568	NS
Sulfate (mg/L)	110	110	1,250	1,810	2,970	NS
Total Alkalinity (mg/L)	110	110	309	413	710	NS
Total Dissolved Solids (mg/L)	110	110	2,500	3,220	5,040	NS
Total Hardness (mg/L)	110	110	1,180	1,690	2,550	NS
Vanadium, diss (mg/L)	110	80	0.00002	0.000774	0.00352	NS
Zinc, diss (mg/L)	110	26	0.00146	0.00507	0.076	2

Data collected between February 2017 and September 2023 from WA-219, WA-222, WA-225, WA-226, WA-227, WA-230, WA-231, and WA-232.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 28. Overburden Water Quality.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	51	0	1	1	1	NS
Aluminum, diss (mg/L)	51	50	0.00817	0.0432	0.189	NS
Ammonia (mg/L)	51	33	0.0050	0.15	0.961	NS
Arsenic, diss (mg/L)	51	35	0.000035	0.000311	0.00121	0.01
Bicarbonate Alkalinity (mg/L)	51	51	363	639	935	NS
Boron, diss (mg/L)	51	51	0.20	0.391	1.11	NS
Cadmium, diss (mg/L)	51	30	0.000040	0.0000952	0.000688	0.005
Calcium, diss (mg/L)	51	51	162	260	368	NS
Carbonate Alkalinity (mg/L)	51	0	1	1	1	NS
Chloride (mg/L)	51	51	6.24	9.55	23.0	NS
Copper, diss (mg/L)	51	41	0.000018	0.00166	0.045	1.3
Fluoride (mg/L)	51	34	0.0054	0.20	**5.63**	4
Hydroxide Alkalinity (mg/L)	51	0	1	1	1	NS
Iron, diss (mg/L)	51	46	0.000688	0.41	3.21	NS
Laboratory Conductivity (µS/cm)	51	51	2,530	3,880	6,840	NS
Laboratory pH (s.u.)	51	51	7.72	8.0	8.3	NS
Lead, diss (mg/L)	51	32	0.0000023	0.000088	0.0019	0.015
Magnesium, diss (mg/L)	51	51	239	345	645	NS
Manganese, diss (mg/L)	51	48	0.0000867	0.0332	0.472	NS
Nickel, diss (mg/L)	51	27	0.000764	0.000937	0.022	0.1
Nitrate+Nitrite (mg/L)	51	26	0.0030	0.0151	1.71	10
Potassium, diss (mg/L)	51	51	8.0	11.9	17	NS
Selenium, diss (mg/L)	51	43	0.000135	0.000403	**0.0761**	0.05
Sodium, diss (mg/L)	51	51	143	436	951	NS
Sulfate (mg/L)	51	51	1,350	1,970	4,470	NS
Total Alkalinity (mg/L)	51	51	363	639	935	NS
Total Dissolved Solids (mg/L)	51	51	2,740	3,670	7,350	NS
Total Hardness (mg/L)	51	51	1,600	1,990	3,570	NS
Vanadium, diss (mg/L)	51	39	0.00002	0.000768	0.00652	NS
Zinc, diss (mg/L)	51	35	0.00146	0.0161	0.124	2

Data collected between February 2017 and September 2023 from WO-184, WO-185, WO-186, WO-187, and WO-192.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 29. Rosebud Water Quality.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	84	0	1	1	1	NS
Aluminum, diss (mg/L)	84	81	0.00817	0.0291	1.89	NS
Ammonia (mg/L)	84	73	0.0050	0.348	0.944	NS
Arsenic, diss (mg/L)	84	43	0.000035	0.00023	0.0020	0.01
Bicarbonate Alkalinity (mg/L)	84	84	294	481	749	NS
Boron, diss (mg/L)	84	84	0.18	0.43	1.3	NS
Cadmium, diss (mg/L)	84	43	0.000040	0.0000771	0.000412	0.005
Calcium, diss (mg/L)	84	84	32.8	124	250	NS
Carbonate Alkalinity (mg/L)	84	17	1	1	114	NS
Chloride (mg/L)	84	84	1	4	11.1	NS
Copper, diss (mg/L)	84	61	0.000018	0.00104	0.161	1.3
Fluoride (mg/L)	84	60	0.0054	0.075	2.05	4
Hydroxide Alkalinity (mg/L)	84	0	1	1	1	NS
Iron, diss (mg/L)	84	84	0.00518	0.060	5.68	NS
Laboratory Conductivity (µS/cm)	84	84	714	2,365	3,860	NS
Laboratory pH (s.u.)	84	84	7.8	8.15	8.51	NS
Lead, diss (mg/L)	84	42	0.0000023	0.000072	0.0032	0.015
Magnesium, diss (mg/L)	84	84	15.3	77	293	NS
Manganese, diss (mg/L)	84	84	0.00289	0.0647	0.65	NS
Nickel, diss (mg/L)	84	40	0.000764	0.000937	0.011	0.1
Nitrate+Nitrite (mg/L)	84	34	0.0030	0.0066	0.19	10
Potassium, diss (mg/L)	84	84	2	5.3	15	NS
Selenium, diss (mg/L)	84	35	0.000094	0.000171	0.0176	0.05
Sodium, diss (mg/L)	84	84	7.77	154	885	NS
Sulfate (mg/L)	84	84	70	973	1,970	NS
Total Alkalinity (mg/L)	84	84	294	481	749	NS
Total Dissolved Solids (mg/L)	84	84	470	2,030	3,610	NS
Total Hardness (mg/L)	84	84	145	632	1,780	NS
Vanadium, diss (mg/L)	84	72	0.000020	0.000595	0.00309	NS
Zinc, diss (mg/L)	84	51	0.00146	0.00495	0.125	2

Data collected between February 2017 and September 2023 from WR-231, WR-233, WR-234, WR-235, WR-237, WR-238, and WR-239.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 30. McKay Water Quality.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	112	0	1	1	1	NS
Aluminum, diss (mg/L)	112	107	0.00817	0.0382	0.616	NS
Ammonia (mg/L)	112	97	0.0050	0.423	1.23	NS
Arsenic, diss (mg/L)	112	60	0.000035	0.000199	0.000804	0.01
Bicarbonate Alkalinity (mg/L)	112	112	202	372	620	NS
Boron, diss (mg/L)	112	112	0.14	0.333	0.837	NS
Cadmium, diss (mg/L)	112	55	0.000040	0.0000858	0.000464	0.005
Calcium, diss (mg/L)	112	112	21.3	56.2	254	NS
Carbonate Alkalinity (mg/L)	112	62	1.0	2.14	26.2	NS
Chloride (mg/L)	112	112	1.0	4.0	17.9	NS
Copper, diss (mg/L)	112	100	0.000018	0.00127	0.030	1.3
Fluoride (mg/L)	112	105	0.0054	0.30	3.4	4
Hydroxide Alkalinity (mg/L)	112	0	1	1	1	NS
Iron, diss (mg/L)	112	108	0.000688	0.0669	2.59	NS
Laboratory Conductivity (µS/cm)	112	112	755	2,125	4,760	NS
Laboratory pH (s.u.)	112	112	8.0	8.3	8.6	NS
Lead, diss (mg/L)	112	53	0.0000023	0.0000715	0.00318	0.015
Magnesium, diss (mg/L)	112	112	6.82	31	355	NS
Manganese, diss (mg/L)	112	111	0.0000867	0.0296	0.148	NS
Nickel, diss (mg/L)	112	54	0.000763	0.0009805	0.015	0.1
Nitrate+Nitrite (mg/L)	112	67	0.0030	0.035	1.54	10
Potassium, diss (mg/L)	112	112	4.0	7.0	15.8	NS
Selenium, diss (mg/L)	112	54	0.000094	0.000173	0.0186	0.05
Sodium, diss (mg/L)	112	112	76	316	721	NS
Sulfate (mg/L)	112	112	76	833	2,700	NS
Total Alkalinity (mg/L)	112	112	213	372	620	NS
Total Dissolved Solids (mg/L)	112	112	510	1,600	4,750	NS
Total Hardness (mg/L)	112	112	84.2	264	2,090	NS
Vanadium, diss (mg/L)	112	86	0.0000136	0.000544	0.00713	NS
Zinc, diss (mg/L)	112	71	0.00146	0.00487	0.143	2

Data collected between February 2017 and September 2023 from WM-192, WM-193, WM-194, WM-195, WM-196, WM-197, WM-198, WM-199, and WM-208.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

Table 31. Sub-McKay Water Quality.

Parameter	Number of Samples	Number of Detections	Minimum	Median	Maximum	Human Health Standard
Acidity (mg/L)	98	0	1	1	1	NS
Aluminum, diss (mg/L)	98	95	0.00817	0.038	0.683	NS
Ammonia (mg/L)	98	84	0.0050	0.50	1.7	NS
Arsenic, diss (mg/L)	98	58	0.000035	0.00034	0.0020	0.01
Bicarbonate Alkalinity (mg/L)	98	98	231	408	890	NS
Boron, diss (mg/L)	98	98	0.17	0.274	0.855	NS
Cadmium, diss (mg/L)	98	48	0.000040	0.0000787	0.000704	0.005
Calcium, diss (mg/L)	98	98	6.94	47	302	NS
Carbonate Alkalinity (mg/L)	98	65	1.0	11.6	63	NS
Chloride (mg/L)	98	98	1.0	5.0	19	NS
Copper, diss (mg/L)	98	80	0.000018	0.0014	0.011	1.3
Fluoride (mg/L)	98	86	0.0054	0.50	**4.63**	4
Hydroxide Alkalinity (mg/L)	98	0	1	1	1	NS
Iron, diss (mg/L)	98	98	0.00351	0.135	5.7	NS
Laboratory Conductivity (µS/cm)	98	98	1,210	2,305	4,570	NS
Laboratory pH (s.u.)	98	98	7.8	8.4	8.7	NS
Lead, diss (mg/L)	98	54	0.0000023	0.0000715	0.0031	0.015
Magnesium, diss (mg/L)	98	98	2.0	22.6	350	NS
Manganese, diss (mg/L)	98	98	0.00058	0.025	0.10	NS
Nickel, diss (mg/L)	98	51	0.000763	0.000995	0.0349	0.1
Nitrate+Nitrite (mg/L)	98	68	0.0030	0.044	0.411	10
Potassium, diss (mg/L)	98	98	2.69	7.46	15	NS
Selenium, diss (mg/L)	98	44	0.000094	0.00017	0.0010	0.05
Sodium, diss (mg/L)	98	98	172	374	724	NS
Sulfate (mg/L)	98	98	332	786	2,210	NS
Total Alkalinity (mg/L)	98	98	239	422	890	NS
Total Dissolved Solids (mg/L)	98	98	976	1,590	4,410	NS
Total Hardness (mg/L)	98	98	25	211	2,180	NS
Vanadium, diss (mg/L)	98	76	0.000020	0.000584	0.00342	NS
Zinc, diss (mg/L)	98	61	0.00146	0.00577	0.073	2

Data collected between February 2017 and September 2023 from WD-187, WD-188, WD-189, WD-191, WD-192, WD-193, WD-194, and WD-210.
NS = no numeric standard.
diss = dissolved; µS/cm = micro Siemens/centimeter; s.u. = standard units; mg/L = milligrams per liter.
For less than detection limit concentrations, detection limit used to calculate summary statistics.
Concentrations in bold exceed Human Health Standard for ground water.

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Appendix 4 – BBC IMPLAN Analysis

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MEMORANDUM

To: Nicole DenHerder, ERO Resources Corporation

From: Doug Jeavons, BBC Research & Consulting

Re: IMPLAN Analysis of Economic and Fiscal Effects of the Rosebud Mine for the SEIS (including Economic and Fiscal Effects from Colstrip and Rosebud Power Plants)

Date: July 22, 2024 Update

For the Area F Supplemental EIS, BBC Research & Consulting (BBC) conducted an updated IMPLAN analysis to quantify the regional economic effects from mine operations under the SEIS alternatives. BBC also analyzed the indirect economic effects from coal supplied by Area F to the nearby Colstrip and Rosebud electric generating stations, which receive all of the coal they use to produce electricity from the Rosebud Mine (and are the mine's only customers).

The Rosebud coal mine is located in southeastern Montana. The mine's operations are primarily located in Rosebud County, with a portion of the mineable area extending into Treasure County.

BBC's analysis focuses on the current economic effects of these facilities, which are projected to remain approximately the same in future years, though the duration of the effects may differ depending on the SEIS alternative that is ultimately selected. Under the No Action Alternative, mining from Area F would cease after 2025. Under the Proposed Action (the current Federal mine plan also referred to as Alternative 4), mining from Area F would continue through 2039. Under the Partial Mining Alternative (also referred to as Alternative 5), mining from Area F would continue through 2030.

Methods for the Analysis

BBC used the IMPLAN regional economic modeling system to estimate the direct, indirect, and induced regional economic effects from the Rosebud Mine and the Colstrip and Rosebud power plants. IMPLAN is an input-output model, originally developed by the U.S. Forest Service that is now widely used for impact analysis by public and private sector economists throughout the United States. Input-output analysis is a means of examining relationships within an economy between businesses and between businesses and final consumers. The analysis captures all monetary market transactions for consumption in a given period. The resulting mathematical representation allows examination of the effect of a change in one or more economic activities on an entire economy with all other factors being constant. Input-output analysis also provides multipliers, which are used to estimate indirect and induced effects, or secondary effects.

In an input-output analysis, direct effects refer to the initial round of spending from the activity being studied (e.g., the payroll, and supplies, materials, and services purchased by the Rosebud Mine). Indirect effects refer to the economic activity which results from the purchase of goods and services by the other local businesses that receive payments from the directly affected operation (in this case, the Rosebud Mine). Induced effects refer to the economic activity which results from the purchase of household goods and services by employees of the mine and the indirectly affected businesses. Together, indirect and induced effects are sometimes referred to as "secondary" economic impacts, or "multiplier effects."

The IMPLAN model captures only the "backward linkages" (the interconnection of an industry to other industries from which it purchases its inputs in order to produce its output) from mine operations due to the mine's purchases, payroll, and other local expenditures. In this analysis, however, "forward linkages" from the mine are also important. The Rosebud Mine is the primary fuel supplier to the Colstrip Power Plant. Colstrip is the largest industrial facility in Montana and one of the largest coal-fired power plants in the western United States. Waste coal from the Rosebud Mine is burned at the much smaller Rosebud Power Plant.

To examine both the "backward linkages" and the "forward linkages" from the Rosebud Mine, BBC conducted separate IMPLAN analyses of the regional economic effects from mine operations and the regional economic effects from operations of the power plant. In this report, we initially present the regional economic effects from the mine, since the permitting decision would directly affect future mine operations. BBC then discusses the regional economic effects from the power plants, which may or may not be substantially affected by the mine permitting decision. Since the IMPLAN estimates of the economic contribution from the power plants include the economic effects from the operation of the mine (a "backward linkage" from the power plant), BBC removed the estimated economic contribution from the mine from the overall economic contribution of the power plants in order to assess the *additional* regional economic effects from the power plants (and to avoid double counting the economic effects from the generating facilities and the mine).

The IMPLAN model that BBC constructed for this analysis included Rosebud County, Big Horn County, and Treasure County, which are the three local counties most affected by mine operations. BBC used IMPLAN's multiregional analysis capabilities (based on estimated trade flows between the counties) to model how mine activities, primarily based in Rosebud County, affect the economies in the other two counties.

The IMPLAN model provides information on economic activity (employment, labor compensation, output, and other metrics) for the coal-mining sector in Rosebud County in 2022 (the most recent data available from IMPLAN). Employment and production at the Rosebud Mine vary from year to year. Currently (as of July 2024), a total of 320 people work at the Rosebud Mine. Given the impossibility of accurately forecasting year-to-year variability in mine employment, for purposes of this analysis we assumed constant employment of 320 workers from year 2024 through the end of production at the mine under each alternative.

BBC also considered the effects of mine operations on members of the Northern Cheyenne Reservation located primarily in Rosebud County as well as the effects on other Native American workers at the mine.

Estimated Effects on Regional Economy (2020 through 2045)

Direct effects from mine operations. The direct effects of the Rosebud Mine are the employment and output directly related to the mine's production. Since the Rosebud Mine is based in Rosebud County, all direct effects are assumed to occur in that county.

BBC estimates that Rosebud Mine operations currently support an annual average of approximately 320 direct jobs and $148 million in annual direct economic output. 46 of the 320 mine workers (14 percent) are members of the Northern Cheyenne Reservation. Another 30 of the 320 workers (9 percent) are Native Americans who are not members of the Northern Cheyenne tribe, likely predominantly members of the relatively nearby Crow tribe.

Figure 1. Annual Direct Effects by Location (Dollars in Thousands)

Area	Employment	Total Output
Rosebud County	320	$148,073
Big Horn County	0	$0
Treasure County	0	$0
Total	320	$148,073

Source: IMPLAN and BBC Research & Consulting, 2024.

Indirect effects from mine operations. Indirect effects (described earlier in the *Methods for the Analysis* section) occur beyond the geographic boundaries of the direct effects and impact the larger economic region as a whole. The estimated current indirect economic effects on the region from the Rosebud Mine are shown in Figure 2.

Indirect effects also likely occur outside of the three-county regional economic study area used in this analysis – particularly in Yellowstone County, which includes the City of Billings. Billings is the largest city and the primary regional trade center in southeastern Montana. The effects beyond the three-county study area are not captured in this analysis.

Figure 2. Indirect Effects by Location (Dollars in Thousands)

Area	Employment	Total Output
Rosebud County	49	$17,091
Big Horn County	1	$465
Treasure County	3	$819
Total	53	$18,375

Source: IMPLAN and BBC Research & Consulting, 2024.

BBC estimates that the Rosebud Mine currently supports approximately 53 indirect jobs. The mine also generates approximately $18 million annually in indirect economic output in the region.

Induced effects from mine operations. Figure 3 shows the estimated induced effects (described in the *Methods for the Analysis* section) of current Rosebud Mine operations within Rosebud, Big Horn, and Treasure counties.

Figure 3. Induced Effects by Location (Dollars in Thousands)

Area	Employment	Total Output
Rosebud County	58	$9,748
Big Horn County	6	$907
Treasure County	1	$84
Total	65	$10,379

Source: IMPLAN and BBC Research & Consulting, 2024.

The Rosebud Mine is estimated to currently support approximately 65 induced jobs and over $10 million in annual induced output across the three-county study area.

Total regional effects from mine operations. The total regional economic impact of the mine is the combination of the direct, indirect, and induced impacts. The majority of the economic effects occur at or near the mine; and Rosebud County is estimated to experience the largest economic impacts. However, since indirect and induced spending occurs across the larger regional economy, both Big Horn County and Treasure County experience some economic effects due to mine operations (Figure 4).

Figure 4. Total Annual Economic Effects by Location (Dollars in Thousands)

Area	Employment	Total Output
Rosebud County	427	$174,912
Big Horn County	7	$1,372
Treasure County	4	$904
Total	438	$177,188

Source: IMPLAN and BBC Research & Consulting, 2024.

The Rosebud Mine is estimated to currently support about 438 direct, indirect, and induced jobs throughout the three-county region and to stimulate about $177 million in annual economic output within the region. As noted previously, about 23 percent of the mine's direct workforce are members of the Northern Cheyenne tribe (14 percent) or other Native Americans (9 percent).

Current effects of mine operations on government revenues. Another important component of the mine's economic effects is the resulting fiscal revenues provided to local governments, the state of Montana and the federal government. BBC estimated the fiscal contributions from the Rosebud Mine based on the mine's employment level and corresponding economic output and tax revenues estimated using the IMPLAN model.

The Rosebud Mine is estimated to provide approximately $52 million in annual direct revenues to Rosebud County, the state of Montana and the federal government, as summarized in Figure

5. These revenues include federal and state royalties, severance taxes, resource indemnity trusts, gross proceeds taxes, and property taxes.

As shown in Figure 5, the Rosebud Mine directly generated approximately $32 million in annual state revenues in 2023. Local governments received approximately $11 million and the federal government received approximately $9 million in annual taxes and royalties.

Figure 5. Direct Governmental Revenues from the Rosebud Mine (Dollars in Thousands)

	Local Governments	State of Montana	Federal Government
Taxes	$10,643	$30,338	
Royalties	0	$2,003	$9,068
Total	$10,643	$32,341	$9,068

Source: Westmoreland Resources and BBC Research and Consulting, 2024.

In addition to the direct fiscal impacts, the indirect and induced economic activity generated by the mine throughout the region produces additional tax revenues. These effects include payroll and income taxes, property taxes and other fees. Induced fiscal effects are relatively small because there are no sales taxes in Montana that capture revenues from the induced increase in household spending.

As shown in Figure 6, the indirect and induced effects, combined with the direct effects shown in Figure 5, are estimated to generate approximately $12 million, $33 million, and $11 million in annual revenues in 2023 for local governments, the state of Montana, and the federal government, respectively.

Figure 6. Total Annual Governmental Revenues from Mine Operations (Dollars in Thousands)

	Local Governments	State of Montana	Federal Government
Direct	$10,643	$32,341	$9,068
Indirect	$750	$452	$918
Induced	$258	$236	$687
Total	$11,651	$33,029	$10,673

Source: IMPLAN and BBC Research & Consulting, 2024.

***Additional* Current Regional Economic Effects from Operations of Colstrip and Rosebud Power Plants.** As noted previously, the Colstrip Power Plant purchases virtually all of the coal produced by the Rosebud Mine except for waste coal that is burned at the Rosebud Power Plant. Since the retirement of Units 1 and 2 in early 2020, Colstrip has reduced its workforce and currently employs about 250 workers.

In total, BBC estimates that the Colstrip and Rosebud Power Plants currently support about $556 million dollars in annual economic output across the three-county region, and approximately 640 jobs. However, some of this output and jobs reflects the supporting operations of the Rosebud Mine described earlier. Figure 7 summarizes the current *additional* effects from power plant operations on annual economic output and employment in the three-county region. The data shown in Figure 7 were adjusted to exclude the economic effects of the mine, reported previously in Figure 4.

Figure 7. *Additional* Economic Effects from Colstrip and Rosebud Power Plants (Dollars in Thousands)

	Employment	Total Output
Direct	255	$361,283
Indirect	44	$28,243
Induced	62	$13,369
Total	361	$402,895

Note: Excludes economic effects from mine operations shown previously in Figure 4.
Source: IMPLAN and BBC Research & Consulting, 2024

Power plant operations also produce substantial federal, state and local tax revenues. The Colstrip and Rosebud electric generating operations are estimated to directly produce about $42 million per year in direct revenues for state, local and the federal government. Figure 8 also depicts the total combined contribution to government revenues from Colstrip and Rosebud Power Plant operations and Rosebud Mine operations, including the direct, indirect and induced annual government revenues from mine operations reported previously in Figure 6. In total, the mine and the powerplants are estimated to produce about $97 million per year in revenues for the federal, state and local governments.

Figure 8. *Total* Government Revenues from Colstrip Generating Station and Rosebud Mine (Dollars in Thousands)

	Power Plant Revenues	Mine Revenues	Total Revenues
State and Local	$29,299	$44,680	$73,919
Federal	$12,591	$10,673	$23,264
Total	$41,890	$55,353	$97,243

Source: IMPLAN and BBC Research & Consulting, 2024.

Summary

For the SEIS, BBC has updated its previous economic and fiscal impact analysis regarding the economic contributions from the Rosebud Mine and the Colstrip and Rosebud power plants. Based on the latest information available information, BBC estimates that the mine supports a total of 438 local jobs and $177 million in annual economic output – primarily, though not exclusively, in Rosebud County. Approximately 23 percent of the mine's labor force are Native Americans, including about 14 percent of the workforce that are members of the Northern Cheyenne Tribe.

Operations of the Colstrip and Rosebud generating stations support an additional 361 local jobs and $403 million in annual economic output – excluding the economic contribution from the operations of the mine. On a combined basis, the three facilities support almost 800 local jobs (over 7 percent of total employment in the three-county region including Rosebud County, Big Horn County and Treasure County) and about $569 million in annual economic output (approximately 24 percent of total economic output in the three-county region).

Under the Proposed Action (Alternative 4), these annual economic contributions are anticipated to be supported by Area F coal mining through year 2039. Under the Partial Mining Alternative (Alternative 5) Area F coal production would help support the economic and fiscal contributions from the mine and powerplant through year 2030. Under the No Action Alternative, Area F mining operations would cease after 2025.

For this analysis, the Colstrip and Rosebud power plants are assumed to continue to operate as long as the mine is producing coal. Whether or not the powerplants could secure an alternative source of coal after mine operations cease and continue their operations is unknown.