

U.S. Department of the Interior
Bureau of Land Management

Volume I: Chapters 1–5, Appendices A-C

Draft Resource Management Plan Amendment and Environmental Impact Statement for Big Game Habitat Conservation for Oil and Gas Management in Colorado



BLM MISSION

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

DOI-BLM-CO-0000-2022-0003-RMP-EIS



United States Department of the Interior
BUREAU OF LAND MANAGEMENT



Colorado State Office
Denver Federal Center, Building 40
Lakewood, Colorado 80225
www.blm.gov/colorado

In Reply Refer To:
1610 (CO930)

Dear Reader:

The completed draft Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) for Big Game Habitat Conservation for Oil and Gas Management is available for your review and comment. The planning area includes all 64 counties in Colorado. The approximately 8.3 million acres of BLM-administered surface land and 4.7 million acres of Federal mineral split estate in the decision area plays an important role in the region's social, ecological, and economic well-being.

This draft plan includes management alternatives for the decision area that may modify or amend oil and gas management decisions in the existing BLM Colorado Resource Management Plans:

- Northeast Resource Area RMP (1986)
- Royal Gorge Resource Area RMP (1996)
- San Luis Resource Area RMP (1991)
- Gunnison Resource Area RMP (1993)
- Uncompahgre Field Office RMP (2020)
- Colorado River Valley Field Office RMP (2015) and Roan Plateau RMP (2016)
- Grand Junction Field Office RMP (2015)
- Kremmling RMP (2015)
- Little Snake RMP (2011)
- White River Field Office RMP (1997)
- Tres Rios Field Office RMP (2015)
- Canyons of the Ancients National Monument RMP (2010)
- Gunnison Gorge National Conservation Area RMP (2004)

Oil and gas management is a focal area for this draft RMPA/EIS. The BLM recognizes the importance of conserving ecological connectivity and big game High Priority Habitats, movement areas, and migration corridors when managing oil and gas resource development.

The BLM encourages the public to provide information and comments regarding the analysis presented in the Draft RMPA/EIS. We are particularly interested in comments concerning the adequacy of the alternatives and impact analysis.

The BLM will accept comments for 90 calendar days following the Environmental Protection Agency's publication of its Notice of Availability in the *Federal Register*. The BLM can best use your comments and resource information submissions if it receives them within the review period. Documents pertinent to this proposal may be examined online at <https://go.usa.gov/xzXxY>.

You may submit comments electronically on the project website at <https://go.usa.gov/xzXxY>, or you can mail or hand deliver comments to BLM Colorado State Office, Attn: Big Game Habitat Conservation Amendment/EIS, Denver Federal Center Building 40, Lakewood, CO 80225. To facilitate analysis of comments and information submitted, the BLM strongly encourages you to submit comments in an electronic format.

Your review and comment on the content of this document are critical to the success of this planning effort. If you submit comments, the BLM requests that you make them as specific as possible. Comments will be more helpful if you include suggested changes, sources, or methods and reference a section or page number. The BLM will consider comments containing only opinions or preferences and will include them as part of the decision-making process; however, the BLM will not respond formally to those comments.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Public meetings to provide an overview of the document and to respond to questions will be announced by local media and on the project website at least 15 days in advance.

Thank you for your continued interest in the EIS. The BLM appreciates the information and suggestions you contribute to the planning process. For additional information or clarification of this document or planning process, please contact Alan Bittner at 303-239-3768 or email BLM_CO_corridors_planning@blm.gov.

Sincerely,



Doug Vilsack
State Director

Digitally signed by DOUGLAS
VILSACK
Date: 2023.10.30 14:22:10
-06'00'

Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Big Game Habitat Conservation for Oil and Gas Management in Colorado

DOI-BLM-CO-0000-2022-0003-RMP-EIS

1. Responsible Agency: United States Department of the Interior
Bureau of Land Management
2. Type of Action: Administrative (X) Legislative ()
3. Document Status: Draft (X) Final ()
4. Abstract: This Draft Resource Management Plan Amendment and Environmental Impact Statement describes and analyzes four alternatives for managing 8.3 million acres of BLM-administered surface land and approximately 4.7 million acres of nonfederal surface estate with subsurface federal mineral split estate in Colorado for the purpose of big game habitat conservation. The plan alternatives are Alternative A (the “no action” alternative or continuation of the existing approved RMPs, as amended, throughout Colorado), Alternative B (conservation and cooperation and the preferred alternative), Alternative C (enhanced conservation; balanced use for split-estate), and Alternative D (greatest conservation). Planning issues addressed include categories such as air quality, fluid minerals, climate, big game species and habitat, Native American religious concerns, socioeconomics, and environmental justice. Components of this draft are subject to change following cooperating agency review and further coordination with cooperators.
5. Public Review Period: The public review and comment period for the Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Big Game Habitat Conservation for Oil and Gas Management in Colorado is 90 calendar days. The review period will begin when the US Environmental Protection Agency publishes a Notice of Availability in the *Federal Register*. Based on the current schedule, this is anticipated November 2023.
6. For further information contact:
Ashley Phillips, Project Manager
Bureau of Land Management
Colorado State Office
2850 Youngfield St.
Lakewood, CO 80215
Telephone: (303) 239-3948
Email: BLM_CO_corridors_planning@blm.gov
Web site: <https://eplanning.blm.gov/eplanning-ui/project/2018400/510>

This page intentionally left blank.

Executive Summary

ES.I INTRODUCTION

In accordance with the National Environmental Policy Act (NEPA), the Bureau of Land Management (BLM) Colorado State Office has prepared this resource management plan amendment (RMPA) and environmental impact statement (EIS) to consider amending BLM's resource management plans (RMP) in Colorado to include additional measures to promote big game habitat conservation. Specifically, the BLM has developed this EIS to evaluate land use planning decisions to allocate areas as open or closed to oil and gas leasing, incorporate oil and gas lease stipulations (including major and moderate restrictions), and adopt other plan components to enhance protection for high priority habitat (HPH) areas for elk, mule deer, pronghorn, and bighorn sheep (Rocky Mountain and Desert).

Appendix D contains maps of current big game HPH for this plan. The following areas are considered big game HPH in this plan:

- Bighorn Sheep – production areas, corridors, winter range
- Elk – production areas, corridors, severe winter range, winter concentration areas
- Mule deer - corridors, severe winter range, winter concentration areas
- Pronghorn - corridors, winter concentration areas

This document provides direction for managing public lands and Federal mineral estate in Colorado and analyzes the environmental effects that could result from implementing each of the planning alternatives considered. The affected lands in the planning area are currently managed under 16 separate land use plans.

The planning area includes all 64 counties in Colorado and encompasses approximately 8.3 million acres of BLM-administered surface land and approximately 27 million acres of Federal mineral estate. Approximately 6.17 million acres of big game HPH are on BLM-administered surface land in Colorado, and 15.94 million acres of big game HPH are on Federal mineral estate. The decision area includes all 8.3 million acres of BLM-administered surface land (except where Federal minerals have been withdrawn from mineral leasing) plus approximately 4.7 million acres of nonfederal surface estate with subsurface federal mineral split estate (**Table ES-1** and **Table ES-2**). Note that the decision area excludes National Forest System land and other federal land where the BLM does not make planning decisions about oil and gas management or other uses.

Table ES-1. Decision Area

Lands Affected by this Plan	Acres
BLM-administered surface estate and mineral estate	8,317,000
BLM-administered mineral estate with nonfederal surface estate	4,693,000
BLM-administered surface estate with no BLM-administered subsurface mineral estate	117,691
Total decision area	13,010,000

Source: BLM GIS 2022

Table ES-2. Decision Area Lands by County

County	Acres¹
Adams County	3,000
Alamosa County	52,000
Arapahoe County	11,000
Archuleta County	30,000
Baca County	94,000
Bent County	127,000
Boulder County	16,000
Broomfield County*	0
Chaffee County	78,000
Cheyenne County	4,000
Clear Creek County	4,000
Conejos County	207,000
Costilla County	1,000
Crowley County	31,000
Custer County	97,000
Delta County	289,000
Denver County	0
Dolores County	183,000
Douglas County	4,000
Eagle County	324,000
El Paso County	20,000
Elbert County	9,000
Fremont County	498,000
Garfield County	841,000
Gilpin County	9,000
Grand County	246,000
Gunnison County	544,000
Hinsdale County	129,000
Huerfano County	205,000
Jackson County	317,000
Jefferson County	26,000
Kiowa County	20,000
Kit Carson County	21,000
La Plata County	76,000
Lake County	21,000
Larimer County	89,000
Las Animas County	711,000
Lincoln County	21,000
Logan County	19,000
Mesa County	1,122,000
Mineral County	4,000
Moffat County	1,978,000
Montezuma County	264,000
Montrose County	718,000
Morgan County	27,000
Otero County	98,000
Ouray County	53,000
Park County	344,000
Phillips County	7,000
Pitkin County	46,000

County	Acres¹
Prowers County	44,000
Pueblo County	120,000
Rio Blanco County	1,379,000
Rio Grande County	74,000
Routt County	280,000
Saguache County	424,000
San Juan County	46,000
San Miguel County	416,000
Sedgwick County	2,000
Summit County	14,000
Teller County	51,000
Washington County	23,000
Weld County	47,000
Yuma County	53,000
Total	13,011,000*

Source: BLM GIS 2022

¹ Acres are rounded.

ES.2 PURPOSE OF AND NEED FOR ACTION

The purpose of this RMPA process is to evaluate alternative approaches for oil and gas planning decisions to maintain, conserve, and protect big game corridors and other big game HPH on BLM-administered lands and Federal mineral estate in Colorado. This draft RMPA/EIS establishes goals, objectives, and needs to address conflicts or issues related to oil and gas development and big game HPH. Under the authority of Section 202 of FLPMA, the BLM also seeks to evaluate consistency with plans or policies and programs of other Federal agencies, State and local governments, and Tribes, to the extent consistent with Federal laws, regulations, policies and programs applicable to BLM-administered lands.

The RMPA process considers consistency with the policies and programs of State agencies that manage big game habitat and regulate oil and gas in Colorado – Colorado Parks and Wildlife and the Colorado Energy and Carbon Management Commission (ECMC). CPW manages wildlife in Colorado, and the ECMC regulates oil and gas development. The ECMC 1200 series rules identify certain big game habitats where oil and gas operations are subject to specific ECMC requirements. CPW's consultation role within the ECMC requirements for HPH is intended to avoid, minimize, and mitigate impacts to big game habitats.

Therefore, this action is needed to ensure the BLM fulfills its responsibilities under FLPMA by considering current big game population and habitat data and evaluating management consistency with plans, policies, and programs of other Federal agencies, State and local governments, and Tribes, to the extent consistent with Federal laws, regulations, policies and programs applicable to BLM-administered lands. This RMPA process also complies with the terms of the settlement agreement in *State of Colorado v. Bureau of Land Management* (U.S. District Court for Colorado, 1:21-cv-00129). **Chapter I** provides more background and detail on the BLM's purpose and need for this plan.

ES.3 SCOPING

The policy of the BLM is to provide opportunities for the public, various groups, other federal agencies, Native American tribal members, and state and local governments to participate meaningfully and substantively by providing input and comments during the preparation of the RMPA/EIS.

The BLM began the scoping process with a Notice of Intent published July 19, 2022, starting a 45-day public scoping period which ended September 2, 2022. The BLM sent over 250 notifications to known potentially

interested or affected stakeholders. The BLM held five meetings—three in-person and two virtual—to provide the public with opportunities to become involved, to learn about the project and the planning process, and to offer comments. The scoping meetings were attended by 78 individuals total. The BLM received 597 submissions during the scoping period—most comment submissions were form letters, followed by 108 unique individual submissions. The comments received during the public scoping process were analyzed, and a scoping summary report was finalized in December 2022 (BLM 2022a).

The public outreach phases are ongoing, while public review of the Draft RMPA/EIS is occurring for 90 days following its publication. Information about the planning process can be obtained by the public at any time on the project website at <https://go.usa.gov/xzXxY>.

ES.4 ISSUES

Issue identification is the first step of the BLM planning process. A planning issue is a major controversy or dispute regarding management of resources or uses on BLM-administered lands that can be addressed in a variety of ways. Based on internal and external scoping for the RMPA, the BLM preliminarily identified 15 planning issue categories. A planning issue statement was developed for each of the planning issue categories. Each planning issue statement summarizes the related issues and concerns identified during scoping. The planning issue statements are presented in **Table ES-3** (Planning Issue Statements).

Table ES-3. Planning Issue Statements

Resource Category	Planning Issues
Physical Environment	
Geology and Fluid Minerals	<ul style="list-style-type: none"> • How would new moderate constraints (timing limitations [TLs] and controlled surface use [CSU] stipulations), and new major constraints (no surface occupancy [NSO] and areas closed to leasing [no leasing, NL]), a three percent density threshold, aligning with ECOMC rules (I in 640), and requirements for master development plans and wildlife mitigation plans affect oil and gas development? • How would geophysical exploration activities be affected under the proposed alternatives? • How would new stipulations, conservation measures, and development limitations affect geology? • How would demand for mineral materials be impacted under the proposed alternative?
Air Quality	<ul style="list-style-type: none"> • What are the potential impacts to air pollutant concentrations and air quality related values that could be associated with direct and indirect foreseeable resource activities including upstream, midstream and downstream oil and gas emissions sources for the baseline future scenario (No Action Alternative) compared to the action alternatives? • For the foreseeable future (up to 10 years), at what levels could BLM managed activities and emissions sources potentially affect vegetation and ecosystems in big game habitat areas? • What are the potential differences in cumulative greenhouse gas (GHG) emissions levels and corresponding climate impacts (including social costs) that could be associated with direct and indirect foreseeable oil and gas emissions sources for the baseline future scenario (No Action Alternative) compared to the most restrictive alternative?

Resource Category	Planning Issues
Climate	<ul style="list-style-type: none"> • How do the alternatives potentially impact GHGs / climate change (see Air Quality)? What are the impacts to natural resources in the planning area already or predicted to be vulnerable and exacerbated by climate change, especially those resources critical for big game? • How do the alternatives contribute to landscape resiliency, given prolonged and intensifying drought conditions and scarce riparian resources? • How might alternatives affect project level planning, which may interplay with natural events such as wildfire and flooding? Specifically, how can climate change, drought, and novel weather patterns be accounted for within implementation-level oil and gas management? • How will climate variability impact big game populations in the planning area, taking into account foreseeable trends and planned actions in the area? • What are the impacts across alternatives to big game habitat effectiveness when combined with forecasted impacts from climate change in 20 years? • How do the alternatives differ with respect to the cumulative effects of climate change when considered with non-BLM land use activities in the planning area. How does the implementation of conservation actions contribute to cumulative effects on big game and their habitats associated with climate change?
Noise and Acoustic Environment	<ul style="list-style-type: none"> • How does the closure of lands to fluid mineral leasing areas in and outside of HPH impact noise associated with drilling and operating wells or transfer stations?
Lands and Realty	<ul style="list-style-type: none"> • How would the alternatives affect land use authorizations on BLM-administered lands?
Soil Resources	<ul style="list-style-type: none"> • What are the impacts of big game on soil quality? • What are the effects to soil quality from the no action and action alternatives?
Paleontological Resources	<ul style="list-style-type: none"> • How would each alternative affect paleontological resources across the planning area? Where and how will potential oil and gas development limitations affect paleontological resources? • What impact do big game populations have on paleontological resources on BLM land in Colorado?
Biological Resources	
Big Game Species and Habitat	<ul style="list-style-type: none"> • What are the direct and indirect impacts to big game habitat and population trends from the alternatives related to oil and gas? What are the impacts from BLM and neighboring land use activities combined (cumulative disturbance) across alternatives and reasonably foreseeable future actions? • How would new stipulations, conservation measures, and development limitations affect big game species and high priority habitat?

Resource Category	Planning Issues
Special Status Species and Other Wildlife, including Terrestrial, Mammals, Fish, Aquatic Species, and Migratory Birds	<ul style="list-style-type: none"> • How would fluid mineral leasing and development under the alternatives impact special status species and their habitat, including Gunnison and greater sage-grouse, Piping Plovers, Least Terns, Bald and Golden Eagles, other raptors, and other special status birds? • How do alternatives contribute to access and conservation goals and objectives for fish and wildlife habitat, and hunting and fishing opportunities? • What are the impacts (including beneficial) towards efforts to stabilize and/or recover other species that are declining and may have conflicts with other management objectives on BLM lands? How are these effects different across alternatives? • How do big game populations and important habitat contribute to habitat for aquatic species and fish populations?
Vegetation	<ul style="list-style-type: none"> • What is the impact to affected vegetation from the alternatives, including potential limitations from oil and gas development? • How do the alternatives contribute to achieving vegetation objectives as it pertains to habitat effectiveness for big game on these vegetation communities? • How would vegetation management intended for wildlife habitat improvement adversely alter lands with potential wilderness character? • How might vegetation be altered in terms of alteration or increase of forage of water supplies for livestock?
Social and Economic Systems	
Native American Religious Concerns	<ul style="list-style-type: none"> • How would each alternative's management of oil and gas affect Native American Tribes' access to sacred sites and traditional gathering areas?
Cultural Resources	<ul style="list-style-type: none"> • How would each alternative affect cultural resources across the planning area? Where and how will potential oil and gas development limitations affect cultural resources? • What impact do big game populations have on cultural resources on BLM land in Colorado?
Socioeconomics and Environmental Justice	<ul style="list-style-type: none"> • What is the economic impact associated with potentially decreased levels of oil and gas development? • How will protection of big game HPH influence management of energy resources and social and economic values? • How will BLM's management decisions affect the values people and communities enjoy from public lands in the planning area? • Do any of the alternatives disproportionately and adversely impact minority, low income, or Tribal populations?
Recreation	<ul style="list-style-type: none"> • How would changing the eligibility of lands for oil and gas leasing change recreation opportunities and experiences?
Travel and Transportation	<ul style="list-style-type: none"> • How would open and closed fluid mineral leasing areas impact OHV routes and OHV areas with use restrictions?
Visual Resources	<ul style="list-style-type: none"> • How would changing the eligibility of lands for oil and gas leasing affect visual resources?
Lands and Realty	<ul style="list-style-type: none"> • How would the alternatives affect land use authorizations on BLM-administered land?

ES.5 PLANNING CRITERIA

Planning criteria are the standards, rules, and guidelines that help guide data collection and alternative formulation and selection in the RMPA development process. In conjunction with the planning issues, planning criteria ensure that the planning process is focused. The criteria also help guide the final plan selection and provide a basis for judging the responsiveness of the planning options. The BLM developed preliminary planning criteria before public scoping meetings to set the sideboards for focused planning of the RMPA and guide decision making by topic. These criteria were introduced to the public for review in July 2022 and at all scoping meetings. The public was encouraged to comment on, and suggest additions to, these criteria at the meetings, through written correspondence, and at the project eplanning website. See **Section I.7** for additional information on planning criteria.

ES.6 MANAGEMENT ALTERNATIVES

The basic goal of developing alternatives is to prepare different combinations of resource uses and protections to address the identified major planning issues, enhance or expand resources or resource uses, and resolve conflicts among resources and resource uses. Alternatives must meet the purpose and need; be reasonable; provide a mix of resource protection, management use, and development; be responsive to the issues; meet the established planning criteria; and meet federal laws, regulations, policies, and standards, including the multiple use mandates of the FLPMA.

Between October 2022 and January 2023, the BLM and cooperating agencies met to discuss management goals and objectives, actions to address the goals, and share feedback, suggestions, and concerns. During this time, the BLM developed one No Action Alternative (Alternative A) and three preliminary action alternatives. The alternatives continued to refine through March 2023 with internal agency and cooperator reviews.

Chapter 2 describes the four alternatives: the No Action Alternative (Alternative A) and three action alternatives, Alternatives B, C, and D. The following sections provide some key components of the alternatives. The action alternatives offer a range of management approaches to conservation of habitat for the following big game species: elk, mule deer, pronghorn, and bighorn sheep. BLM's authority to manage the land or habitat for big game populations involves collaboration with federal and state land management agencies, local government, and other stakeholders. The alternatives contain sets of management actions that reflect differing approaches to big game conservation and oil and gas development, including various combinations of allowable uses, stipulations, and conservation measures.

The primary differences among the alternatives are described below. The goals and objectives of each alternative are met in varying degrees, with the potential for different long-range outcomes and conditions pertaining to the planning issues identified. See **Chapter 3** for a summary of the development scenario and future impacts to big game from each alternative.

ES.6.1 Alternative A: No Action

Alternative A is the No Action Alternative based on existing approved RMPs, as amended, throughout Colorado. This alternative reflects the management decisions and language retained in existing RMPs (16). The analysis considers how the BLM is currently managing big game habitat protection and oil and gas development across the state, and provides a characterization of the existing environment for comparison with the action alternatives.

ES.6.2 Alternative B

Alternative B, conservation and cooperation, is based on management alignment with the ECMC's rules for oil and gas development in elk, mule deer, pronghorn, and bighorn sheep HPH (Rule 1202.c, d; Rule 1203). Where lands are open to oil and gas leasing under existing RMPs, Alternative B prescribes measures consistent with the ECMC rules to conserve seasonal habitats and connectivity within big game HPH in support of CPW's big game population objectives. Alternative B incorporates various oil and gas lease stipulations, including a CSU density limitation of one pad per square mile and less than one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. The plan would require operators to develop and implement mitigation plans to minimize and offset direct and indirect impacts. Under this alternative, BLM may approve waivers, exceptions, and modifications to stipulations in some circumstances.

Alternative B also incorporates adaptive management based on new information and best available science. This alternative would include a density trigger (proposed development of greater than 1 location/sq mile) that would require the operator to address indirect impacts through compensatory mitigation. Where determined appropriate at implementation, avoiding activities in HPH, applying a surface density limitation, and mitigating impacts could limit the duration and extent of development activities in big game HPH through all phases of development. Mitigation plans would address direct impacts, indirect impacts, and the cumulative effects of oil and gas activities on big game populations and their CPW-mapped big game HPH.

ES.6.3 Alternative C

Alternative C is similar to Alternative B, in that it incorporates lease stipulations that align the BLM's oil and gas management with ECMC's rules for big game HPH in the decision area. This includes similar oil and gas lease stipulations, including a CSU density limitation of one pad per square mile and less than one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. Alternative C also includes a CSU that would prescribe a 3% surface disturbance threshold on oil and gas development within big game HPH on BLM surface lands only. This threshold does not apply to private, local government, or state lands in the decision area.

This alternative gives the BLM greater flexibility to approve waivers, exceptions, and modifications to the stipulations in appropriate circumstances, as compared with Alternative B. Some big game HPH lands that would be subject to the 3% threshold are already subject to such a limitation to protect greater sage-grouse habitat. The overall management objective under this alternative would be to cluster, collocate, and consolidate surface facilities associated with oil and gas development within a 3 percent disturbance threshold, where determined appropriate during implementation. This alternative contemplates the establishment of other density thresholds (specific to big game Data Analysis Units) in coordination with CPW based on best available science in the future.

ES.6.4 Alternative D

Alternative D is similar to Alternative C in that it also incorporates lease stipulations that align the BLM's oil and gas management with ECMC's rules for big game HPH in the decision area. Alternative D includes a CSU density limitation of one pad per square mile and one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. Alternative D also includes a CSU that would prescribe a 3% surface disturbance threshold on oil and gas development within big game HPH, however the application of this threshold is not limited to BLM surface lands only as it is under Alternative C. Under this alternative, the disturbance threshold applies to big game HPH on all lands regardless of land ownership in the decision area.

Additionally, unlike Alternatives B and C, this alternative proposes to reduce the area open to leasing of oil and gas. Under Alternative D, the acreage within big game HPH closed to new oil and gas leasing would increase compared to Alternatives A, B, and C. Specifically, big game HPH areas identified with low, moderate, or no known oil and gas development potential would be closed to new oil and gas leasing. With expanded closure to new oil and gas leasing and more stringent implementation of stipulations, Alternative D prioritizes avoidance of impacts to big game habitat from oil and gas development.

ES.7 ENVIRONMENTAL CONSEQUENCES

The purpose of the environmental consequences analysis in this RMPA/EIS is to determine and disclose the potential for significant impacts of the federal action on the human environment. Council on Environmental Quality regulations for implementing NEPA states that the “human environment” is interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment (40 CFR, Part 1508.14). The “federal action” is the BLM’s selection of an RMPA on which future land use actions will be based for the BLM in Colorado.

Chapter 3 objectively evaluates the likely direct, indirect, and cumulative impacts on the human and natural environment in terms of environmental, social, and economic consequences that are projected to occur from implementing the alternatives. Some types of impacts for resources or resource uses could be confined to BLM-administered lands (such as soil disturbance from oil and gas development), whereas some actions may have off-site/indirect impacts on resources on other land jurisdictions (e.g., private or state lands) overlying federal mineral estate (e.g., requirements to protect resources such as special status species and cultural resources overlying energy and minerals). Some BLM management actions might affect only certain resources and alternatives. The impact analysis identifies both enhancing and improving effects on a resource from a management action, as well as those that have the potential to diminish resource values.

This page intentionally left blank.

TABLE OF CONTENTS

Chapter

Page

EXECUTIVE SUMMARY ES-I

CHAPTER I. INTRODUCTION I-1

1.1	Introduction	I-1
1.2	Purpose of and Need for Action	I-1
1.3	Planning Area and Decision Area	I-2
1.4	Administrative Framework.....	I-4
1.4.1	Planning and Oil and Gas Management Framework.....	I-4
1.4.2	Big Game Policy Framework.....	I-5
1.5	Planning Process.....	I-6
1.6	Public Involvement and Issues Development.....	I-6
1.6.1	Scoping Process.....	I-6
1.6.2	Issue Identification	I-6
1.6.3	Issues Considered but Not Further Analyzed.....	I-9
1.7	Planning Criteria.....	I-9
1.8	Related Plans and Authorities.....	I-10
1.8.1	Local Plans	I-10
1.8.2	State Plans.....	I-11
1.8.3	Federal Plans	I-11
1.8.4	Coordinating Ongoing Planning Efforts.....	I-12

CHAPTER 2. ALTERNATIVES..... 2-1

2.1	Introduction	2-1
2.2	Development of Alternatives.....	2-3
2.3	Alternatives (Conceptual Description)	2-3
2.3.1	Acreeage of Stipulations and Closures by Alternative.....	2-6
2.4	Alternatives Considered But Not Analyzed in Detail.....	2-10
2.4.1	Out of Scope Land Uses (Non-Oil and Gas Management)	2-10
2.4.2	New Protections in Areas with Special Designations (Wilderness Study Areas, Areas of Critical Environmental Concern)	2-11
2.4.3	Prohibit Oil and Gas Leasing Throughout Decision Area (No Leasing)	2-11
2.4.4	Greenhouse Gas Emissions Management and Phased Decline of Oil and Gas Production.....	2-11
2.4.5	Oil and Gas Production Emphasis	2-11
2.5	Management Common to All Action Alternatives and Broad Management Decisions.....	2-12
2.6	Evaluation.....	2-13
2.7	Implementation, Monitoring, and Adaptive Management	2-14
2.7.1	Implementation	2-14
2.7.2	Additional NEPA Reviews and Future Leasing	2-15
2.7.3	Monitoring.....	2-16
2.7.4	Adaptive Management	2-16
2.7.5	Mitigation	2-18
2.8	Detailed Alternatives – Goals, Objectives, Allowable Uses, and Management Actions	2-20
2.9	Summary of Environmental Consequences.....	2-41

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES	3-1
3.1 Introduction	3-1
3.1.1 Cumulative Impacts	3-1
3.2 Physical Environment	3-3
3.2.1 Geology and Fluid Minerals	3-3
3.2.2 Air Quality and Related Values, and Greenhouse Gas Emissions	3-37
3.2.3 Climate	3-53
3.2.4 Noise and Acoustic Environment	3-56
3.2.5 Soil Resources	3-61
3.2.6 Paleontological Resources	3-75
3.3 Biological Resources	3-81
3.3.1 Big Game Species and Habitat	3-81
3.3.2 Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds	3-106
3.3.3 Vegetation	3-125
3.4 Social Systems	3-134
3.4.1 Native American Religious Concerns	3-134
3.4.2 Cultural Resources	3-139
3.4.3 Socioeconomics	3-145
3.4.4 Environmental Justice	3-177
3.4.5 Recreation	3-184
3.4.6 Travel and Transportation	3-195
3.4.7 Visual Resources	3-199
3.4.8 Lands, Realty, and Cadastral Survey	3-205
CHAPTER 4. CONSULTATION, COORDINATION, AND PUBLIC INVOLVEMENT	4-1
4.1 Public Engagement	4-1
4.1.1 Mailing List / List of Recipients of the Draft RMPA/EIS	4-1
4.1.2 Scoping Process	4-2
4.2 Consultation and Coordination	4-3
4.2.1 Federally Recognized Tribes	4-3
4.2.2 Compliance with Federal, State, and Local Laws and Regulations	4-5
4.3 Cooperating Agencies	4-5
4.4 Coordination and Consistency	4-7
4.5 Distribution and Availability of the Draft RMPA/EIS	4-8
4.6 List of Preparers	4-8
CHAPTER 5. REFERENCES	5-1

TABLES		Page
1-1	Decision Area.....	1-3
1-2	Decision Area Lands by County	1-3
1-3	Planning Issue Statements.....	1-7
2-1	Acres Open and Closed to Leasing by Alternative	2-7
2-2	Acres Open to Leasing, Subject to NSO, CSU, and TL Stipulations by Alternative	2-7
2-3	Acres Open to Leasing, Subject to NSO Stipulations by BLM Field Office and Alternative	2-8
2-4	Acres Open to Leasing, Subject to CSU Stipulations by BLM Field Office.....	2-8
2-5	Acres Open to Leasing, Subject to TL Stipulations by BLM Field Office	2-8
2-6	Acres Closed to Leasing by BLM Field Office.....	2-9
2-7	Acres of Stipulations and Closures by Region.....	2-9
2-8	Summary of Alternatives.....	2-21
2-9	Summary of Environmental Consequences.....	2-41
3-1	Cumulative Impacts Analysis Areas by Resource	3-2
3-2	Past, Present, and Reasonably Foreseeable Future Actions	3-2
3-3	Surface Management of the Federal Subsurface Decision Area	3-5
3-4	Oil and Gas Development Potential in the Decision Area.....	3-6
3-5	Oil and Gas Wells by BLM Field Office in the Decision Area	3-6
3-6	Acres Unleased and Acres of Pending and Existing Leases by Status Within the Decision Area by Field Office.....	3-7
3-7	Fluid Mineral Leasing Management and Stipulation Acres and Percentage by Alternative in the Decision Area.....	3-9
3-8	Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative A.....	3-12
3-9	Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative B.....	3-18
3-10	Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative C.....	3-24
3-11	Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative D.....	3-30
3-12	EPA NEI – 2017 and 2020 Annual Emissions – Colorado	3-39
3-13	Ozone Concentrations (2018 – 2022)	3-39
3-14	Annual Nitrogen Deposition (2017 – 2021)	3-40
3-15	Global, U.S., and Colorado GHG Emissions 2015 - 2020 (Mt CO ₂ e/yr)	3-41
3-16	New Federal Oil and Gas Criteria Air Pollutant and Precursor Emissions under Alternatives B and C in Colorado in 2032 by BLM Field Office in Tons/year and Corresponding Percent Change from the No Action Alternative	3-46
3-17	New Federal Oil and Gas criteria Air Pollutant and Precursor Emissions under Alternative D in Colorado in 2032 by BLM Field Office in Tons/year and Corresponding Percent Change from the No Action Alternative	3-47
3-18	Total SC-GHG for New Colorado Federal Oil and Gas GHG Emissions (2025-2050) – Alternative A.....	3-52
3-19	Typical Noise Levels and the Associated Human Perception or Response.....	3-56
3-20	Permitted Noise Levels.....	3-58
3-21	Major Land Resource Areas for the Decision Area.....	3-63
3-22	Acres of Percent Slope in the Decision Area.....	3-64
3-23	Acres of Erosion Hazard Ratings in the Decision Area	3-65
3-24	Acres of Hydrologic Soil Groups in the Decision Area.....	3-65

3-25	Acres of Depth to Bedrock Ranges in the Decision Area.....	3-66
3-26	Existing Oil and Gas Wells and Leasing in the Decision Area by Slope.....	3-66
3-27	Existing Oil and Gas Wells and Leasing in the Decision Area by Erosion Hazard Rating	3-67
3-28	Existing Oil and Gas Wells and Leasing in the Decision Area by Hydrologic Soil Group	3-67
3-29	Existing Oil and Gas Wells and Leasing in the Decision Area by Depth to Bedrock.....	3-67
3-30	Acres of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternative A	3-68
3-31	Acres of Soil Fragility Characteristics Closed to Oil & Gas Facilities in Fluid Mineral by Other Designations for Alternatives A, B, and C	3-69
3-32	Acres of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternatives B and C.....	3-70
3-33	Acres of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternative D.....	3-72
3-34	Acres of Soil Fragility Characteristics Closed to Oil & Gas Facilities in Fluid Mineral by Other Designations for Alternative D	3-72
3-35	PFYC Classifications in the Decision Area by Acres	3-77
3-36	Existing Oil and Gas Wells in the Decision Area by PFYC Classifications.....	3-77
3-37	Acres of PFYC Classification in Oil & Gas Facilities in Areas Subject to Fluid Mineral Leasing Stipulations	3-79
3-38	High Priority Habitat for Big Game Species in Colorado	3-83
3-39	Acres of Big Game HPHs in the Decision Area.....	3-84
3-40	Acres of Additional Big Game Migration and Movement Corridors by BLM Field Office	3-84
3-41:	Acres of CPW Mapped Migration and Movement Corridors Not Currently subject to Open CSU/Open CSU/TL fluid mineral stipulations in the Decision Area	3-85
3-42	Number of Oil and Gas Wells in HPHs in the Decision Area	3-90
3-43	Acres Open to Leasing in Big Game HPH in the Decision Area	3-90
3-44	Acres of Authorized and Pending BLM Oil and Gas Leases in Big Game HPH in the Decision Area.....	3-91
3-45	Miles of Rights-of-way in Big Game HPH in the Decision Area.....	3-92
3-46	Recreation Management Areas Within HPH in the Decision Area	3-92
3-47	Miles of OHV Routes by Designation in HPH in the Decision Area	3-93
3-48	Miles of Recreation Trails Within Big Game HPH in the Decision Area.....	3-94
3-49	Acres and Percentage Closed and Open to Fluid Mineral Leasing by Alternative in Big Game HPH in the Decision Area	3-96
3-50	Fluid Mineral Leasing Stipulation Acres and Percentage by Alternative in Big Game HPH in the Decision Area.....	3-97
3-51	Fluid Mineral Leasing Stipulation Acres and Percentage by Big Game HPH in the Decision Area Under Alternative A	3-97
3-52	Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative B	3-98
3-53	Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative C	3-100
3-54	Anthropogenic Disturbance Within Big Game High Priority Habitat: Alternative C.....	3-101
3-55	Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative D	3-102
3-56	Anthropogenic Disturbance Within Big Game High Priority Habitat: Alternative D.....	3-103
3-57	Priority Bird Species Designated by CPW.....	3-110
3-58	Acres of Greater Sage Grouse Habitat in the Decision Area	3-113
3-59	Acres of Gunnison Sage Grouse Habitat in the Decision Area	3-114
3-60	Federally Listed Species That May Exist in the Decision Area	3-115

3-61	Fluid Mineral Leasing Stipulation Acres by Sage-Grouse Habitat in the Decision Area by Alternative	3-120
3-62	Fluid Mineral Leasing Stipulation Acres by Proposed and Designated Critical Habitat in the Decision Area by Alternative	3-121
3-63	Ecoregions in the Decision Area	3-127
3-64	BLM-Administered Land Within the Big Game HPH for Each County in the Planning Area	3-146
3-65	Field Offices for Associated Counties in the Primary Socioeconomic Analysis Area.....	3-147
3-66	Historical and Projected Population	3-148
3-67	Per Capita Income and Household Income (2021)	3-149
3-68	Average Annual Percentage Unemployment (2012–2022).....	3-149
3-69	Estimated Non-Government Employment in Colorado by Industry (2010–2021)	3-150
3-70	Estimated Earnings in Colorado by Industry, 2010–2021 (2022 Dollars in Thousands).....	3-151
3-71	Employment and Labor Earnings by Sector for the Primary Socioeconomic Analysis Area, as a Percentage of Total for the County (2021).....	3-152
3-72	Labor and Nonlabor Income by County in the Primary Socioeconomic Analysis Area, 2021	3-153
3-73	Estimated BLM-Related PILT Revenue	3-156
3-74	Rents, Royalty, and Bonus Revenue Collected for the Primary Socioeconomic Analysis Area (Fiscal Year 2021).....	3-157
3-75	Number of Producing Federal Oil and Gas Wells by Field Office and Well Type in Colorado (2022).....	3-158
3-76	Total Economic Contributions of Big Game Hunting in Colorado (2017).....	3-160
3-77	Total Hunting Economic Contributions for Primary Socioeconomic Analysis Area	3-160
3-78	Total Economic Contributions of Hunting and Wildlife Watching by Region in Colorado.....	3-161
3-79	Projected Oil and Gas Production for All Alternatives.....	3-164
3-80	Number of Projected Oil and Gas Wells by Alternative.....	3-165
3-81	Percentage of Types of Wells in Each Field Office (2022).....	3-165
3-82	Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative A	3-166
3-83	Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative A.....	3-167
3-84	Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative A, 2025-2050 (\$000)	3-167
3-85	Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative B.....	3-168
3-86	Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative B	3-168
3-87	Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative B, 2025-2050 (\$000)	3-169
3-88	Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative C.....	3-170
3-89	Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative C.....	3-170
3-90	Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative C, 2025-2050 (\$000).....	3-171
3-91	Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative D.....	3-172

3-92	Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative D	3-172
3-93	Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative D, 2025-2050 (\$000).....	3-173
3-94	Populations for EJ Consideration.....	3-179
3-95	Number of Visits to RMAs Overlapping with Big Game HPH	3-185
3-96	RMAs in Big Game Habitat.....	3-187
3-97	Recreation Setting Characteristics in the Decision Area.....	3-189
3-98	National Monuments and National Conservation Areas in the Decision Area	3-190
3-99	Acres Closed and Open to Leasing, Subject to NSO, CSU, and TL Stipulations Under Alternative A.....	3-192
3-100	Comparison of Acres Open to Leasing, Subject to NSO, CSU, and TL Stipulations Under Alternatives A, B, and C	3-193
3-101	Comparison of Acres Closed and Open to Leasing, Subject to NSO Stipulations Under Alternatives A and D	3-194
3-102	OHV Area Designations by Field Office in the Decision Area.....	3-197
3-103	BLM Motorized and Nonmotorized Routes in the Decision Area.....	3-197
3-104	Seasonal Closures in the Decision Area	3-198
3-105	VRM and VRI Classes in the Decision Area by Alternative.....	3-202
4-1	Public Scoping Meetings in 2022	4-2
4-2	Cooperating Agency Participation.....	4-6
4-3	RMP/EIS Preparers.....	4-8

FIGURES *(see Appendix D for most figures)*

1	2022 AEO Oil and Gas Growth Factors – Rocky Mountain Region	3-42
2	BLM Regional Modeling Study – Scenario A – Predicted 2028 Cumulative Ozone Concentrations.....	3-44
3	Eight-Hour Ozone Contributions from New Federal Oil and Gas Development and Operations in Colorado.....	3-48
4	Maximum Predicted Annual Nitrogen Deposition due to Air Pollutant Emissions from New Federal Oil and Gas Sources in Colorado for the BLM Regional Modeling Study 2032 Scenario	3-50
1-1	The Planning and Decision Areas	
1-2	High Priority Habitat in the Planning Area	
1-3	Bighorn Sheep High Priority Habitat in the Planning Area	
1-4	Elk High Priority Habitat in the Planning Area	
1-5	Mule Deer High Priority Habitat in the Planning Area	
1-6	Pronghorn High Priority Habitat in the Planning Area	
1-7	High Priority Habitat in the Planning Area—Northwest	
1-8	High Priority Habitat in the Planning Area—Northeast	
1-9	High Priority Habitat in the Planning Area—Southwest	
1-10	High Priority Habitat in the Planning Area—Southeast	
2-1	Alternatives A, B, and C: Closed to Fluid Mineral Leasing	
2-2	Alternative D: Closed to Fluid Mineral Leasing	
2-3	Alternative A: No Surface Occupancy	
2-4	Alternative B: No Surface Occupancy	

2-5	Alternative C: No Surface Occupancy
2-6	Alternative D: No Surface Occupancy
2-7	Alternative A: Controlled Surface Use
2-8	Alternative B: Controlled Surface Use
2-9	Alternative C: Controlled Surface Use
2-10	Alternative D: Controlled Surface Use
2-11	Alternative A: Timing Limitations
2-12	Alternative B: Timing Limitations
2-13	Alternative C: Timing Limitations
2-14	Alternative D: Timing Limitations
2-15	Alternatives A, B, and C: 2015 Greater Sage-grouse and Closed to Fluid Mineral Leasing
2-16	Alternative D: 2015 Greater Sage-grouse and Closed to Fluid Mineral Leasing
2-17	Alternative A: 2015 Greater Sage-grouse and No Surface Occupancy
2-18	Alternative B: 2015 Greater Sage-grouse and No Surface Occupancy
2-19	Alternative C: 2015 Greater Sage-grouse and No Surface Occupancy
2-20	Alternative D: 2015 Greater Sage-grouse and No Surface Occupancy
2-21	Alternative A: 2015 Greater Sage-grouse and Controlled Surface Use
2-22	Alternative B: 2015 Greater Sage-grouse and Controlled Surface Use
2-23	Alternative C: 2015 Greater Sage-grouse and Controlled Surface Use
2-24	Alternative D: 2015 Greater Sage-grouse and Controlled Surface Use
2-25	Alternative A: 2015 Greater Sage-grouse and Timing Limitations
2-26	Alternative B: 2015 Greater Sage-grouse and Timing Limitations
2-27	Alternative C: 2015 Greater Sage-grouse and Timing Limitations
2-28	Alternative D: 2015 Greater Sage-grouse and Timing Limitations
2-29	Alternative A: 2019 Greater Sage-grouse Stipulations
2-30	Alternatives A, B, and C: 2019 Greater Sage-grouse Stipulations and Closed to Fluid Mineral Leasing
2-31	Alternative D: 2019 Greater Sage-grouse Stipulations and Closed to Fluid Mineral Leasing
2-32	Alternative A: 2019 Greater Sage-grouse Stipulations and No Surface Occupancy
2-33	Alternative B: 2019 Greater Sage-grouse Stipulations and No Surface Occupancy
2-34	Alternative C: 2019 Greater Sage-grouse Stipulations and No Surface Occupancy
2-35	Alternative D: 2019 Greater Sage-grouse Stipulations and No Surface Occupancy
2-36	Alternative A: 2019 Greater Sage-grouse Stipulations and Controlled Surface Use
2-37	Alternative B: 2019 Greater Sage-grouse Stipulations and Controlled Surface Use
2-38	Alternative C: 2019 Greater Sage-grouse Stipulations and Controlled Surface Use
2-39	Alternative D: 2019 Greater Sage-grouse Stipulations and Controlled Surface Use
2-40	Alternative A: 2019 Greater Sage-grouse Stipulations and Timing Limitations
2-41	Alternative B: 2019 Greater Sage-grouse Stipulations and Timing Limitations
2-42	Alternative C: 2019 Greater Sage-grouse Stipulations and Timing Limitations
2-43	Alternative D: 2019 Greater Sage-grouse Stipulations and Timing Limitations
2-44	Alternatives A to B: Change in Fluid Mineral Leasing Stipulations
2-45	Alternatives A to C: Change in Fluid Mineral Leasing Stipulations
2-46	Alternatives A to D: Change in Fluid Mineral Leasing Stipulations
2-47	Alternatives A, B, and C: Closed to Fluid Mineral Leasing —Northwest
2-48	Alternative D: Closed to Fluid Mineral Leasing —Northwest
2-49	Alternative A: No Surface Occupancy—Northwest
2-50	Alternative B: No Surface Occupancy—Northwest
2-51	Alternative C: No Surface Occupancy—Northwest
2-52	Alternative D: No Surface Occupancy—Northwest
2-53	Alternative A: Controlled Surface Use— Northwest

2-54	Alternative B: Controlled Surface Use— Northwest
2-55	Alternative C: Controlled Surface Use— Northwest
2-56	Alternative D: Controlled Surface Use— Northwest
2-57	Alternative A: Timing Limitations— Northwest
2-58	Alternative B: Timing Limitations— Northwest
2-59	Alternative C: Timing Limitations— Northwest
2-60	Alternative D: Timing Limitations— Northwest
2-61	Alternatives A, B, and C: Closed to Fluid Mineral Leasing —Northeast
2-62	Alternative D: Closed to Fluid Mineral Leasing — Northeast
2-63	Alternative A: No Surface Occupancy—Northeast
2-64	Alternative B: No Surface Occupancy— Northeast
2-65	Alternative C: No Surface Occupancy— Northeast
2-66	Alternative D: No Surface Occupancy— Northeast
2-67	Alternative A: Controlled Surface Use— Northeast
2-68	Alternative B: Controlled Surface Use— Northeast
2-69	Alternative C: Controlled Surface Use— Northeast
2-70	Alternative D: Controlled Surface Use— Northeast
2-71	Alternative A: Timing Limitations— Northeast
2-72	Alternative B: Timing Limitations— Northeast
2-73	Alternative C: Timing Limitations— Northeast
2-74	Alternative D: Timing Limitations— Northeast
2-75	Alternatives A, B, and C: Closed to Fluid Mineral Leasing —Southwest
2-76	Alternative D: Closed to Fluid Mineral Leasing — Southwest
2-77	Alternative A: No Surface Occupancy— Southwest
2-78	Alternative B: No Surface Occupancy— Southwest
2-79	Alternative C: No Surface Occupancy— Southwest
2-80	Alternative D: No Surface Occupancy— Southwest
2-81	Alternative A: Controlled Surface Use— Southwest
2-82	Alternative B: Controlled Surface Use— Southwest
2-83	Alternative C: Controlled Surface Use— Southwest
2-84	Alternative D: Controlled Surface Use— Southwest
2-85	Alternative A: Timing Limitations— Southwest
2-86	Alternative B: Timing Limitations— Southwest
2-87	Alternative C: Timing Limitations— Southwest
2-88	Alternative D: Timing Limitations— Southwest
2-89	Alternatives A, B, and C: Closed to Fluid Mineral Leasing —Southeast
2-90	Alternative D: Closed to Fluid Mineral Leasing — Southeast
2-91	Alternative A: No Surface Occupancy— Southeast
2-92	Alternative B: No Surface Occupancy— Southeast
2-93	Alternative C: No Surface Occupancy— Southeast
2-94	Alternative D: No Surface Occupancy— Southeast
2-95	Alternative A: Controlled Surface Use— Southeast
2-96	Alternative B: Controlled Surface Use— Southeast
2-97	Alternative C: Controlled Surface Use— Southeast
2-98	Alternative D: Controlled Surface Use— Southeast
2-99	Alternative A: Timing Limitations— Southeast
2-100	Alternative B: Timing Limitations— Southeast
2-101	Alternative C: Timing Limitations— Southeast
2-102	Alternative D: Timing Limitations— Southeast
2-103	Pinch Points

3-1	Oil and Gas Development Potential
3-2	Leasing Areas in Open and Closed to Fluid Mineral Leasing
3-3	Oil and Gas Wells and Leasing Areas
3-4	Oil and Gas Wells in Relation to Big Game High Priority Habitat
3-5	Roads in Big Game High Priority Habitat
3-6	Soil Orders
3-7	Big Game Migration Corridors
3-8	Sage-grouse Habitat
3-9	Ecoregions
3-10	Primary Socioeconomic Analysis Area
3-11	Projected Population Change (2020-2040)
3-12	Household Income
3-13	Per Capita Income
3-14	Oil and Gas Revenue
3-15	Hunting Economic Output
3-16	Low-income Populations for Environmental Justice Consideration
3-17	Minority Populations for Environmental Justice Consideration
3-18	Recreation
3-19	Existing Off-highway Vehicle Areas
3-20	Visual Resource Management
3-21	Visual Resources Inventory Scenic Quality
3-22	Authorized Rights-of-Way

APPENDICES

A	List of Acronyms
B	Glossary
C	Index
D	Figures
E	Restrictions Applicable to Oil and Gas Fluid Minerals Leasing, Lease Stipulation with Exception, Modification, and Waiver Criteria
F	COGCC Implementation Methods for Oil and Gas Permitting
G	Methodology for Calculating 3% Disturbance Threshold for Alternative C
H	Methodology for Calculating 3% Disturbance Threshold for Alternative D
I	Air Resources Technical Support Document
J	Federally Listed Plant Species that May Occur in the Decision Area
K	List of Noxious and Invasive Weed Species that May Occur in the Decision Area
L	Density and Disturbance Calculations
M	Complete Socioeconomics Indicators by Counties Tables
N	Environmental Justice Supporting Information

This page intentionally left blank.

Chapter I. Introduction

I.1 INTRODUCTION

In accordance with the National Environmental Policy Act (NEPA), the Bureau of Land Management (BLM) Colorado State Office has prepared this resource management plan amendment (RMPA) and environmental impact statement (EIS) to consider amending BLM's resource management plans (RMP) in Colorado to include additional measures to promote big game habitat conservation. Specifically, the BLM has developed this EIS to evaluate land use planning decisions to allocate areas as open or closed to oil and gas leasing, incorporate oil and gas lease stipulations (including major and moderate restrictions), and adopt other plan components to enhance protection for important habitat areas for elk, mule deer, pronghorn, and bighorn sheep (Rocky Mountain and Desert). Big game high priority habitat (HPH) areas for these species include migration and movement corridors, production areas, severe winter range, winter concentration areas, and winter range, depending on the species (See **Table 3-29** for definitions of big game HPH types). This decision that results from this document will provide direction for managing public lands and Federal mineral estate in Colorado under the decision-making authority of the BLM. This document analyzes the environmental effects that could result from implementing each of the planning alternatives considered. The affected lands in the planning area are currently managed under 16 separate land use plans.

BLM will decide whether to amend one or more of its existing RMPs to include new or modified oil and gas management decisions. Planning-scale oil and gas management decisions include:

- Moderate constraints, such as timing limitations and controlled surface use restrictions
- Major constraints, such as no surface occupancy restrictions
- Closures of areas to future oil and gas leasing

This RMPA process will not affect planning decisions related to renewable energy, recreation, locatable minerals (such as gold, silver, and copper), salable minerals (such as sand and gravel), or other non-oil-and-gas leasable minerals. In addition, this RMPA process will not diminish valid and existing rights, although development of existing oil and gas leases would be required to conform with the objectives of new planning decisions to the extent consistent with the applicable lease terms. Consistent with the Draft RMP Amendment's objective outlined in Section 2.8, the intent of the RMPA process is to identify and consider management that will avoid, minimize, and mitigate oil and gas impacts to HPH for elk, mule deer, pronghorn, and bighorn sheep.

I.2 PURPOSE OF AND NEED FOR ACTION

The purpose of this RMPA process is to evaluate alternative approaches for oil and gas planning decisions to maintain, conserve, and protect big game corridors and other big game HPH on BLM-administered lands and Federal mineral estate in Colorado. This draft RMPA/EIS establishes goals, objectives, and needs to address conflicts or issues related to oil and gas development and big game HPH. Under the authority of Section 202 of the Federal Land Policy and Management Act of 1976 (FLPMA), the BLM also seeks to evaluate consistency with plans or policies and programs of other Federal agencies, State and local governments, and Tribes, to the extent consistent with Federal laws, regulations, policies and programs applicable to BLM-administered lands.

This RMPA process will consider current big game population and habitat data and evaluate planning alternatives' consistency with the policies and programs of State agencies that manage big game populations and regulate oil and gas operations in Colorado – Colorado Parks and Wildlife (CPW) and the Colorado Energy and Carbon Management Commission (ECMC). CPW manages wildlife in Colorado, and the ECMC regulates oil and gas development. Senate Bill 19-181 Oil and Gas Act gives the ECMC the authority to promulgate regulations that are protective of human health, safety, welfare, the environment and wildlife resources. The ECMC 1200 series rules identify certain big game habitats where oil and gas operations are subject to specific ECMC requirements. CPW's consultation role within the ECMC requirements for HPH is intended to avoid, minimize, and mitigate impacts to big game habitats.

Therefore, this action is needed to ensure the BLM fulfills its responsibilities under FLPMA by considering current big game population and habitat data and evaluating management consistency with plans, policies, and programs of other Federal agencies, State and local governments, and Tribes, to the extent consistent with Federal laws, regulations, policies and programs applicable to BLM-administered lands. This RMPA process also complies with the terms of the settlement agreement in *State of Colorado v. Bureau of Land Management* (U.S. District Court for Colorado, 1:21-cv-00129).

Colorado's iconic big game species, including bighorn sheep, elk, mule deer, and pronghorn, are important to natural systems, hunting and wildlife viewing enthusiasts, and local economies. Some big game species and local populations, including elk and mule deer, have suffered declines in recent decades. Anthropogenic activities and development infrastructure can alter wildlife habitat use and behavior where animals may be forced to relocate from high quality habitat areas to lower quality areas, experience greater energy expenditures from frequent flight responses and increased vigilance, or shift their behaviors (e.g., foraging, reproduction, etc.) to avoid time periods of high human activity. Activities related to oil and gas development and operations may reduce the amount of habitat available to wildlife, which can lead to changes in animal physiology, reproduction, survival, and population trends. The BLM will consider alternative management approaches to minimize oil and gas disturbance to priority big game habitat and improve conservation of elk, mule deer, pronghorn, and bighorn sheep priority habitat.

I.3 PLANNING AREA AND DECISION AREA

The planning area includes all 64 counties in Colorado and encompasses approximately 8.3 million acres of BLM-administered surface land and approximately 27 million acres of Federal mineral estate. Federal mineral estate includes areas with federal minerals underlying federal surface land and Federal mineral split estate (federal minerals underlying surface land with nonfederal ownership [private, local, State]) (**Figure I-1, Appendix D**, The Planning and Decision Areas). Approximately 6.17 million acres of big game HPH are on BLM-administered surface land in Colorado, and 15.94 million acres of big game HPH comprise the footprint on Federal mineral estate (**Figures I-2 through I-10, Appendix D**).

The decision area includes all 8.3 million acres of BLM-administered surface land (except where Federal minerals have been withdrawn from mineral leasing) plus approximately 4.7 million acres of nonfederal surface estate with subsurface federal mineral split estate (**Table I-1** and **Table I-2**). Note that the decision area excludes National Forest System land and other federal land where the BLM does not make planning decisions about oil and gas management or other uses. For example, to lease minerals beneath surface lands administered by the Forest Service, the BLM must receive consent to lease from the Forest Service. The BLM typically applies the requirements established by other federal land managers when leasing the associated mineral estate; while such lands are within the planning area, they are outside the decision area for this RMPA.

Table I-1. Decision Area

Lands Affected by this Plan	Acres
BLM-administered surface estate and mineral estate	8,317,000
BLM-administered mineral estate with nonfederal surface estate	4,693,000
BLM-administered surface estate with no BLM-administered subsurface mineral estate	117,691
Total decision area	13,010,000

Source: BLM GIS 2022

Table I-2. Decision Area Lands by County

County	Acres¹
Adams County	3,000
Alamosa County	52,000
Arapahoe County	11,000
Archuleta County	30,000
Baca County	94,000
Bent County	127,000
Boulder County	16,000
Broomfield County*	0
Chaffee County	78,000
Cheyenne County	4,000
Clear Creek County	4,000
Conejos County	207,000
Costilla County	1,000
Crowley County	31,000
Custer County	97,000
Delta County	289,000
Denver County	0
Dolores County	183,000
Douglas County	4,000
Eagle County	324,000
El Paso County	20,000
Elbert County	9,000
Fremont County	498,000
Garfield County	841,000
Gilpin County	9,000
Grand County	246,000
Gunnison County	544,000
Hinsdale County	129,000
Huerfano County	205,000
Jackson County	317,000
Jefferson County	26,000
Kiowa County	20,000
Kit Carson County	21,000
La Plata County	76,000
Lake County	21,000
Larimer County	89,000
Las Animas County	711,000
Lincoln County	21,000
Logan County	19,000
Mesa County	1,122,000
Mineral County	4,000

County	Acres¹
Moffat County	1,978,000
Montezuma County	264,000
Montrose County	718,000
Morgan County	27,000
Otero County	98,000
Ouray County	53,000
Park County	344,000
Phillips County	7,000
Pitkin County	46,000
Prowers County	44,000
Pueblo County	120,000
Rio Blanco County	1,379,000
Rio Grande County	74,000
Routt County	280,000
Saguache County	424,000
San Juan County	46,000
San Miguel County	416,000
Sedgwick County	2,000
Summit County	14,000
Teller County	51,000
Washington County	23,000
Weld County	47,000
Yuma County	53,000
Total	13,011,000*

Source: BLM GIS 2022

¹ Acres are rounded.

I.4 ADMINISTRATIVE FRAMEWORK

I.4.1 Planning and Oil and Gas Management Framework

The Mineral Leasing Act of 1920, as amended, gives the Secretary responsibility for oil and gas leasing on about 564 million acres of federal lands managed by the BLM, Forest Service, and other federal agencies, as well as state and private surface lands where mineral rights have been retained by the federal government. BLM’s management of federal oil and gas development includes planning decisions about lands open to oil and gas leasing, issuance of leases, permitting geophysical exploration (on or off-lease), approving applications from companies to explore, develop, and produce oil and gas resources on both federal and Native American lands, and granting rights-of-way (ROWs) for exploration or development. The BLM also conducts inspection and enforcement of oil and gas activities, including geophysical exploration, development (pad and facilities construction, well drilling/completions/production), and reclamation, to ensure that lessees and operators comply with the lease requirements and BLM’s regulations.

FLPMA states that the Secretary “shall, with public involvement...develop, maintain, and when appropriate, revise land use plans” (43 USC §1712[a]). FLPMA also declares the policy of the U.S. concerning the management of federally owned land, including lands administered by the BLM. Key to this management policy is the direction that the agency “shall manage the public lands under principles of multiple use and sustained yield, in accordance with the [developed] land use plans” (43 USC 35§732[a]). The commitment to multiple use does not mean that all land will be open for all uses. Some uses may be excluded on some land to protect specific resource values or uses, as directed by FLPMA (43 USC 35§1712[c][3]). Such exclusions are based on laws or regulations or determined through a planning process. FLPMA also directs the BLM to coordinate land use planning with the planning and management of other federal departments

and agencies, state, and local governments, and American Indian tribes. This coordination however, is limited “to the extent [the planning and management of other organizations remains] consistent with the laws governing the administration of the public lands” (43 USC 35§1712[c][9]).

The land use planning process identifies the manner in which Federal public lands are managed at the landscape scale and, when suitable for planning decisions, the site-specific scale. The process requires coordination with local, State, and Tribal governments; the general public; local user groups; and various industries. Through the land use planning process for oil and gas management, the BLM determines which lands are eligible for oil and gas leasing, and identifies stipulations that can be applied to future oil and gas leases to protect resource values and other resource uses.

In addition to these laws, management of public land and resources is authorized and directed through other resource-specific and resource use-specific statutes, regulations, and executive orders. The Department and BLM provide further procedural direction through agency guidance documents such as Instruction Memoranda (IM), Information Bulletins (IB), manuals, and handbooks.

1.4.2 Big Game Policy Framework

Several Federal and State policies guide management of big game species and their habitat. Secretarial Order 3356, “Hunting, Fishing, Recreational Shooting, and Wildlife Conservation Opportunities and Coordination with States, Tribes, and Territories” (September 15, 2017), directs agencies to collaborate with state, Tribal, and territorial fish and wildlife agencies to attain or sustain wildlife population goals during land use planning, and provides other direction. Additionally, Secretarial Order 3362, “Improving Habitat Quality in Western Big Game Winter Range and Migration Corridors” (February 9, 2018), focuses on conserving, enhancing, restoring, or improving the condition of priority big game winter range and migration corridor habitat. The order directs the BLM to work with State, tribal, and territorial fish and wildlife agencies to enhance and improve habitat connectivity of federal lands administered by the department.

In 2019, the Governor of Colorado signed Executive Order D 2019-011, “Conserving Colorado’s Big Game Winter Range and Migration Corridors.” In 2020, Colorado Parks and Wildlife updated its action plan for implementation of Secretarial Order 3362. In 2021, the Department of Natural Resources released a report titled, “Opportunities to Improve Sensitive Habitat and Movement Route Connectivity for Colorado’s Big Game Species,” which guides Colorado Parks and Wildlife and the Energy and Carbon Management Commission (ECMC) (formerly known as the Colorado Oil and Gas Conservation Commission, COGCC) to work with federal land management agencies to incorporate wildlife recommendations into federal planning decisions.

In May 2020, Colorado Parks and Wildlife released a report (CPW 2020 Status Report) concluding that big game species are impacted by energy development and other anthropogenic land uses. The report focuses on big game winter habitat and migration corridors, and discusses baseline population and habitat information for mule deer, elk, pronghorn, bighorn sheep, and moose. The State recommends a landscape analysis to better understand measures that may support its big game population priorities. Colorado’s big game species are important to natural systems, hunting and wildlife viewing enthusiasts, and local economies. The 2020 status report identified numerous factors impacting big game including loss, degradation, and fragmentation of big game habitat from residential, commercial, industrial development, recreation, transportation, mining, and energy development including oil, gas, and coal, and renewable energy.

Some populations of big game species in Colorado, including elk and mule deer, have suffered declines in recent decades. Anthropogenic activities, including oil and gas and other development, can alter wildlife

habitat quality and patterns of use. Since December 2018, BLM Colorado has deferred offering over 140 oil and gas lease parcels totaling more than 174,600 acres. CPW's consultation role within ECMC regulations and requirements for big game HPH allow it to further evaluate the State's concerns.

I.5 PLANNING PROCESS

The BLM's planning process is guided by its planning regulations in 43 CFR part 1600, the Council on Environmental Quality's (CEQ) regulations implementing the National Environmental Policy Act (NEPA), 40 CFR part 1500, and the Department's NEPA regulations, 43 CFR part 46.

In accordance with FLPMA, the BLM develops resource management plans (RMP), which prescribe the allocation of BLM-administered lands and resources for various uses, along with general future management. The RMP also guides implementation activities, such as site-specific projects and daily operations. Implementation decisions, such as fluid mineral leasing and authorization of subsequent development activities, may require site-specific NEPA analysis of the likely effects of the proposal and potential mitigation.

This RMPA process will evaluate potential amendments to BLM's existing RMPs related to the purpose and need described above. The RMPA process will include publication of a Draft RMPA/EIS, a Proposed RMPA/Final EIS, and an Approved RMPA/Record of Decision (ROD).

I.6 PUBLIC INVOLVEMENT AND ISSUES DEVELOPMENT

Consistent with FLPMA, NEPA, and BLM's policy, the BLM will provide opportunities for the public, various groups, other federal agencies, Tribes, and state and local governments to participate meaningfully and substantively during the preparation of the draft RMPA/EIS. The public involvement process includes the following: public scoping; public outreach via newsletters, news releases, and updates on the eplanning website (<https://go.usa.gov/xzXxY>); consultation with interested Tribes; coordination with cooperating agencies (participating federal, state, and local government agencies), tribal governments, and Resource Advisory Councils; and a period for public review of the Draft RMP/EIS, during which BLM will accept public comment on its draft analysis.

I.6.1 Scoping Process

Public scoping occurs before NEPA analysis begins to inform the BLM's development of the scope of issues and alternatives to be addressed in the RMPA/EIS. The BLM began the scoping process with a Notice of Intent published July 19, 2022 starting a 45-day public scoping period which ended September 2, 2022 (see **Section 4.1** for information about the scoping process).

I.6.2 Issue Identification

Issue identification is the first step of the BLM planning process. A planning issue is a major controversy or dispute regarding management of resources or uses on BLM-administered lands that can be addressed in a variety of ways. Based on internal and external scoping for the RMPA, the BLM preliminarily identified 15 planning issue categories. A planning issue statement was developed for each of the planning issue categories. Each planning issue statement summarizes the related issues and concerns identified during scoping. The planning issue statements are presented in **Table I-3** (Planning Issue Statements). An analysis of the direct, indirect, and cumulative effects associated with each planning issue is included in **Chapter 3**.

Table I-3. Planning Issue Statements

Resource Category	Planning Issues
Physical Environment	
Geology and Fluid Minerals	<ul style="list-style-type: none"> • How would new moderate constraints (timing limitations [TLs] and controlled surface use [CSU] stipulations), and new major constraints (no surface occupancy [NSO] and areas closed to leasing [no leasing, NL]), a three percent disturbance threshold, aligning with ECMC rules (I in 640), and requirements for master development plans and wildlife mitigation plans affect oil and gas development? • How would geophysical exploration activities be affected under the proposed alternatives? • How would new stipulations, conservation measures, and development limitations affect geology? • How would demand for mineral materials be impacted under the proposed alternative?
Air Quality	<ul style="list-style-type: none"> • What are the potential impacts to air pollutant concentrations and air quality related values that could be associated with direct and indirect foreseeable resource activities including upstream, midstream and downstream oil and gas emissions sources for the baseline future scenario (No Action Alternative) compared to the action alternatives? • For the foreseeable future (up to 10 years), at what levels could BLM managed activities and emissions sources potentially affect vegetation and ecosystems in big game habitat areas? • What are the potential differences in cumulative greenhouse gas (GHG) emissions levels and corresponding climate impacts (including social costs) that could be associated with direct and indirect foreseeable oil and gas emissions sources for the baseline future scenario (No Action Alternative) compared to the most restrictive alternative?
Climate	<ul style="list-style-type: none"> • How do the alternatives potentially impact GHGs / climate change (see Air Quality)? What are the impacts to natural resources in the planning area already or predicted to be vulnerable and exacerbated by climate change, especially those resources critical for big game? • How do the alternatives contribute to landscape resiliency, given prolonged and intensifying drought conditions and scarce riparian resources? • How might alternatives affect project level planning, which may interplay with natural events such as wildfire and flooding? Specifically, how can climate change, drought, and novel weather patterns be accounted for within implementation-level oil and gas management? • How will climate variability impact big game populations in the planning area, taking into account foreseeable trends and planned actions in the area? • What are the impacts across alternatives to big game habitat effectiveness when combined with forecasted impacts from climate change in 20 years? • How do the alternatives differ with respect to the cumulative effects of climate change when considered with non-BLM land use activities in the planning area. How does the implementation of conservation actions contribute to cumulative effects on big game and their habitats associated with climate change?

Resource Category	Planning Issues
Noise and Acoustic Environment	<ul style="list-style-type: none"> • How does the closure of lands to fluid mineral leasing in and outside of HPH impact noise associated with drilling and operating wells or transfer stations?
Lands and Realty	<ul style="list-style-type: none"> • How would the alternatives affect land use authorizations on BLM-administered lands?
Soil Resources	<ul style="list-style-type: none"> • What are the impacts of big game on soil quality? • What are the effects to soil quality from the no action and action alternatives?
Biological Resources	
Big Game Species and Habitat	<ul style="list-style-type: none"> • What are the direct and indirect impacts to big game habitat and population trends from the alternatives related to oil and gas? What are the impacts from BLM and neighboring land use activities combined (cumulative disturbance) across alternatives and reasonably foreseeable future actions? • How would new stipulations, conservation measures, and development limitations affect big game species and high priority habitat?
Special Status Species and Other Wildlife, including Terrestrial, Mammals, Fish, Aquatic Species, and Migratory Birds	<ul style="list-style-type: none"> • How would fluid mineral leasing and development under the alternatives impact special status species and their habitat, including Gunnison and greater sage-grouse, Piping Plovers, Least Terns, Bald and Golden Eagles, other raptors, and other special status birds? • How do alternatives contribute to access and conservation goals and objectives for fish and wildlife habitat, and hunting and fishing opportunities? • What are the impacts (including beneficial) towards efforts to stabilize and/or recover other species that are declining and may have conflicts with other management objectives on BLM lands? How are these effects different across alternatives? • How do big game populations and important habitat contribute to habitat for aquatic species and fish populations?
Vegetation	<ul style="list-style-type: none"> • What is the impact to affected vegetation from the alternatives, including potential limitations from oil and gas development? • How do the alternatives contribute to achieving vegetation objectives as it pertains to habitat effectiveness for big game on these vegetation communities? • How would vegetation management intended for wildlife habitat improvement adversely alter lands with potential wilderness character? • How might vegetation be altered in terms of alteration or increase of forage of water supplies for livestock?
Social and Economic Systems	
Native American Religious Concerns	<ul style="list-style-type: none"> • How would each alternative's management of oil and gas affect Native American Tribes' access to sacred sites and traditional gathering areas?
Cultural and Paleontological Resources	<ul style="list-style-type: none"> • How would each alternative affect cultural and paleontological resources across the planning area? Where and how will potential oil and gas development limitations affect cultural resources? • What impact do big game populations have on cultural resources on BLM land in Colorado?

Resource Category	Planning Issues
Socioeconomics and Environmental Justice	<ul style="list-style-type: none"> • What is the economic impact associated with potentially decreased levels of oil and gas development? • How will sustainable development encourage social, environmental, and economic considerations while managing for energy resources? • How will BLM’s management decisions affect the values people and communities enjoy from public lands in the planning area? • Do any of the alternatives disproportionately and adversely impact minority, low income, or Tribal populations?
Recreation	<ul style="list-style-type: none"> • How would changing the eligibility of lands for oil and gas leasing change recreation opportunities and experiences?
Travel and Transportation	<ul style="list-style-type: none"> • How would open and closed fluid mineral leasing areas impact OHV routes and OHV areas with use restrictions?
Visual Resources	<ul style="list-style-type: none"> • How would changing the eligibility of lands for oil and gas leasing affect visual resources?
Lands and Realty	<ul style="list-style-type: none"> • How would the alternatives affect land use authorizations on BLM-administered land?

1.6.3 Issues Considered but Not Further Analyzed

Consistent with the purpose of this action, issues addressed in this RMPA/EIS are those that address impacts from oil and gas exploration, development and production activities in Colorado on big game HPH, and the cumulative effect together with other resource uses within the Planning Area. Scoping comments included several concerns regarding issues that would not be addressed in the RMPA, including administrative/policy issues, implementation issues, issues outside the scope of the RMPA because they are not consistent with the purpose and need for the action, and issues that have already been addressed through other BLM activities. The Scoping Summary Report (BLM 2022a) provides more detail on these issues. Examples of issues or topics not addressed in this RMPA/EIS include, but are not limited to:

- Activities and uses beyond the jurisdiction of the BLM.
- Changing existing laws, policies, and regulations.
- Designation of new special designations, such as new Areas of Critical Environmental Concern (ACECs)
- Change of grazing allotments or forage allocations.
- Change of wild horse and burro management levels.
- Revision to allowable uses or management actions for resources not related to oil and gas activities (e.g., travel management decisions).
- Considering alternative energy sources (wind and solar energy) as substitutes for activities related to oil and gas development.
- Decisions for species other than bighorn sheep, elk, mule deer, and pronghorn.

1.7 PLANNING CRITERIA

Planning criteria are the standards, rules, and guidelines that help guide data collection and alternative formulation and selection in the RMPA development process. In conjunction with the planning issues, planning criteria ensure that the planning process is focused. The criteria also help guide the final plan selection and provide a basis for judging the responsiveness of the planning options. The BLM developed preliminary planning criteria before public scoping meetings to set the sideboards for focused planning of the RMPA and guide decision making by topic. These criteria were introduced to the public for review in July 2022 and at all scoping meetings. The public was encouraged to comment on, and suggest additions to, these

criteria at the meetings, through written correspondence, and at the project eplanning website. The planning criteria are:

- The RMPA and associated environmental analysis will be completed in compliance with FLPMA, NEPA, and other Federal laws, Executive Orders, regulations, and management policies of the BLM;
- All existing land use plan decisions that are not affected by the amendment will remain in effect after issuance of the Record of Decision;
- The RMPA is limited to land use planning decisions specific to oil and gas management as they relate to the conservation of big game species including mule deer, elk, pronghorn, and bighorn sheep, and their High Priority Habitats. These important habitats may include migration and movement corridors, production areas, severe winter range, winter concentration areas, and winter range, depending on the species;
- The BLM will consider the adequacy of big game conservation measures in existing land use plans;
- The analysis in the EIS for the RMPA will consider the effects of the alternatives together with the effects of past and reasonably foreseeable disturbance to big game habitat;
- The BLM will strive for consistency with plans or policies and programs of other Federal agencies, State and Local governments, and Tribes, to the extent those plans, policies, and programs are consistent with the Federal laws, regulations, policies, and programs applicable to public lands;
- The BLM will endeavor to use current scientific information (including inventory and monitoring data) and technologies to determine appropriate management strategies to protect and conserve important habitat;
- Lands within the decision area for the RMPA will be BLM-managed public lands and split-estate lands (federal minerals and private or state-owned surface); and
- The RMPA will not diminish valid existing rights.

Additional planning criteria suggested in public scoping comments included incorporation of adaptive management strategies, use of best available science, implementation of mitigation hierarchy, site-specific planning to better address issues on a smaller scale, and alignment with local and state regulations.

1.8 RELATED PLANS AND AUTHORITIES

The BLM's planning regulations require plans to be consistent with officially approved or adopted resource-related plans of other federal, state, local, and tribal governments, to the extent those plans are consistent with the purposes, policies, and programs of federal laws and regulations applicable to BLM-administered lands. Plans formulated by federal, state, local, and tribal governments related to management of lands and resources have been reviewed and considered as the RMPA/EIS has been developed. The BLM considered the following plans identified by cooperating agencies:

1.8.1 Local Plans

- Arapahoe County Comprehensive Plan
- Eagle County Comprehensive Plan
- Eagle County Safe Passages for Wildlife Plan
- Eagle River Watershed Plan
- Garfield County Federal Lands Natural Resources Coordination Plan and Policies
- Garfield County Master Plan
- Garfield Count Resolution Opposing 30 x 30 Land Initiative
- Mesa County Mineral and Energy Master Plan

- Mesa County RMP
- Moffat County Federal Lands Plan
- Moffat County No Net Loss of Private Lands Resolution
- Moffat County Resolution Opposing 30 x 30 Land Initiative
- Rio Blanco County Local Plan
- San Miguel County Land Use Code
- Routt Master Plan
- Summit County Safe Passages Plan
- Pitkin – Land Use Code for Pitkin County

I.8.2 State Plans

- Colorado Department of Natural Resources and CDOT's Big Game Policy Report for implementing EO D 2019 011, "Opportunities to Improve Sensitive Habitat and Movement Route Connectivity for Colorado's Big Game Species"
- Colorado Habitat Stewardship Act, Colorado's Protect Public Welfare Oil and Gas Operations Senate Bill 19-181
- Colorado Natural Heritage Program
- Colorado Oil and Gas Act
- ECMC's 1200 series rules
- CPW – Energy development and land use best management practice
- Colorado State Wildlife Action Plan
- Colorado's Guide to Planning Trails with Wildlife in Mind
- Colorado's Greenhouse Gas Pollution Reduction Roadmap
- Colorado's State Action Plan for implementing SO 3362 and 3366
- CPW's 2020 Status Report: Big Game Winter Range and Migration Corridors
- CPW's High-Priority Habitat Recommendations to Avoid and Minimize Impacts to Wildlife from Land Use Development in Colorado
- Colorado Herd Management Plans
- CDOT Eastern Slope and Plains Wildlife Prioritization Study (April 2022, Document No: PPS0131221623DEN) CDOT Western Slope Wildlife Prioritization Studie (April 2019, Report No. CDOT-2019-01)

I.8.3 Federal Plans

- Existing BLM Colorado RMPs and RMPs in neighboring states
- Arapaho & Roosevelt National Forests Pawnee National Grassland
- Grand Mesa, Uncompahgre and Gunnison National Forests (under revision)
- Pike and San Isabel National Forests, Cimarron and Comanche National Grasslands
- Rio Grande National Forest (under litigation)
- Rout National Forest
- San Juan National Forest
- White River National Forest

Tribal plans and agreements, such as the Brunot Agreement, were also considered.

I.8.4 Coordinating Ongoing Planning Efforts

In addition to this RMPA, the BLM is also considering several other decisions that could affect analysis or decision-making in this process. Some of these contemporaneous planning efforts will amend existing Resource Management Plans considered in this Draft RMPA/EIS. The BLM will consider any more stringent requirements of another future approved plan where management direction may overlap. The BLM continues to coordinate and consider proposed actions from these other plans for cumulative effects on key issues like big game, other wildlife, fluid minerals, and socioeconomics. Contemporaneous planning efforts include:

- Greater Sage-Grouse Resource Management Plan Amendment
- Gunnison Sage-Grouse Resource Management Plan Amendment
- Eastern Colorado Resource Management Plan Revision
- Supplemental EIS for the Grand Junction and Colorado River Valley Resource Management Plans
- Western Utility-Scale Solar Programmatic EIS
- Uncompahgre Field Office Resource Management Plan Amendment

Chapter 2. Alternatives

2.1 INTRODUCTION

BLM Colorado developed alternatives in this Draft RMPA/EIS to analyze planning approaches for oil and gas management within 8.3 million acres of BLM-managed surface land and approximately 27 million acres of Federal mineral estate. This mineral acreage includes Federal minerals on BLM-managed Federal lands (and excludes National Forest System land and other federal land where the BLM does not make planning decisions about oil and gas management or other uses) and split-estate Federal minerals located under private, local government, and state lands (herein referred to as landowners). The alternatives were developed based on consideration of evolving science, public and cooperator scoping comments, and internal and interagency discussions.

Consistent with its multiple use mission, the BLM must balance management of federal oil and gas resources in Colorado (including 4,712 existing leases totaling 3.7 million acres on BLM-administered lands and mineral estate) with management of other resources, including the conservation of elk, mule deer, pronghorn, bighorn sheep, and their important habitat. As of February 2023, Colorado has approximately 28,356,809 acres of big game HPH, covering approximately 43 percent of the state. The decision area (BLM-administered surface land and split-estate federal minerals) contains 8,645,000 acres of big game HPH (approximately 66 percent of the decision area). Big game seasonal habitats are identified by CPW and vary by the species; however, they are generally defined by the area utilized by a majority of each species for summer, winter, migration, and reproduction, and considering the proportion (density or percentage) of animals in an area relative to overall herd size, the geographic location of animals during the calendar year, and the weather conditions that describe those seasons. CPW wildlife biologists, district wildlife managers, and GIS staff delineate these big game HPH areas based on current observed habitat use, including data sources such as annual big game population counts (ground-based and aerial), GPS and VHF collar data, hunter harvest information, and third party reporting. HPH areas for big game are identified in **Table 3-29** and individual HPH layers are defined in the Glossary (Appendix B)¹. These seasonal habitats do contain overlap and are not geographically distinct. The following big game HPH are considered in this planning effort consistent with current data for these big game HPH layers (see maps in **Appendix D**):

- **Bighorn Sheep** - production areas, corridors, winter range
- **Elk** - production areas, corridors, severe winter range, winter concentration areas
- **Mule deer** - corridors, severe winter range, winter concentration areas
- **Pronghorn** - corridors, winter concentration areas

This chapter details the BLM's planning alternatives—each a combination of potential management actions to meet the purpose and need identified in Section 1.2. Alternatives are not management decisions; rather, they provide reasonable options for BLM to evaluate when making decisions about the management of big game HPH and oil and gas development. The action alternatives presented in this EIS reflect a range of resource use allocations and resource protection measures. All action alternatives are intended to minimize adverse impacts on physical, biological, chemical, and socioeconomic resources while allowing oil and gas development to proceed in areas with fewer resource conflicts, consistent with current laws and BLM

¹ CPW has also identified HPH for non-big game species that are not within the scope of this plan and are not included in the analysis.

policies. The No Action Alternative allows for comparison of current management with the action alternatives, and may not necessarily respond to the purpose and need.

This chapter discusses the alternatives considered, as follows:

- The No Action Alternative, in which the BLM would continue implementing its current land management under the existing resource management plans
- Three action alternatives
- The alternatives considered but eliminated from detailed analysis

Land use planning decisions consist of identifying and clearly defining goals and objectives (desired outcomes) for resources and resource uses, along with allowable uses and management actions necessary to achieve the goals and objectives. These critical determinations guide future land management actions and subsequent site-specific implementation actions to meet multiple use and sustained yield mandates. Goals are broad statements of desired outcomes and are not quantifiable or measurable. Objectives are specific measurable desired conditions or outcomes intended to meet goals. Management objectives identify more specific desired outcomes for resources and resource uses, and should include a measurable or quantifiable component and an established timeframe for achievement, if possible. In this Draft RMPA/EIS, similar and different goals and objectives were established across the action alternatives; the greatest variance among the alternatives is within allowable uses, management actions, and methodology undertaken to achieve objectives.

Allowable uses identify surface lands and federal subsurface oil and gas mineral estate where uses are allowed, including protective measures to meet desired outcomes; some land uses may be excluded in certain areas to protect resource values. For example, protective measures consistent with the mineral rights granted by the lease could restrict the location and timing of disturbance and activities. Allowable uses could be framed by lease stipulations, Conditions of Approval (COAs) developed through the agency's review and environmental analysis of the proposed operations, Notices to Lessees, or regulations. The alternatives consider allowable uses in a range of scenarios: where leases exist and COAs may be applied, where lands are open to new leasing and stipulations applied, or where other land uses may be authorized pursuant to this RMPA/EIS. Some allowable uses and restrictions may be subject to exceptions, waivers, modifications, or suspensions in appropriate circumstances, when consistent with BLM's planning goals and objectives.

Acresages presented in this EIS have been calculated using Geographic Information System (GIS) data provided by the BLM; the results may differ from other documents due to advancement of GIS technology, refinement in the precision of mapping various datasets over time, changes in data, and variations in the selection of data sets utilized for calculations.

The BLM has identified Alternative B as the Preferred Alternative for this planning effort. Identification of a Preferred Alternative in the Draft RMPA/EIS is required and does not constitute a commitment or decision in principle, and there is no requirement to select the Preferred Alternative or any of the separate alternatives presented in this Draft RMPA/EIS as the Proposed RMPA in the Proposed RMPA/Final EIS. The BLM has the discretion to identify any of the alternatives as the Preferred Alternative in the Draft RMPA/EIS. The BLM may select any of the alternatives from the Draft EIS, or a combination of elements from those alternatives (including a modification of the Preferred Alternative) as the Proposed RMPA identified in the Final EIS.

2.2 DEVELOPMENT OF ALTERNATIVES

NEPA directs agencies to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources.” (NEPA Section 102[2][e]). Land use planning and NEPA regulations require the BLM to formulate a reasonable range of alternatives, which means alternatives that meet the purpose and need and are technically and economically feasible (40 CFR Part 1508.1). Through public and internal scoping, BLM identified issues that present opportunities for alternative courses of action, while the purpose and need and planning criteria provide sideboards for determining the reasonableness of possible alternatives.

The planning team used the BLM planning process (outlined in **Section 1.5**, Planning Process) to develop a reasonable range of alternatives for the Draft RMPA/EIS. The BLM complied with NEPA and the CEQ’s implementing regulations at 40 CFR Part 1500 in developing alternatives. Public input received during the scoping process was considered as the BLM identified significant issues and unresolved conflicts deserving of detailed study.

After public and internal scoping, the BLM refined the purpose and need and planning criteria to help frame the development of alternatives. The BLM developed the No Action Alternative (Alternative A) and preliminary action alternatives, which were further refined through internal and cooperating agency review. Between October 2022 and January 2023, the BLM and cooperating agencies met to discuss management goals and objectives and actions to address the goals, and share feedback, suggestions, and concerns. Internal and cooperating agency coordination on components of this Draft RMPA/EIS continues.

The three action alternatives in this Draft RMPA/EIS were designed to produce potential management scenarios that:

- Address the identified major planning issues
- Ensure opportunities to enhance management of big game priority habitat and develop oil and gas resources in a manner that avoids, minimizes, and/or mitigates impacts to big game habitat
- Resolve conflicts among resources and resource uses
- Meet the purpose of and need for the Amendment
- Meet the multiple use mandate of FLPMA

This process shows the diverse ways in which conflicts regarding resources and resource uses might be resolved, and offers the decisionmaker a reasonable range of alternatives from which to make an informed decision.

2.3 ALTERNATIVES (CONCEPTUAL DESCRIPTION)

The three action alternatives (Alternatives B, C, and D) in this Draft RMPA/EIS offer a range of management approaches to conservation of habitat for the following big game species: elk, mule deer, pronghorn, and bighorn sheep. BLM's authority to manage the land or habitat for big game populations involves collaboration with federal and state land management agencies, local government, and other stakeholders. The alternatives contain sets of management actions that reflect differing approaches to big game conservation and oil and gas development, including various combinations of allowable uses, stipulations, and conservation measures.

The action alternatives include management options for the decision area that would modify decisions in the existing BLM Colorado RMPs:

- Northeast Resource Area RMP (1986)
- Royal Gorge Resource Area RMP (1996)
- San Luis Resource Area RMP (1991)
- Gunnison Resource Area RMP (1993)
- Uncompahgre Field Office RMP (2020)
- Colorado River Valley Field Office RMP (2015) and Roan Plateau Amendment (2016)
- Grand Junction Field Office RMP (2015)
- Kremmling RMP (2015)
- Little Snake RMP (2011)
- White River Field Office RMP (1997)
- Tres Rios Field Office RMP (2015)
- Canyons of the Ancients National Monument (NM) RMP (2010)
- Gunnison Gorge National Conservation Area (NCA) RMP (2004).

Alternatives do not propose changes to the following three plans where minerals have been withdrawn from operation of the mining and mineral leasing laws: Browns Canyon NM RMP (2020), Dominguez-Escalante NCA RMP (2017), and McInnis Canyons NCA RMP (2004).

In instances where multiple management plans overlap a single polygon, the most resource protective management prescription would apply. Since this Draft RMPA/EIS addresses management approaches for big game HPH and oil and gas development, some existing RMP decisions that avoid, minimize, or mitigate impacts to one or more of the species within the scope of this effort may be part of one or more action alternatives (as well as the No-Action Alternative). In these instances, the BLM may not need to develop and analyze an additional alternative management prescription.

The primary differences among the alternatives are described below. The goals and objectives of each alternative are met in varying degrees, with the potential for different long-range outcomes and conditions pertaining to the planning issues identified.

Alternative A is the No Action alternative based on existing approved RMPs, as amended, throughout Colorado. This alternative reflects the management decisions in the existing RMPs (16). The analysis considers how the BLM is currently managing big game habitat protection and oil and gas development across the state, and provides a characterization of the existing environment for comparison with the action alternatives (**Figures 2-1, 2-3, 2-7, 2-11, 2-15, 2-17, 2-21, 2-25, 2-29, 2-30, 2-32, 2-36, 2-40, 2-47, 2-49, 2-53, 2-57, 2-61, 2-63, 2-67, 2-71, 2-75, 2-77, 2-81, 2-85, 2-89, 2-91, 2-95, 2-99, Appendix D**). See Chapter 3 for a summary of the development scenario and future impacts to big game habitat under Alternative A.

Alternative B, conservation and cooperation, is based on management alignment with the ECOMC's rules for oil and gas development in elk, mule deer, pronghorn, and bighorn sheep HPH (Rule 1202.c, d; Rule 1203). Where lands are open to oil and gas leasing under existing RMPs, Alternative B prescribes measures consistent with the ECOMC rules to conserve seasonal habitats and connectivity within big game HPH in support of CPW's big game population objectives. Alternative B incorporates various oil and gas lease stipulations, including a CSU density limitation of one pad per

square mile and less than one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. The plan would require operators to develop and implement mitigation plans to minimize and offset direct and indirect impacts. Under this alternative, BLM may approve waivers, exceptions, and modifications to stipulations in some circumstances.

Alternative B also incorporates adaptive management based on new information and best available science. This alternative would include a density trigger (proposed development of greater than 1 location/sq mile) that would require the operator to address indirect impacts through compensatory mitigation. Where determined appropriate at implementation, avoiding activities in HPH, applying a surface density limitation, and mitigating impacts could limit the duration and extent of development activities in big game HPH through all phases of development. Mitigation plans would address direct impacts, indirect impacts, and the cumulative effects of oil and gas activities on big game populations and their CPW-mapped big game HPH (**Figures 2-1, 2-4, 2-8, 2-12, 2-15, 2-18, 2-22, 2-26, 2-30, 2-33, 2-37, 2-41, 2-44, 2-47, 2-50, 2-54, 2-58, 2-61, 2-64, 2-68, 2-72, 2-75, 2-78, 2-82, 2-86, 2-89, 2-92, 2-96, 2-100, Appendix D**).

See Chapter 3 for a summary of the development scenario and future impacts to big game habitat under Alternative B. **Appendix F** contains additional details regarding how these stipulations would be implemented in alignment with ECMC regulations.

Alternative C is similar to Alternative B, in that it incorporates lease stipulations that align the BLM's oil and gas management with ECMC's rules for big game HPH in the decision area. This includes similar oil and gas lease stipulations, including a CSU density limitation of one pad per square mile and less than one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. Alternative C also includes a CSU that would prescribe a 3% surface disturbance threshold on oil and gas development within big game HPH on BLM surface lands only. This threshold does not apply to private, local government, or state lands in the decision area. **Appendix G** explains the methodology for calculating this disturbance threshold for Alternative C.

This alternative gives the BLM greater flexibility to approve waivers, exceptions, and modifications to the stipulations in appropriate circumstances, as compared with Alternative B. Some big game HPH lands that would be subject to the 3% threshold are already subject to such a limitation to protect greater sage-grouse habitat. The overall management objective under this alternative would be to cluster, collocate, and consolidate surface facilities associated with oil and gas development within a 3 percent disturbance threshold, where determined appropriate during implementation. This alternative contemplates the establishment of other density thresholds (specific to big game Data Analysis Units) in coordination with CPW based on best available science in the future (**Figures 2-1, 2-5, 2-9, 2-13, 2-15, 2-19, 2-23, 2-27, 2-30, 2-34, 2-38, 2-42, 2-45, 2-47, 2-51, 2-55, 2-59, 2-61, 2-65, 2-69, 2-73, 2-75, 2-79, 2-83, 2-87, 2-89, 2-93, 2-97, 2-101, Appendix D**). See Chapter 3 for a summary of the development scenario and future impacts to big game habitat under Alternative C.

Alternative D is similar to Alternative C in that it also incorporates lease stipulations that align the BLM's oil and gas management with ECMC's rules for big game HPH in the decision area. Alternative D includes a CSU density limitation of one pad per square mile and one linear mile of oil and gas routes per square mile (640 acres) in big game HPH. Alternative D also includes a CSU that would prescribe a 3% surface disturbance threshold on oil and gas development within big game HPH, however the application of this threshold is not limited to BLM surface lands only as it is under

Alternative C. Under this alternative, the disturbance threshold applies to big game HPH on all lands regardless of land ownership in the decision area. **Appendix H** explains the methodology for calculating this disturbance threshold for Alternative D. Alternative D provides less flexibility for BLM to approve waivers, exceptions, and modifications compared to the other alternatives.

Additionally, unlike Alternatives B and C, this alternative proposes to reduce the area open to leasing of oil and gas. Under Alternative D, the acreage within big game HPH closed to new oil and gas leasing would increase compared to Alternatives A, B, and C. Specifically, big game HPH areas identified with low, moderate, or no known oil and gas development potential would be closed to new oil and gas leasing. Two helium areas identified within the Approved Eastern Colorado Resource Management Plan and Draft Colorado River Valley/Grand Junction Supplemental EIS would remain open to oil and gas leasing under this alternative. While this oil and gas closure does not apply to non-oil and gas fluid minerals, helium, or geothermal, no leasing for oil and gas leasing could also prevent extracting the recoverable helium resource (see Chapter 3). With expanded closure to new oil and gas leasing and more stringent implementation of stipulations, Alternative D prioritizes avoidance of impacts to big game habitat from oil and gas development (**Figures 2-2, 2-6, 2-10, 2-14, 2-16, 2-20, 2-24, 2-28, 2-31, 2-35, 2-39, 2-43, 2-46, 2-48, 2-52, 2-56, 2-60, 2-62, 2-66, 2-70, 2-74, 2-76, 2-80, 2-84, 2-88, 2-90, 2-94, 2-98, 2-102, Appendix D**).

See Chapter 3 for a summary of the development scenario and future impacts to big game habitat under Alternative D, including estimated new oil and gas wells, acres of associated disturbance from well pads, roads and other facilities.

For additional information about the alternatives, see **Section 2.5**, Management Common to All Action Alternatives and Broad Management Decisions, **Section 2.6**, Evaluation, **Section 2.7**, Implementation, Monitoring, and Adaptive Management, and **Section 2.8**, Detailed Alternatives.

2.3.1 Acreage of Stipulations and Closures by Alternative

The number of acres subject to stipulations and closure are presented in the tables below. In some instances, stipulations may overlap. For example, a TL stipulation may occur in an area that is also subject to a CSU stipulation. However, in instances where multiple stipulations of the same type occur, they are not double counted, and in areas where a CSU stipulation overlaps with an NSO stipulation, only the acres of the NSO stipulation are counted, as it is the more restrictive stipulation. **Tables 2-1** and **2-2** below present acres under Alternative A with the decisions from the 2015 and 2019 Greater Sage-Grouse Approved Resource Management Plan Amendments in different columns².

² Both acres are provided due to the injunction on the 2019 Greater Sage-Grouse Approved Resource Management Plan Amendments. The BLM currently implements the 2015 Greater Sage-Grouse Approved Resource Management Plan Amendments while the 2019 amendments are enjoined.

Table 2-1. Acres Open and Closed to Leasing by Alternative

Status	Alternative A: Acres (Percent of Decision Area), 2015 Sage-Grouse Decisions	Alternative A: Acres (Percent of Decision Area), 2019 Sage-Grouse Decisions	Alternative B: Acres (Percent of Decision Area)	Alternative C: Acres (Percent of Decision Area)	Alternative D: Acres (Percent of Decision Area)
Closed to Leasing	1,792,000 (13.8%)	1,462,000 (11.2%)	1,792,000 (13.8%)	1,792,000 (13.8%)	5,726,000 (44%)
Open to Leasing	11,218,000 (86.2%)	11,548,000 (88.8%)	11,218,000 (86.2%)	11,218,000 (86.2%)	7,284,000 (56%)
Total acres	13,010,000 (100%)	13,010,000 (100%)	13,010,000 (100%)	13,010,000 (100%)	13,010,000 (100%)

Table 2-2. Acres Open to Leasing, Subject to NSO, CSU, and TL Stipulations by Alternative

Status	Alternative A: Acres (Percent of Decision Area), 2015 Sage-Grouse Decisions	Alternative A: Acres (Percent of Decision Area), 2019 Sage-Grouse Decisions	Alternative B: Acres (Percent of Decision Area)	Alternative C: Acres (Percent of Decision Area)	Alternative D: Acres (Percent of Decision Area)
Open to leasing subject to NSO	2,706,000 (20.8%)	3,712,000 (28.5%)	2,878,000 (22.1%)	2,878,000 (22.1%)	1,904,000 (14.6%)
Open to leasing subject to CSU	3,407,000 (26.2%)	3,473,000 (26.7%)	8,182,000 (62.9%)	8,182,000 (62.9%)	4,252,000 (32.7%)
Open to leasing subject to TL	6,920,000 (53.2%)	7,149,000 (55.0%)	8,259,000 (63.5%)	8,259,000 (63.5%)	4,532,000 (34.8%)

Table 2-3. Acres Open to Leasing, Subject to NSO Stipulations by BLM Field Office and Alternative

Location	Alternative A	Alternative B	Alternative C	Alternative D
Rocky Mountain District				
Royal Gorge FO	142,000	277,000	277,000	107,000
San Luis Valley FO	27,000	33,000	33,000	13,000
Southwest District				
Gunnison FO	52,000	69,000	69,000	27,000
Tres Rios FO	215,000	222,000	222,000	178,000
Uncompahgre FO	341,000	343,000	343,000	84,000
Northwest District				
Kremmling FO	188,000	191,000	191,000	100,000
Little Snake FO	681,000	681,000	681,000	610,000
White River FO	565,000	565,000	565,000	499,000
Upper Colorado River District				
Colorado River Valley FO	323,000	323,000	323,000	146,000
Grand Junction FO	172,000	173,000	173,000	139,000
Total	2,706,000	2,876,000	2,876,000	3,093,000

Table 2-4. Acres Open to Leasing, Subject to CSU Stipulations by BLM Field Office

Location	Alternative A	Alternative B	Alternative C	Alternative D
Rocky Mountain District				
Royal Gorge FO	31,000	1,174,000	1,174,000	89,000
San Luis Valley FO	0	453,000	453,000	319,000
Southwest District				
Gunnison FO	41,000	750,000	750,000	29,000
Tres Rios FO	527,000	654,000	654,000	509,000
Uncompahgre FO	783,000	821,000	821,000	177,000
Northwest District				
Kremmling FO	0	341,000	341,000	42,000
Little Snake FO	328,000	1,173,000	1,173,000	906,000
White River FO	648,000	1,472,000	1,472,000	499,000
Upper Colorado River District				
Colorado River Valley FO	549,000	603,000	603,000	306,000
Grand Junction FO	501,000	740,000	740,000	536,000
Total	3,408,000	8,180,000	8,180,000	2,669,000

Table 2-5. Acres Open to Leasing, Subject to TL Stipulations by BLM Field Office

Location	Alternative A	Alternative B	Alternative C	Alternative D
Rocky Mountain District				
Royal Gorge FO	1,054,000	1,259,000	1,259,000	191,000
San Luis Valley FO	578,000	586,000	586,000	451,000
Southwest District				
Gunnison FO	9,000	587,000	587,000	0
Tres Rios FO	457,000	597,000	597,000	468,000
Uncompahgre FO	703,000	740,000	740,000	114,000

Location	Alternative A	Alternative B	Alternative C	Alternative D
Northwest District				
Kremmling FO	251,000	422,000	422,000	132,000
Little Snake FO	1,348,000	1,448,000	1,448,000	1,181,000
White River FO	1,635,000	1,636,000	1,636,000	1,503,000
Upper Colorado River District				
Colorado River Valley FO	397,000	467,000	467,000	435,000
Grand Junction FO	488,000	518,000	518,000	715,000
Total	6,920,000	8,260,000	8,260,000	4,862,000

Table 2-6. Acres Closed to Leasing by BLM Field Office

Location	Alternative A	Alternative B	Alternative C	Alternative D
Rocky Mountain District				
Royal Gorge FO	76,000	76,000	76,000	1,164,000
San Luis Valley FO	19,000	19,000	19,000	154,000
Southwest District				
Gunnison FO	0	0	0	722,000
Tres Rios FO	119,000	119,000	119,000	263,000
Uncompahgre FO	220,000	220,000	220,000	865,000
Northwest District				
Kremmling FO	135,000	135,000	135,000	434,000
Little Snake FO	438,000	438,000	438,000	705,000
White River FO	137,000	137,000	137,000	270,000
Upper Colorado River District				
Colorado River Valley FO	138,000	138,000	138,000	435,000
Grand Junction FO	510,000	510,000	510,000	715,000
Total	1,792,000	1,792,000	1,792,000	4,862,000

Table 2-7. Acres of Stipulations and Closures by Region

Location	Major Stipulations (NSO)	Moderate Stipulations (CSU)	Moderate Stipulations (TL)	Closed
Alternative A				
Northwest	1,923,000	1,978,000	4,044,000	1,195,000
Northeast	78,000	30,000	238,000	0
Southwest	641,000	1,399,000	1,810,000	521,000
Southeast	64,000	0	829,000	76,000
Total	2,706,000	3,407,000	6,921,000	1,792,000
Alternative B				
Northwest	1,928,000	4,226,000	4,394,000	1,195,000
Northeast	78,000	322,000	339,000	0
Southwest	673,000	2,755,000	2,573,000	521,000
Southeast	199,000	878,000	953,000	76,000
Total	2,878,000	8,181,000	8,259,000	1,792,000

Location	Major Stipulations (NSO)	Moderate Stipulations (CSU)	Moderate Stipulations (TL)	Closed
Alternative C				
Northwest	1,928,000	4,226,000	4,394,000	1,195,000
Northeast	78,000	322,000	339,000	0
Southwest	673,000	2,755,000	2,573,000	521,000
Southeast	199,000	878,000	953,000	76,000
Total	2,878,000	8,181,000	8,259,000	1,792,000
Alternative D				
Northwest	1,494,000	3,116,000	3,300,000	2,306,000
Northeast	69,000	68,000	92,000	254,000
Southwest	303,000	1,047,000	1,032,000	2,230,000
Southeast	37,000	21,000	107,000	936,000
Total	1,903,000	4,252,000	4,531,000	8,012,000

2.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

An EIS must rigorously explore and objectively evaluate all reasonable alternatives. The BLM may eliminate from detailed analysis an alternative that is not reasonable; does not meet the purpose and need for action; is technically or economically infeasible; is inconsistent with the basic policy objectives for the management of the area; is remote or speculative; is substantially similar to an alternative being considered in detail; or it would have substantially similar effects to an alternative being considered in detail. Public comments received during scoping provided suggestions for alternative methods of achieving the purpose and need for action. Some of these alternatives were outside the scope of the BLM's purpose and need for action in this draft statewide plan amendment, or substantially similar to the alternatives considered in detail.

The BLM's rationale for excluding these additional alternatives from detailed analysis is described below.

2.4.1 Out of Scope Land Uses (Non-Oil and Gas Management)

During the scoping and alternatives development process, a number of individuals and cooperating agencies requested that the BLM consider an alternative that would address other non-oil and gas land uses, such as recreational trail development, renewable energy (e.g. solar farms), and livestock grazing. This recommendation was based on the supposition that there is a correlation between other non-oil and gas land uses and declines in big game populations or significant degradation of high priority habitat on BLM-administered public lands within the decision area. This alternative was considered but eliminated from detailed analysis because under each of the alternatives considered in detail, there would be site specific, targeted opportunities for field offices to consider other land uses during implementation processes.

The CEQ has described reasonable alternatives as "those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable." Applying restrictions to surface use of other land uses beyond oil and gas was considered but eliminated from detail analysis because the purpose of this plan is to evaluate alternative approaches specifically for oil and gas planning decisions. Based on available information, and conditions set forth in the terms of the settlement agreement for the *State of Colorado v. Bureau of Land Management* (District Court of Colorado, 1:21-cv-00129), the BLM did not determine an approach to reasonably restrict other land uses at a statewide level consistent with BLM policy objectives, multiple-use mission, and unique management areas set forth within existing Resource Management Plans in Colorado. This is a statewide plan with an extensive decision area – the BLM's purpose and need for this plan is focused on addressing oil and gas management concerns and restricting other land uses does not meet this purpose.

2.4.2 New Protections in Areas with Special Designations (Wilderness Study Areas, Areas of Critical Environmental Concern)

The BLM received comments recommending that it consider closing routes, setting route density limits, prohibiting new oil and gas leasing, prohibiting new rights-of-way, and adopting other energy development restrictions in special designation areas, such as Areas of Critical Environmental Concern. The BLM did not analyze in detail new special designation protections at a statewide level because the action alternatives already include allocations and actions that protect areas with special designations and lands with wilderness characteristics where there is big game HPH within the decision area, including HPH within existing designations where minerals are not withdrawn from mineral leasing.

2.4.3 Prohibit Oil and Gas Leasing Throughout Decision Area (No Leasing)

An alternative that closes all BLM-administered lands within the decision area to oil and gas leasing was considered and eliminated from further consideration. Alternative D proposes closure of some areas to fluid mineral leasing to further protect resource values. Resource values that can only be protected by prohibiting all fluid mineral leasing throughout the decision area have not been identified. Although greenhouse gas emissions and associated climate change impacts were considered as an issue that could reflect a resource conflict, a full closure to fluid mineral leasing alternative was not carried forward because the BLM has no suitable thresholds or standards to measure and compare the significance of impacts to big game in the planning area related to greenhouse gas emissions under that alternative relative to other alternatives.

Leasing of public lands for fluid mineral exploration and production is authorized and directed by the FLPMA, Mineral Leasing Act of 1920 (as amended), and the Energy Policy Act of 2005 (Public Law 109-58). Section 363 of the Energy Policy Act of 2005 directs field offices to apply the least restrictive lease constraints necessary to protect the resource for which the stipulations apply. The purpose of this plan is to ensure public lands are managed in accordance with the intent of Congress, as stated in the FLPMA, under the principles of multiple-use and sustained yield. Alternatives promoting exclusive use or maximum development, production, or protection of one resource at the expense of another resource or resource use were eliminated from further consideration.

2.4.4 Greenhouse Gas Emissions Management and Phased Decline of Oil and Gas Production

During the scoping process, the BLM received comments to consider a declining rate of production that accommodates lease rights but provides for a phase-out of oil and gas production consistent with or exceeding declining rates of emissions necessary to limit temperature rise to 1.5°C, and specifically to analyze an alternative that would result in net zero emissions from fossil fuels across the state and/or individual field offices by 2030 and a continuing rapid decline curve of fossil fuel development and production thereafter until zero emissions are achieved. This alternative was not analyzed in detail because the range of alternatives already includes major and minor constraints in big game high priority habitat on new leases and Conditions of Approval (COA) for existing leases, where appropriate and subject to valid existing rights. The BLM has no suitable thresholds or standards to measure and compare the significance of impacts related to greenhouse gas emissions under that alternative relative to other alternatives. BLM has not analyzed in detail additional restrictions or limitations on production alone because it does address the conservation of big game high priority habitat in a substantially different way than the action alternatives.

2.4.5 Oil and Gas Production Emphasis

An alternative specifically focused on oil and gas production was considered but eliminated from detailed analysis because it would not meet the purpose of the plan to maintain, conserve, and protect big game

HPH. Full development of oil and gas resources and infrastructure on lands identified as big game HPH would likely result in habitat degradation and fragmentation, which would hinder conservation of the big game species. Therefore, this alternative was not carried forward for analysis. Additionally, oil and gas development is contemplated in the range of alternatives. Goals and objectives in Alternatives B, C, and D allow thoughtful oil and gas development where impacts to big game high priority habitat can be avoided, minimized, or mitigated. These alternatives allow for concentrated development to be authorized in some areas during implementation. Under the action alternatives, leasing and development would still occur subject to the environmental protection afforded by applicable laws, BLM policy, and the restrictions set forth in the plan. The No Action Alternative represents the most extensive development scenario among the alternatives analyzed.

[Note: The BLM anticipates updating this section following internal and cooperating review of draft alternatives and the draft RMPA/EIS].

2.5 MANAGEMENT COMMON TO ALL ACTION ALTERNATIVES AND BROAD MANAGEMENT DECISIONS

The action alternatives all contain oil and gas management measures that align with ECMC's rules containing land use recommendations for big game HPH representing the best available science to avoid, minimize, and mitigate impacts to elk, mule deer, pronghorn, and bighorn sheep (Rule 1202.c, d; Rule 1203). Under all action alternatives, the following stipulations would apply in CPW mapped big game HPH throughout the decision area as specified below.

- **Allowable Use: Stipulation NSO (Bighorn Sheep Production Areas):** Prohibit surface occupancy and use and apply restrictions within bighorn sheep production areas. This may include special design, construction, and implementation measures, including relocation of proposed facilities and operations by more than 200 meters (656 feet).
- **Allowable Use: Stipulation NSO (HPH):** Prohibit surface occupancy and use within 0.5 -mile of mapped big game migratory highway-crossing "pinch points" in big game HPH and non-highway crossing pinch points are NSO. Apply restrictions to identified big game pinch points mapped as big game HPH (**Figure 2-103, Appendix D, Pinch Points**).
- **Allowable Use: Stipulation CSU (HPH):** Avoid authorizing new oil and gas access roads within HPH where the route density already exceeds 1 linear mile per square mile, and avoid authorizing new oil and gas facility locations within HPH that would cause the density of such locations to exceed 1 location per square mile. Additions of new access roads or oil and gas facility locations within big game HPH that would cause the combined route density in a proposed project's zone of influence to exceed 1 linear mile per square mile, or the location density to exceed 1 location per square mile, will require a CPW and BLM-approved wildlife mitigation plan (WMP) that addresses both direct and indirect functional habitat loss and offsets unavoidable adverse impacts to the affected big game herd.
- **Allowable Use: Stipulation CSU (HPH):** Avoid authorizing new oil and gas facility locations within HPH big game habitats that cause the density of oil and gas locations to exceed 1 per square mile or that contribute to increased density beyond 1 active oil and gas location per square mile.

- **Allowable Use: Stipulation TL (HPH):** Prohibit authorized surface-disturbing and disruptive activities during the following time period(s) in the identified big game HPH:
 - Elk and mule deer severe winter range and winter concentration areas - December 1 to April 30;
 - Pronghorn winter concentration areas - January 1 to April 30;
 - Bighorn sheep winter range - November 1 to April 30;
 - Elk production (calving) areas - May 15 to June 30;
 - Bighorn sheep production areas - Rocky Mountain bighorn sheep April 15 - June 30, Desert bighorn sheep February 1 to May 1.

Refer to **Appendix E** for the full stipulation language. This chapter contains summaries consistent with CPW's land use recommendations.

Refer to **Section 2.8** for additional management common to Alternatives B, C, and D.

2.6 EVALUATION

This RMPA and monitoring data will be evaluated periodically to determine if BLM is making progress toward or meeting management objectives. Evaluation is the process of reviewing the RMPA and determining whether decisions are still appropriate and whether the RMPA is being adequately implemented. Specifically, plans are evaluated to determine if: (1) decisions remain relevant to current issues, (2) decisions are effective in achieving (or making progress toward achieving) desired outcomes, including whether mitigation is satisfactory, (3) whether decisions need to be maintained or amended, dropped from further consideration, and (4) any areas that require new decisions. New decisions and analysis may be appropriate to respond to new circumstances or information, such as significant changes in related plans of other entities or new data, among other factors.

During the plan evaluation process, the BLM will assess each planning area in Colorado relative to the decisions in the approved RMPA. Evaluations would follow the protocols established by the BLM Land Use Planning Handbook (H-1601-1, BLM 2005a), DOI Adaptive Management Guidance (including Williams et. al 2009, Adaptive Management: The U.S. Department of the Interior Guide and Adamcik et al. 2004, Writing Refuge Management Goals and Objectives: A Handbook. US Fish and Wildlife Service), and other appropriate guidance in effect at the time the evaluation is initiated. Data collected as part of the RMPA implementation process may help to inform the plan evaluation. The BLM Land Use Planning Handbook (H-1601-1; BLM 2005a) directs the evaluation of an RMP at least every five years.

This RMPA will, as appropriate, consider indigenous knowledge, density and disturbance calculations, reasonably foreseeable oil and gas development projections, and other new information. Plan evaluations will consider indigenous knowledge that may arise during implementation of this RMPA, per any consent obtained from the Tribe(s). In such cases, indigenous knowledge should guide the metrics of this component of the evaluation.

Through the evaluation process, the BLM will determine whether plan maintenance or amendment is warranted. Maintenance cannot change where or how the BLM would apply approved management decisions or change terms of RMPA decisions, and maintenance shall not result in expansion of scope of resource use or restrictions.

2.7 IMPLEMENTATION, MONITORING, AND ADAPTIVE MANAGEMENT

2.7.1 Implementation

Plan implementation is a continuous and active process. Planning decisions go into effect upon signature of the Record of Decision and Approved RMPA. These include decisions such as the allocation of lands as open or closed to oil and gas leasing. Planning decisions require no additional analysis and provide the framework for any subsequent activities proposed in the planning area. All future authorizations must conform to the Approved RMPA (43 CFR 1610.5-3(a)). Further, the Authorized Officer is required to make operations and activities under existing permits conform to the Approved RMPA within a reasonable period of time, subject to valid existing rights (43 CFR 1610.5-3(b)).

As part of implementation, the BLM will collaborate with CPW and other agency experts (see **Section 2.6** for information about evaluations), assist strategic implementation, and review plan progress. This effort will further address monitoring, mitigation, projects, and activities to achieve the goals and objectives of the plan during implementation. Priorities for implementation will be based on current and projected resource needs and demands, the most current BLM program policy, and national, state, Tribal, and community priorities. Additionally, technical experts may compile, maintain, and analyze new data about landscape disturbance/density information in big game HPH to assist project-level reviews and assessments during implementation of the plan. During implementation, the BLM will compare existing or updated reasonably foreseeable oil and gas development projections for the state with the predicted future development analyzed in the most recent BLM or interagency air impacts analysis. The BLM will use the projected development and emissions data to determine whether the air resource modeling analysis remains appropriate as a reference for subsequent project-specific analyses. Reclamation data for existing locations would be included once available.

The BLM will continue to work cooperatively with CPW in accordance with current and any future Memorandums of Understanding, Instruction Memorandums, latest BLM policy, and Goals and Objectives retained from approved RMPs. The BLM will collaborate with CPW to address big game goals and objectives during land management planning and implementation, specifically to achieve population objectives and improve habitat quality and condition. Cooperation during planning and in leasing federal minerals is essential to applying appropriate stipulations that avoid, minimize, and mitigate impacts to big game resources while allowing for efficient oil and gas development. Combined review of proposed lease parcels ensures CPW has the opportunity to provide input on wildlife stipulations, conservation measures, and other issues related to leasing and development. The BLM will continue to cooperate on site-specific oil and gas development proposals, such as through BLM's APD approval process, for the purpose of identifying, avoiding, minimizing, and where necessary, mitigating wildlife impacts. In addition to meaningful Tribal consultation, as part of this implementation plan, the BLM will engage in efforts to include Indigenous Knowledge and collaborate with Tribal Nations and Indigenous Peoples. This means the BLM will pursue inclusion of Indigenous Knowledge and include Indigenous Knowledge in implementation-level decisions for this RMPA, including early and sustained engagement to ensure that Indigenous Knowledge shared with the agency is considered throughout, consistent with the expectations of the applicable Tribal Nations and Indigenous Peoples to facilitate interagency information sharing which may enhance practices for including Indigenous Knowledge. The BLM will respect that Tribes and Indigenous Peoples may have different preferences for their involvement or how information is shared for BLM's consideration.

During implementation of this plan, the BLM will coordinate a technical team to further cooperation during the implementation phase. This team will evaluate current disturbance and density information, when a Data Analysis Unit (DAU) or other scale is reaching a threshold, mitigation, evaluation of how disturbances are

being restored/reclaimed, where technically and legally feasible monitoring and adaptive management such as updates to big game populations or high priority habitat from CPW.

2.7.2 Additional NEPA Reviews and Future Leasing

Implementation actions are typically site-specific activities that entail further NEPA review before approval, such as lease sales, APDs, and ROW applications.

In Colorado, operators that propose to develop Federal oil and gas follow the permitting processes of the BLM and the ECMC. To ensure adequate big game protection and management, the BLM, ECMC, CPW, other pertinent agencies, and leaseholders collaborate to evaluate potential impacts and, as necessary, mitigation. When oil and gas development is proposed, regulatory agencies and landowners often coordinate to ensure that proposals comply with land use plan management decisions; assess alternative locations, if any; analyze potential impacts; and identify conditions of approval (COA) that may be applied. The BLM has discretion to deny approval of a specific APD even though an operator has the right to develop a lease. The site-specific evaluations would be facilitated by the programmatic analysis of impacts disclosed in the Final EIS.

The BLM has the discretion to modify surface operations to change or add specific mitigation measures when supported by scientific analysis and consistent with existing rights. All mitigation/conservation measures not already required as stipulations would be analyzed in a site-specific NEPA document, and incorporated, as appropriate, as conditions of approval of the permit, plan of development, or other use authorization. In discussing surface use rights, 43 CFR 3101.1-2 states that the lessee has the right “to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource.” However, lessees are subject to lease stipulations, nondiscretionary statutes, and “such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed.”

Lessees are required to conduct operations in a manner that not only “results in maximum ultimate economic recovery of oil and gas with minimum waste” but also “protects other natural resources and environmental quality” (43 CFR 3162.1). The BLM may require relocation of proposed operations by more than 660 feet (200 meters) and may prohibit surface disturbing operations for more than 60 days when supported by a site-specific NEPA analysis, to minimize adverse impacts to other resource values, land uses, or users (43 CFR 3101.1-2). New lease stipulations resulting from the ROD and approved RMPA could be applied to other oil and gas related authorizations (i.e., other than oil and gas leases, such as ROWs) as COAs to maintain or achieve desired resource conditions. Also, BLM may direct or grant requests for suspension of operations and/or production to promote the conservation of resources (43 CFR 3103.4-4).

Decisions implementing the existing RMPs have established valid existing rights or other obligations that are important considerations in preparing the RMPA. For example, in some BLM field office planning areas, many of the oil and gas resources are already leased. The presence of these valid existing rights influences, and sometimes limits, management choices. Specific to the oil and gas program, the alternatives in this Draft RMPA/EIS would apply to RMPs and activity level decisions that are not yet implemented by addressing the availability of lands for future oil and gas leasing, stipulations that could be applied to future leases, and additional mitigation to be considered and applied during the APD process.

2.7.3 Monitoring

In accordance with BLM's Land Use Planning Handbook, the BLM is responsible for development of a monitoring plan as a part of the implementation plan (see **Section 2.7.1**).

A Monitoring Plan will detail any process that the BLM would use to monitor implementation and effectiveness of RMPA decisions. The BLM's planning regulations require the RMPA establish intervals and standards for monitoring based on the sensitivity of the resource decisions (43 CFR 1610.4-9). Monitoring in this context is the process of tracking the implementation of RMPA decisions (implementation monitoring) and collecting data/information necessary to evaluate the effectiveness of RMPA decisions (effectiveness monitoring). Monitoring of mitigation success and performance standards is an important part of implementation of this plan. The monitoring plan will describe the BLM's process for monitoring implementation and effectiveness. Effectiveness monitoring includes monitoring disturbance in high priority habitat (HPH). To monitor habitats, the BLM would evaluate data that measures attributes of HPH, linkage/connectivity, or animal movement. Disturbance monitoring would measure and track changes in the amount of habitat in the landscape and changes in the human footprint, including changes in density of oil and gas development. More specifically, the plan will discuss what monitoring data the BLM may use or track to assess effectiveness of RMPA decisions.

During implementation of this RMPA, population trends will be monitored by CPW and habitat will be monitored and evaluated by the BLM. . Monitoring would evaluate the effects of BLM permitted activities on big game HPH and populations and make specific recommendations for changes in oil and gas management. Monitoring would also evaluate the effectiveness of reclamation activities and mitigation (including compensatory mitigation) associated with permitted activities. Monitoring strategies should be collaborative, as habitat occurs across jurisdictional boundaries. CPW has primary responsibility for population-level wildlife management, including population monitoring. Therefore, population monitoring would be conducted in partnership with the state.

Monitoring data gathered over time will be examined and used to draw conclusions through plan evaluations about whether management actions are meeting stated objectives, and if not, why. The BLM's conclusions will inform recommendations about whether to continue current management or to identify the necessary changes in management practices to meet objectives. The monitoring plan will include methods, data standards, and intervals of monitoring; analysis and reporting methods; and the incorporation of monitoring results into future management actions.

If there is lack of consistency in how questions are interpreted and answered for monitoring, best available science will be used to understand terrestrial ecosystem habitat integrity conditions for big game HPH on BLM lands, status and trend of big game populations in relation to Herd Management Plans, status and trend of oil and gas development and socioeconomic plan components, and climate change. The BLM may conduct monitoring at the scale of CPW's big game Data Analysis Unit (DAU) or Game Management Unit (GMU), or other scales determined appropriate in the future. Population monitoring methods may be updated based on new science and advances in technology (e.g., integrated population models).

The monitoring plan may include geospatial and tabular data for disturbance or density mapping used for annual evaluation assessments described in **Section 2.6**.

2.7.4 Adaptive Management

The monitoring plan should include adaptive management actions and specific examples of using monitoring data to adapt management actions. The examples should highlight how monitoring data may be reasonably

interpreted, evaluated, and used by authorized officers and land managers to adaptively inform implementation-level decisions.

Adaptive management is a decision process that promotes flexible resource management decision-making. Decisions can be adjusted as outcomes from management actions and other events become better understood based on new technology, updated data (including habitat monitoring data), and new mapping. Carefully monitoring these outcomes both advances scientific understanding and helps with adjusting resource management directions as part of an iterative learning process.

On February 1, 2008, the Department of the Interior published its Adaptive Management Implementation Policy (522 DM 1). Adaptive management may help in assessing whether big game conservation measures contain the needed level of certainty for effectiveness. Principles of adaptive management are incorporated into the conservation measures in the plan to lessen threats to HPH. The BLM intends to use monitoring data and any relevant information to identify any changes in habitat related to the goals and objectives of an approved plan. The BLM will use this to determine when adaptive management is appropriate and incorporate best available science including local data and information into the adaptive management strategy. The BLM acknowledges that the best available science for understanding the dynamics of habitat effectiveness and permeability in Colorado will continue to change in the future.

As habitat conditions, law, and policy change over time or new data are collected, this plan would continue to be updated through maintenance actions or amendments, as appropriate, to ensure management decisions reflect those changes. Alternatives in this plan are responsive to landscape condition. The BLM would adjust habitat areas to reflect the best available science and be consistent with habitat management recommended by CPW.

Should the CPW make changes to big game HPH areas, the BLM will review and evaluate those changes before extending any BLM management direction in this RMPA to additional big game HPH acres, or reducing the acreage covered by any management decision. For example, if an area is designated big game HPH at the time of this ROD, but is no longer designated big game HPH in 2028, the BLM will evaluate this change through the plan evaluation process and determine if updates to the RMPA are appropriate. If appropriate, the BLM will make adjustments through plan maintenance or plan amendment. The evaluation process allows the BLM to determine how big game HPH will be managed in the future in accordance with law and guidance. See **Section 2.6** for information about plan evaluations.

Currently, CPW HPH data for big game is collected and assessed regionally each year, with potential updates to big game HPH layers occurring annually within one of CPW's four regions, including refinement of publicly available data, as warranted. Subsequently, the ECMC conducts an annual rulemaking process where decisions whether to adopt proposed big game HPH changes into ECMC's oil and gas regulations occur. This review and refinement process is scientifically based and includes public review and input through the State's public process for incorporating map updates with a public hearing. Stakeholders are encouraged to participate in the process by submitting relevant information to CPW throughout the year for field verification purposes. The BLM encourages agency officials and interested parties to participate in this annual public process offered by the state. Engagement from the BLM and interested parties is encouraged during ECMC's annual rulemaking process regarding big game HPH updates. As part of the plan evaluation process, the BLM will review any updated big game HPH layers as a result of proposed changes from CPW.

Adaptive Management Actions

- Action AM-1: As species specific data is collected and updated annually for statewide big game HPH updates by CPW this information will be included in future plan evaluations to reflect the most up-to-date spatial representation of big game HPH and determine the appropriate action. Changes to big game habitat may be adopted by the BLM through appropriate reviews of whether allocation decisions and management actions will be applied to HPH. The BLM may adjust management through an adaptive management process, and in accordance with applicable law. Evaluating CPW's latest mapped big game HPH will promote consistency in management across jurisdictions.
- Action AM 2: An area of big game HPH declining in habitat effectiveness or exhibiting degradation in landscape connectivity would be a priority for avoiding further oil and gas development and promoting restoration treatments or mitigation.
- Action AM 3: If there are concerns about achieving herd population objectives, an interagency team will convene to determine the cause, and if development of federal oil and gas is a factor, project-level responses may be appropriate. The BLM will discuss appropriate actions consistent with this RMPA. Adopting further planning actions may require initiating a plan amendment process.
- Action AM 4: When amending this plan, the BLM will coordinate with CPW to meet the objective of conserving, enhancing, and restoring big game HPH by avoiding, minimizing, and mitigating impacts to HPH.

2.7.5 Mitigation

BLM's aim is to apply the mitigation hierarchy, to avoid, minimize, and mitigate impacts to sensitive resources from the proposed action, in a manner that achieves maximum benefit to the impacted resource, consistent with applicable law. Mitigation can help provide a conservation benefit to the species when impacts from oil and gas development activity are not avoidable. To do so, in undertaking BLM management actions, and, consistent with valid existing rights and applicable law, when oil and gas development results in habitat loss and degradation within HPH, the BLM will require and ensure mitigation that provides a conservation benefit to the species, including accounting for any uncertainty associated with the effectiveness of such mitigation.

Across all action alternatives, mitigation will comply with CEQ, DOI, and BLM guidance. To the extent possible, mitigation will be coordinated across agencies and align with the State's mitigation strategy or apply similar mitigation practices—oil and gas operations will consider alternative locations that either avoid big game HPH altogether, or, where avoidance is not feasible, consider locations that minimize adverse impacts to the maximum extent possible. This hierarchy includes the following concepts when authorizing oil and gas development actions:

Coordination

Under all action alternatives, the BLM will coordinate mitigation across agencies such as CPW and other state agencies when implementing the “avoid, minimize, and mitigate” hierarchy.

Avoid, Minimize, Mitigate

To the extent allowed by law or the terms of existing land use authorizations, the BLM will avoid impacts from BLM-administered land uses by not taking a certain action or parts of an action related to oil and gas development and associated ancillary facilities or authorizations (i.e., pipelines, roads, compressor stations, etc.). The BLM will require minimization of unavoidable impacts by limiting the degree or magnitude of oil and gas development and its implementation. The BLM will also require mitigation of impacts from BLM-authorized oil and gas development by reducing or eliminating development impacts and operations over time, or repairing, rehabilitating, or reclaiming HPH. When adverse impacts on big game and their habitat

remain after avoidance and minimization, mitigation would be considered, subject to the federal regulations governing the authorization and valid existing rights. The BLM may require compensation from public land users for certain types of residual impacts on public lands by replacing or providing substitute resources or environments, through reclamation, establishment, enhancement, and/or preservation of resources.

Wildlife Mitigation Plan for Development Within HPH

The BLM will require the proponent or operator to submit Wildlife Mitigation Plans (WMPs) for oil and gas development in big game HPH to address direct, indirect, and cumulative impacts of oil and gas development and associated authorizations, and to describe operating practices and other measures that will be implemented to avoid, minimize, and mitigate impacts to big game habitat and other wildlife resources. Proposed oil and gas operations on new or amended locations within big game HPH require a Wildlife Mitigation Plan with a description of the operating requirements. WMPs and the mitigation for big game habitat should be coordinated among the BLM, CPW, and the operator.

Mitigation Strategy

The BLM developed a Mitigation Strategy to inform the mitigation components of NEPA analyses for BLM actions and authorizations that result in habitat loss and degradation. The BLM's Manual 1794 and Handbook 1794-I served as a framework for the Mitigation Strategy. The Mitigation Strategy applies to the field offices within BLM Colorado and includes consideration of management in border states. The mitigation strategy is a landscape-scale and fine-scale approach to mitigating impacts to resources. This involves anticipating future mitigation needs and strategically identifying mitigation sites and measures that can provide a conservation benefit to big game. The BLM will consider conditions, trends, and sites, to the greatest extent possible, when applying the mitigation hierarchy.

The BLM will include the avoidance, minimization, and mitigation recommendations from the Mitigation Strategy in the NEPA analysis for proposed implementation actions that may result in habitat loss and degradation, and BLM will include appropriate mitigation actions in its decisions.

The BLM may require compensatory mitigation to offset disturbance or density limitation exceedances and the functional loss of habitat from oil and gas development in HPH. The BLM will ensure that compensatory mitigation is strategically implemented. The compensatory mitigation program will be implemented at a state level in collaboration with BLM's partners (e.g., federal, tribal, and state agencies). Compensatory mitigation may include reclamation of existing disturbances outside of the proposed development (e.g., orphaned oil and gas development, redundant travel routes, unauthorized route and recreation use, fence removal), establishment, enhancement, and preservation of big game HPH (e.g., seeding, noxious weed control, vegetation treatment). Compensatory mitigation requirements may match the magnitude of the anticipated impacts.

The operator may be required to complete compensatory mitigation to offset direct and unavoidable adverse indirect impacts. Direct impacts to big game occur from disturbance or habitat fragmentation during construction, drilling, and/or completion activities and habitat conversion to oil and gas facilities. Indirect impacts to big game occur over time from big game avoidance of disturbance and the cumulative functional habitat loss from fragmentation and modified habitat use as development density increases (See **Section 3.3.1** for further analysis of impacts on big game). Indirect impacts may be avoided or minimized through the application of alternative siting and operating requirements. The BLM in coordination with CPW and ECMC will determine whether compensatory mitigation proposed by the operator is sufficient to protect

big game and HPH from unavoidable, adverse direct and indirect impacts.. The operator will be required to complete compensatory mitigation to offset unavoidable, adverse direct and indirect impacts within HPH.

2.8 DETAILED ALTERNATIVES – GOALS, OBJECTIVES, ALLOWABLE USES, AND MANAGEMENT ACTIONS

RMPA decisions identify and clearly define goals and objectives (desired outcomes) for resources and resource uses, and establish allowable uses and management actions necessary for achieving goals and objectives.

Goals are broad statements of desired (RMPA-wide and resource- or resource use-specific) outcomes and are not quantifiable or measurable. Objectives are specific measurable desired conditions or outcomes intended to meet goals. Goals and objectives can vary across the action alternatives, resulting in different methods for measuring desired conditions or outcomes, in allowable uses, and in management actions for oil and gas.

Management actions and allowable uses are designed to achieve objectives and can generally be described as measures to guide day-to-day and future oil and gas activities. Allowable uses delineate which uses are permitted, restricted, or prohibited and may include stipulations or restrictions. Allowable uses also identify areas where specific uses are excluded to protect resource values, such as where certain areas are open or closed to oil and gas leasing. These critical determinations guide future land management actions and subsequent site-specific implementation actions. Implementation decisions are site-specific on-the-ground actions and are typically not addressed in the RMPA. See **Section 2.5** for further details about implementation of this plan.

For the action alternatives, the BLM would apply and use Best Management Practices (BMPs) and conservation measures, as needed in specific situations, to ensure adequate protection of resource values. BMPs and conservation measures could be applied as COAs when permitting oil and gas development activities and could include a variety of measures to minimize and mitigate impacts over the short- or long-term.

Table 2-8. Summary of Alternatives

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
Fluid Minerals – Oil and Gas				
Goals and Objectives Common to Alternatives B, C, D				
1.	<p>GOAL – Conserve, protect, and maintain high priority habitat (HPH), permeability, and connectivity on a landscape scale for the following species: elk, mule deer, pronghorn, and bighorn sheep (herein referred as “big game”), through avoidance and minimization of conflicts between these species and the BLM’s management of oil and gas activities to provide for multiple use of BLM-administered lands and minerals, subject to appropriate BLM policies, laws, and regulations.</p> <p>MANAGEMENT SUB-GOALS:</p> <p>GOAL – High Priority Habitat Effectiveness and Connectivity: Establish, enhance, and maintain high priority habitat, forage conditions, and ecosystem integrity on BLM-administered lands and minerals in Colorado to support quality habitat, connectivity, and resilient landscape for big game through management of activities to avoid, minimize, and mitigate oil and gas disturbance where effective for big game habitat conservation efforts.</p> <p>GOAL – Big Game Movement and Migration: Manage oil and gas resources to allow for big game migratory movements and habitat permeability in consideration of changing environmental and climatic conditions, while minimizing the impacts to big game using adjacent lands with lesser habitat quality.</p> <p>GOAL – Sustainable Big Game Populations: Provide and protect conditions necessary to sustain big game populations at levels commensurate with multiple use objectives and state-established herd management plans and population objectives by managing for effective conservation of big game HPH and species across BLM-administered lands and minerals in Colorado through response to site-specific conditions to conserve the land to sustain populations, where practical.</p> <p>GOAL – Oil and Gas Development: Make federal oil and gas fluid mineral resources available for economically and environmentally responsible exploration and leasing, except where prohibited by law or where administrative action is justified in the national interest, while conserving big game habitat through management of oil and gas activities that can have direct, indirect, and cumulative effects on migration and movement corridors or otherwise impair the function of big game high priority habitat.</p>			
2.	<p>MANAGEMENT OBJECTIVES:</p> <p>OBJECTIVE: Minimize impacts of new oil and gas leasing and development within big game HPH on BLM land and mineral estate (decision area). Additionally, consider and avoid indirect impacts from BLM management actions that may push new oil and gas leasing and development onto big game HPH on non-BLM lands and minerals, to the extent practicable.</p> <p>OBJECTIVE: Where fluid mineral development projects on existing leases could adversely affect big game HPH, migration, movement, or populations, the BLM will work with the lessees, operators, or other project proponents to avoid, minimize, or mitigate impacts to the extent compatible with valid existing rights. When authorizing development of oil and gas mineral resources, consider current scientific knowledge of impacts and implement the following hierarchy:</p> <ol style="list-style-type: none"> (1) First, if feasible and as subject to applicable stipulations, avoid disturbance from oil and gas development within big game HPH. Eliminate conflicts by relocating disturbance activities outside of big game HPH to avoid disturbance within HPH. (2) If unable to avoid disturbance within big game HPH, minimize^(O&G) adverse direct, indirect, or cumulative impacts to big game HPH, movement, or populations. Since impacts are not avoidable, the adverse effects will need to be both minimized and mitigated. Impacts will be minimized by modifying proposed actions and/ or developing oil and gas authorization conditions to include measures that lessen the adverse effects to big game and their habitat. Minimization does not preclude the need for mitigation of disturbance. (3) If a proposed fluid mineral development project may adversely affect or have unavoidable impacts to big game HPH, mitigate the impacts. If impacts are not avoidable, after required minimization measures are specified, residual adverse effects on HPH will be offset through mitigation actions that result in replacement or enhancement of big game HPH to balance the loss of habitat (spatially and temporally) from the disturbance activity (compensatory mitigation). <p>The BLM will work with the lessees, operators, or other project proponents to avoid, minimize, and mitigate adverse impacts to the extent compatible with lessees' rights to drill and produce fluid mineral resources. The implementation of these priorities will be subject to valid existing rights and any applicable law or regulation, including, but not limited to, 30 U.S.C. 226(p) and 43 CFR 3162.3-1(h). The BLM will work with the lessee, operator, or project proponent in developing an Application for Permit to Drill for the lease to avoid, minimize, and mitigate impacts to big game HPH.</p> <p>OBJECTIVE: Implement an effective compensatory mitigation program consistent with state regulation and policy that compensates for adverse direct and indirect impacts to big game HPH at multiple scales, including the landscape scale, caused by the authorization of oil and gas development activities where cumulative disturbances from land uses on BLM-managed lands and minerals may impede migration or otherwise impair the function of big game HPH. The compensatory mitigation program should provide ample financial resources to offset functional habitat loss and result in conservation benefit to the species, consistent with BLM’s Manual Section (MS-1794) and Handbook (H-1794-1).</p> <p>OBJECTIVE: Protect big game HPH from BLM-managed oil and gas related disturbance to minimize impacts that degrade big game HPH or impede big game migration and movement, and support sustainable populations through limits on route/infrastructure densities and seasonal use restrictions in HPH. Minimization may also be accomplished through site-specific design features, such as reducing the disturbance footprint and co-location of facilities.</p> <p>OBJECTIVE: Where feasible and appropriate, co-locate, consolidate, and cluster oil and gas development to minimize impacts to big game HPH. When co-location and clustering are not feasible, strive for low density oil and gas development within big game HPH.</p> <p>OBJECTIVE: Co-locate, consolidate, and cluster localized disturbances as much as possible to maintain and conserve intact, connected big game HPH.</p> <p>OBJECTIVE: Facilitate exploration and development of oil and gas resources using the best available technology to minimize impacts of oil and gas activities on big game HPH. Enforce operational procedures that minimize exposure of big game to disturbance and risk.</p> <p>OBJECTIVE: Manage oil and gas activities in a manner consistent with applicable local, state, tribal, and federal laws, regulations, standards, and implementation plans.</p>			

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
3.	<p>GOAL – Cooperation, Coordination, and Collaboration: Promote big game conservation stewardship among oil and gas operators and collaborate with agencies to foster maintenance and/or enhancement of high priority habitat. Manage oil and gas resources in coordination with adjacent land management agencies, governments, CPW, CDOT, and landowners to benefit big game and their habitat (which can cross land jurisdictions). Establish partnerships with cooperating entities to develop and adapt best management practices in response to site-specific conditions and other resource objectives.</p> <p>GOAL – Consistency: Evaluate Federal, state, local, and Tribal plans and objectives for big game, oil and gas fluid minerals, and related issues and resources of those plans and objectives. Consider conservation and development actions consistent with local, state, federal, and Tribal management plans and policies, where possible.</p> <p>OBJECTIVE: In big game HPH or areas that may adversely impact HPH, coordinate with CPW and apply best available science on the level and type of disturbance that big game can tolerate in their various seasonal ranges. Keep apprised of the growing body of best available science, literature, and data as it relates to big game movement and habitat in Colorado.</p> <p>OBJECTIVE: Consider the following opportunities in cooperation and collaboration with the State of Colorado and its agencies, other agencies, local governments, private landowners, project proponents, Tribes, partners, and/or other stakeholders:</p> <ul style="list-style-type: none"> • Ensure the best information about big game and their habitat informs and helps guide development of federal leases. • Coordinate early on site-specific projects during the design phase to avoid and minimize impact to big game habitats and populations of local importance. • Facilitate timely and successful completion of implementation actions. • Develop any necessary resource protections or site-specific conservation strategies for oil and gas to meet goals and comply with this plan. • Evaluate existing resource conditions, impacts, and desired uses of the land. • Establish partnerships with cooperating entities to develop and adapt BMPs in response to site-specific conditions and other resource objectives. • Explore and prioritize methods and projects for mitigation within the approved strategy and hierarchy, including options for compensatory mitigation. • Enhance cooperative monitoring efforts. <p>OBJECTIVE: With the BLM, CPW, and leaseholder, collaboratively assess as early as possible long-term impacts to the functionality of big game HPH from potential full lease development. This proactive approach will provide opportunities for adaptive management across the landscape in response to changing needs and conditions. This may include identification of key development avoidance areas or areas where centralized or intensive development may be least detrimental on the landscape.</p>			
4.	<p>GOAL – Consider best available science and adaptively manage BLM’s oil and gas leasing and development decisions to incorporate new information and account for future conditions.</p> <p>OBJECTIVE: Consider avoidance, minimization, and mitigation measures of this plan in relation to future best available information, including future prioritization efforts for big game habitat and movement.</p> <p>OBJECTIVE: Identify BLM-managed lands and minerals adjacent to federal and state highways that have been identified as priority highway wildlife crossing locations by CPW and CDOT (West & East Slope Prioritization Studies). Work with CPW, CDOT, and local governments to develop crossing location conservation plans for BLM-managed lands and minerals adjacent to priority wildlife crossing locations that identify conservation threats, necessary management actions, and habitat improvement needs to maximize the efficacy of proposed wildlife crossing locations to maintain migratory movements for big game species at these locations.</p> <p>OBJECTIVE: During each 5-year period following RMPA approval, identify, reclaim, or enhance acres of HPH for big game habitat statewide. Priority treatment areas should include (but are not limited to) aspen, riparian areas, winter range, and migration/connectivity areas. Actions to help accomplish this objective in relations to and as mitigation for oil and gas developments may include:</p> <ul style="list-style-type: none"> • Improving wildlife movement or habitat connectivity by modifying or removing unneeded structures (roads, trails, fences, well pads, etc.), • Eliminating redundant routes, converting mode of travel for specific routes, or realigning routes into less impactful settings, • Utilizing seasonal area or route closures within HPH, implementing vegetation management practices that maintain or enhance connectivity and forage production (e.g., fire treatment, timber harvest). 			

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
Oil and Gas – Goals and Objectives Unique to Alternatives B, C, or D;				
5.	<p>No change to objectives set forth in existing RMPs:</p> <ul style="list-style-type: none"> Northeast Resource Area RMP (1986) Royal Gorge Resource Area RMP (1996) San Luis Resource Area RMP (1991) Gunnison Resource Area RMP (1993) Uncompahgre RMP (2020) Colorado River Valley Field Office RMP (2015) Grand Junction Field Office RMP (2015) Kremmling RMP (2015) Little Snake RMP (2011) White River Field Office RMP (1997) Tres Rios Field Office RMP (2015) Canyons of the Ancients National Monument (NM) RMP (2010) Gunnison Gorge National Conservation Area (NCA) RMP (2004). 	<p>OBJECTIVE: Facilitate environmentally sound exploration and development of fluid minerals. Consistent with CPW recommendations adopted in state rulemaking to avoid, minimize, and mitigate impacts to wildlife from land use development in Colorado, apply stipulations in HPH for elk, mule deer, pronghorn, and bighorn sheep to limit disturbance from oil and gas activities on BLM-administered lands and minerals.</p> <p>Methods of implementation of the allowable uses and allocations implementing this objective shall be similar to the ECOM 1200 series process. BLM will conduct an onsite, assess resource conditions at the site and project-level density determination, consider alternative locations, review pad, road, pipeline and other ancillary facilities alignments for means to avoid, minimize, and if necessary, mitigate unavoidable residual adverse impacts from proposed oil and gas developments.</p>	<p>OBJECTIVE: Facilitate environmentally sound exploration and development of fluid minerals. Consistent with CPW recommendations adopted in state rulemaking to avoid, minimize, and mitigate impacts to wildlife from land use development in Colorado, apply stipulations in HPH for elk, mule deer, pronghorn, and bighorn sheep to limit disturbance from oil and gas activities primarily on BLM-administered lands, and where consistent with this alternative, BLM-administered subsurface split-estate minerals. Flexibility will be provided for split-estate minerals where the surface ownership of the project area comprises more than 50% of private land.</p> <p>Methods applicable to Alternative B apply to alternative C.</p>	<p>OBJECTIVE: Facilitate environmentally sound exploration and development of fluid minerals. Consistent with CPW recommendations adopted in state rulemaking to avoid, minimize, and mitigate impacts to wildlife from land use development in Colorado, apply stipulations in HPH for elk, mule deer, pronghorn, and bighorn sheep to limit disturbance from oil and gas activities on BLM-administered lands and minerals.</p> <p>Methods applicable to Alternative B and C apply to alternative D.</p>
6.	—	No similar objective, as no additional major constraints are proposed. No closures are proposed.	No similar objective, as no additional major constraints are proposed. No closures are proposed.	OBJECTIVE: Additionally, avoid oil and gas development in HPH through consideration of stipulations with major restraints on new leases. Avoid new leases in areas of no known, low, and medium oil and gas potential where the surface contains big game HPH.
7.	—	OBJECTIVE: Apply a stipulation in areas containing big game pinch points. See below “Allowable Uses and Allocations.”	OBJECTIVE: Same as Alternative B.	OBJECTIVE: Same as Alternative B and C.
8.	—	No similar objective (a surface disturbance threshold does not apply).	<p>OBJECTIVE: Consider information and management of oil and gas activities with an appropriate surface disturbance threshold beneficial to achieving management goals of this plan. Determine whether a surface disturbance threshold is appropriate for a given area to limit the amount of surface disturbance and what threshold for a given area may be beneficial to achieving management goals. Flexibility shall be provided for split-estate minerals where the surface ownership is under private land ownership.</p> <p>The objective of long-term restoration/reclamation is to make areas with disturbance useable by big game.</p>	<p>OBJECTIVE: Consider information and management of oil and gas activities with an appropriate surface disturbance threshold beneficial to achieving management goals of this plan. Determine whether a surface disturbance threshold is appropriate for a given area to limit the amount of surface disturbance and what threshold for a given area may be beneficial to achieving management goals. Management of split-estate minerals on private surface will be similar to management of BLM-administered surface lands.</p> <p>The objective of long-term restoration/reclamation is to make areas with disturbance useable by big game.</p>
9.	—	—	<p>OBJECTIVE: Additionally, avoid surface disturbance within any future identified critical movement areas where big game HPH has been prioritized and overlaps no known, low, and medium oil and gas development potential on BLM surface lands in the decision area. Keep appraised of best available science for Colorado when considering future areas that may be prioritized as most critical big game HPH to support big game migratory movements and habitat connectivity.</p>	<p>OBJECTIVE: Additionally, avoid surface disturbance within any future identified critical movement areas where big game HPH has been prioritized and overlaps no known, low, and medium oil and gas development potential, regardless of land ownership. Keep appraised of best available science for Colorado when considering future areas that may be prioritized as most critical big game HPH to support big game migratory movements and habitat connectivity.</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
10.	—	<p>OBJECTIVE: In all oil and gas development plans, big game mitigation and protection plans, consider the following:</p> <ul style="list-style-type: none"> • Protecting areas of undisturbed habitat essential to maintaining healthy big game populations. • Arrangement and configuration of disturbances and timing or phasing of development. • Direct, indirect, and cumulative high priority habitat loss and disturbance. 	<p>OBJECTIVE: Same as Alternative B.</p>	<p>OBJECTIVE: Same as Alternative B and C.</p>
Unleased Oil and Gas Fluid Minerals – Allocations, Allowable Uses, and Management Actions				
11.	—	<p>ALLOWABLE USE: In big game HPH, new oil and gas leases may be offered consistent and subject to the leasing stipulations in the timing, distance, and density described in the below stipulations under Alternative B. If the lease is partially or entirely within big game HPH areas, subject to topographic and other environmental constraints, any development within big game HPH would be required to be placed in the area least harmful, as determined in coordination with CPW, to big game based on vegetation, topography, or other habitat features.</p>	<p>ALLOWABLE USE: In big game HPH, new oil and gas leases may be offered consistent and subject to the leasing stipulations in the timing, distance, density, and disturbance described in the below stipulations under Alternative C. If the lease is partially or entirely within HPH areas, subject to topographic and other environmental constraints, any development would be required to be placed in the area least harmful, as determined in coordination with CPW, to big game based on vegetation, topography, or other habitat features.</p>	<p>ALLOWABLE USE: In big game HPH, new oil and gas leases may be offered consistent and subject to the leasing stipulations in the timing, distance, density, and disturbance described in the below stipulations under Alternative D. If the lease is partially or entirely within big game HPH areas, avoid any new development within big game HPH.</p>
12.	<p>ALLOWABLE USE: Existing mineral withdrawals would remain in effect. This includes Browns Canyon NM RMP, Dominguez-Escalante NCA RMP, and McInnis Canyons NCA RMP.</p> <p>All existing closures to oil and gas leasing would be retained. A total of 1,792,000 (86 percent of the decision area) acres would remain closed to leasing. Exact acres are subject to change in the future due to other resource management plan revisions and amendments.</p>	<p>No similar action because no additional closures or withdrawals are proposed.</p>	<p>No similar action because no additional closures or withdrawals are proposed.</p>	<p>ALLOWABLE USE – AREAS CLOSED TO LEASING: For all current big game HPH within the decision area where no known, low, or medium oil and gas potential exists, 4,031,000 acres of additional BLM federal oil and gas mineral estate would be closed to new oil and gas leasing to protect big game habitat, for a total of 5,823,000 acres of closure in the decision area. Fifty-five percent of the decision area would remain open to leasing.</p> <p>This closure applies to areas with no known, low, or medium oil and gas potential where big game HPH exists for the following: migration corridors for bighorn sheep, elk, mule deer and pronghorn; bighorn sheep winter range and production areas; severe winter range for elk and mule deer; winter concentration areas for elk, mule deer and pronghorn; elk production areas. The areas would be administratively ineligible for new oil and gas leasing and public lands in these areas would be closed to new geophysical exploration.</p> <p>Identified BLM surface lands of 97,000 acres with moderate or high helium potential but no, very low, and low potential for oil and other gas would remain open to oil and gas leasing. These lands comprise two areas within the Eastern Colorado RMP and Colorado River Valley/Grand Junction Field Office Supplemental.</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
13.	<p>ALLOWABLE USE: STIPULATION CSU, UFO: CSU/SSR-18-19: Apply CSU restrictions to reduce impacts of surface-disturbing activities and operations on bighorn sheep summer range. Special design, construction, and implementation measures, including relocation of operations by more than 200 meters (656 feet) from bighorn sheep, their crucial habitats, or specific habitat features, may be required. Specific habitat features may include, but are not limited to, water areas, mineral licks, and lambing areas.</p> <p>ALLOWABLE USE: STIPULATION CSU/SSR, TRFO: 3.10.2: Surface occupancy or use is subject to the following special operating constraints: In order to provide for healthy ungulate populations capable of meeting state population objectives, anthropomorphic activity and improvements should be designed to maintain and continue to provide effective habitat components that support critical life functions. This includes components of size and quality on the landscape providing connectivity to seasonal habitats (wildlife travel corridors), production areas, severe winter range, and winter concentration areas, along with other habitat components necessary to support herd viability.</p> <p>ALLOWABLE USE: STIPULATION NSO/SSR, KRFO: K-NSO-1: Core Wildlife Areas – Prohibit surface occupancy or use on Core Wildlife Areas (approximately 101,700 acres of the Federal mineral estate) in order to help reduce fragmentation of those areas. (Core Wildlife Areas are areas of high habitat value for multiple species, including sage-grouse, elk, and mule deer.) This stipulation will apply to the following:</p> <ul style="list-style-type: none"> • Eight areas in Jackson County: California Gulch, Walden Reservoir, Spring Creek, Case Flats/Peterson, Cowdrey, Dunes, Independence, and Sentinel (all areas); and • Six areas in Grand County: Wolford Mountain, Cedar Ridge, Junction Butte, Radium Basin, Parshall Divide, and Sulphur Gulch. <p>ALLOWABLE USE: STIPULATION NSO/SSR, CRVFO: CRVFO-NSO-7 Priority Wildlife Habitat: Prohibit surface occupancy and surface-disturbing activities on priority wildlife habitat areas to protect vegetation cover and forage on state wildlife areas and BLM lands with high and overlying wildlife values. Priority wildlife habitat areas include:</p> <ul style="list-style-type: none"> • State wildlife areas (12,900 acres) • Arbaney-Kittle (2,400 acres) • Cottonwood-Eby Creeks (9,600 acres) • Dry Rifle Creek (2,400 acres) • Fisher Creek (4,900 acres) 	<p>ALLOWABLE USE: STIPULATION NSO: Consistent with state efforts, prohibit surface occupancy and use and apply restrictions within bighorn sheep production areas. This may include special design, construction, and implementation measures, including relocation of proposed facilities and operations by more than 200 meters (656 feet).</p> <p>Alternative B would add an additional 170,000 acres of NSO to big game HPH for a total of 2,878,000 acres (21 percent of the decision area) of areas open to leasing subject to NSO.</p> <p>See Appendix E for full stipulation language, including waivers, exceptions, and modifications. TLs would be separately applied as conditions of approval (COA) for additional protection in the event that a WEM were granted.</p>	<p>Same as Alternative B. See Appendix E for full stipulation language, including waivers, exceptions, and modifications. TLs would be separately applied as COA for additional protection in the event that a WEM were granted.</p>	<p>Same as Alternative B and C. Factoring areas closed to leasing under Alternative D, this stipulation would result in 831,000 fewer acres of NSO compared to the no action. See Appendix E for full stipulation language, including waivers, exceptions, and modifications.</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
13. (cont.)	<ul style="list-style-type: none"> • Horse Mountain (5,200 acres) • Light Hill (3,800 acres) • Main-West Elk Ridge (1,100 acres) • North of New Castle (6,000 acres) • Thompson Creek-Holgate Mesa (3,400 acres) • West Elk Ridge (2,300 acres) • West Rifle Creek (1,100 acres) • Williams Hill (1,500 acres) • Wolcott (2,000 acres). <p>ALLOWABLE USE: STIPULATION NSO/SSR, SLVFO: LUA-2-2: No surface occupancy or use is allowed on the lands described below. For the purpose of: Protecting lambing areas selected by bighorn sheep for topography, slope, aspect, and escape cover; San Luis Resource Management Plan (decision LUA-2-2).</p> <p>ALLOWABLE USE: STIPULATION NSO/SSR, GJFO: WILDLIFE HABITAT NSO CO: No surface occupancy or use is allowed within the following wildlife emphasis or priority areas, as identified in the Resource Management Plan:</p> <ul style="list-style-type: none"> • Blue Mesa (wintering habitat for mule deer and elk) (9,300 acres); • Bull Hill (wintering habitat for mule deer and elk) (4,800 acres); • A portion of East Salt Creek (wintering habitat for mule deer and elk) (4,500 acres); • A portion of Prairie Canyon (pronghorn antelope habitat) (5,600 acres); • Sunnyside (wintering and migratory habitat for bighorn sheep, mule deer, elk, and Greater Sage-Grouse) (14,500 acres); and • Timber Ridge (habitat for mule deer, elk, and Gunnison Sage-Grouse) (11,800 acres). <p>ALLOWABLE USE: STIPULATION CSU/SSR, GJFO: WILDLIFE HABITAT CSU CO: Surface occupancy or use may be restricted within the following wildlife emphasis or priority areas, as identified in the Resource Management Plan:</p> <ul style="list-style-type: none"> • Beehive (habitat for mule deer and elk) (4,700 acres); • A portion of East Salt Creek (habitat for mule deer and elk) (20,500 acres); • Glade Park (habitat for Gunnison Sage-Grouse, mule deer, and elk) (27,200 acres); • A portion of Prairie Canyon (long billed curlew, long eared owl, pronghorn antelope, whitetailed prairie dog, kit fox, and burrowing owl habitat) (16,500 acres); • A portion of Rapid Creek (wintering and migratory habitat for mule deer and elk) (26,900 acres); and 	(See above.)	(See above.)	(See above.)

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
13. (cont.)	<ul style="list-style-type: none"> Winter Flats (deer and elk wintering grounds) (3,500 acres). <p>Special design, construction and implementation measures, including relocation of operations by more than 200 meters (656 feet), may be required. A plan of development may be required to demonstrate how potential adverse impacts to wildlife habitat will be mitigated.</p>	(See above.)	(See above.)	(See above.)
14.	<p>ALLOWABLE USE: STIPULATION CSU, GJFO: CSU-24: Apply CSU (site-specific relocation) restrictions to surface-disturbing activities within migration and movement corridors for deer and elk</p>	<p>ALLOWABLE USE: STIPULATION NSO: Prohibit surface occupancy and use within 0.5 -mile of identified big game migratory highways crossing pinch points in big game HPH and non-highway crossing pinch points are NSO as mapped. Apply restrictions to identified pinch points within HPH (Figure 2-103, Appendix D, Pinch Points). Exceptions may be authorized and may include special design, construction, and implementation measures, including relocation of proposed facilities and operations by more than 200 meters (656 feet). See Appendix E for full stipulation language, including waivers, exceptions, and modifications.</p>	Same as Alternative B. See Appendix E for full stipulation language, including waivers, exceptions, and modifications.	Same as Alternative B and C. See Appendix E for full stipulation language, including waivers, exceptions, and modifications.
15.	<p>ACTION, GJFO: F&W-BSG-MA-03: Reduce habitat fragmentation by reducing road density (focusing primarily on duplicative or redundant routes) in production areas and winter ranges, (bighorn sheep, mule deer, elk, pronghorn antelope, and moose) to provide protection of big game production areas from disturbance and displacement by human activities during critical periods. Strive to reduce route densities to less than 2 miles of route per square mile in these areas.</p> <p>ACTION, LSFO: Medium Priority Habitats, New Leases: For any new leases which overlie a medium priority habitat, a stipulation will be attached to the lease to comply with the two criteria described in more detail below: a 5 percent disturbance limitation and a POD illustrating a strategy to leave large blocks of undisturbed habitat. These criteria will be mandatory and BLM will not be obligated to grant an operator an exception to timing limitation stipulations. Operators will have to apply for an exception to this stipulation, which BLM will consider on a case-by-case basis. Defining the project area boundary: Where the surface disturbance stipulation is voluntary, the operator will define the project boundary. An operator is allowed a lot of flexibility in defining the project area. The only requirement is that they control the oil and gas development within the area so that they are able to meet the necessary criteria without interference from other operators. A project boundary could be composed of as little as one lease, or as much as several leases under different operators, or even a federal oil and gas unit. The leases within the project area could either be connected or not contiguous. The project area could be composed of a mixture of federal and private surface. The total allowable surface disturbance will be calculated for the entire project area. For example, a</p>	<p>ALLOWABLE USE: STIPULATION CSU: Consistent with state recommendations, avoid authorizing and constructing new oil and gas access roads within big game HPH where the system route density already exceeds 1 linear mile per square mile. Additions of new system routes within big game HPH that would cause the combined route density in a proposed project's zone of influence to exceed 1 linear mile per square mile will require a CPW-approved mitigation plan that addresses both direct and indirect functional habitat loss and offsets unavoidable adverse impacts to the affected big game herd. This does not apply to administrative routes.</p> <p>Alternative B would add 4,772,000 acres of CSU to big game HPH for a total of 8,180,000 acres (63 percent of the decision area).</p> <p>See Appendix F for methods to guide density determinations and implementation of 1/640 at the permitting level.</p> <p>See Appendix E for full stipulation language, including waivers, exceptions, and modifications.</p>	Same as Alternative B. See Appendix E for full stipulation language, including waivers, exceptions, and modifications.	Same as Alternative B and C. In addition to areas closed to leasing under Alternative D, this stipulation would add 748,000 acres of CSU for a total of 4,155,000 acres of CSU (32 percent of the decision area). See Appendix E for full stipulation language, including waivers, exceptions, and modifications.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
15. (cont.)	<p>project boundary of 1,000 acres will allow 50 acres of disturbance regardless of the size of the leases in the project area. A project area could be composed of medium and high priority habitats. In this case, allowable disturbance in the two different types will be calculated separately. For example, a 1,000 acre project area with 500 acres medium priority habitat and 500 acres high priority habitat, no more than 25 acres of medium priority habitat and 5 acres of high priority habitat could be disturbed at one time. When calculating total acres in a project area, all leased lands will be included, including areas with NSO stipulations. For example, if there are 200 acres covered by an NSO stipulation for sage-grouse in a 1,000 acre project area, the total project area will be 1,000 acres, not 800. It is not necessary for one leaseholder to hold all leases in a project area. In the case of the project area being defined by a federal oil and gas unit, the lead operator will be responsible for coordinating the oil and gas development so the criteria are met. Outside of established units, but within landscapes with multiple leaseholders, multiple operators could enter into this approach together, coordinating development together to ensure meeting the criteria within the project area. Development will have to be organized so that one operator cannot utilize all allowable disturbance acreage for the project area. Larger project areas will benefit both the operator and the wildlife resource. Large project areas will allow operators more flexibility in remaining below the disturbance threshold, as there will be more acres available to disturb. Likewise, larger project areas will facilitate larger sage-grouse sanctuaries and better create habitat protection on a landscape scale. For new leases where this approach is mandatory, the operator could suggest a project area boundary to BLM for approval, which could include existing leases. If the operator does not have a specific project area in mind, compliance with established criteria will be required for the boundary of the new lease.</p> <p>High Priority Habitats, New Leases: For new leases within high priority habitat, a lease stipulation will be attached to comply with the two criteria: a 1 percent disturbance limitation and a POD illustrating a strategy to leave large blocks of undisturbed habitat. These criteria will be mandatory and BLM will not be obligated to grant an exception to timing limitation stipulations. Operators will have to apply for an exception to this stipulation, which BLM will consider on a case-by-case basis. To grant an exception to the 1 percent disturbance threshold, the operator will have to prove that it went to extraordinary means to mitigate or improve high priority habitats. This could include enlisting surrounding leaseholders into a plan to protect even larger blocks of habitat, or performing BLM-approved compensatory mitigation. Non-oil and gas</p>	(See above.)	(See above.)	(See above.)

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
15. (cont.)	related projects will be held to a higher standard in high priority habitats. BLM may require additional mitigation for ROWs, recreation facilities, range improvements, and other projects within these areas. BLM will make an attempt to site projects outside of high potential habitats, if possible. Depending on other possible locations and alternatives, as well as conditions on the ground, BLM may not approve such projects in high potential habitats. BLM will consider these projects on a case-by-case basis to ensure management intent with respect to sagebrush obligate species within these habitats can be achieved.	(See above.)	(See above.)	(See above.)
16.	<p>ACTION, GREATER SAGE-GROUSE FINAL SUPPLEMENTAL EIS (2020): P-MR-6: No new leasing in PHMA if disturbance cap exceeds 3 percent for the biologically significant unit (Colorado populations) and proposed project analysis area (Colorado MZ) or 1 disturbance per 640 acres is exceeded.</p> <p>ACTION, GREATER SAGE-GROUSE FINAL SUPPLEMENTAL EIS (2020): P-MR-5: 3 percent disturbance cap in PHMA with disturbances limited to 1 disturbance per 640 acres density calculated by biologically significant unit (Colorado populations) and proposed project analysis area (Colorado MZ) would apply to new lease activities. The following LN would apply: Greater Sage-Grouse LN46e: any lands leased in PHMA are subject to the restrictions of 1 disturbance per 640 acres calculated by biologically significant unit (Colorado population) and proposed project analysis area (Colorado MZ) to allow clustered development (Appendix D [of the 2015 Final EIS], Stipulations Applicable to Fluid Mineral Leasing and Land Use Authorizations).</p> <p>Figure 2-5, Appendix D, 2019 Sage-grouse Stipulations</p>	<p>ALLOWABLE USE: STIPULATION CSU: Avoid, minimize, or mitigate authorizing and constructing new oil and gas locations within big game HPH big game habitats that cause the density of oil and gas locations to exceed one per square mile or that contribute to increased density beyond one location per square mile. Additions of new oil and gas locations within big game HPH that would cause the density of active oil and gas locations to exceed one per square mile will require a CPW-approved wildlife mitigation plan (WMP) that addresses both direct and indirect functional habitat loss and offsets unavoidable adverse impacts to the affected big game species.</p> <p>See Appendix F for methods to guide density determinations and implementation of 1/640 at the permitting level.</p>	Same as Alternative B.	Same as Alternative B and C.
17.	<p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, KFO: CO-TL-2: Big Game Production Areas – Prohibit surface use during the following time period(s) in mapped big game production areas in order to reduce behavioral disruption during parturition and early young rearing period. [NOTE: This stipulation would not apply to operation and maintenance of production facilities.]:</p> <ul style="list-style-type: none"> • Rocky Mountain Bighorn sheep: April 15 to June 30; • Elk: April 15 to June 30 <p>CO-TL-3: Big Game Crucial Winter Range (Severe Winter Range and Winter Concentration Areas) – Prohibit surface use during the following time period(s) in mapped crucial winter habitat in order to reduce behavioral disruption of big game during the winter season on crucial winter habitat as mapped by the Colorado Parks and Wildlife. [NOTE: This stipulation would not apply to operation and maintenance of production facilities.]:</p>	<p>ALLOWABLE USE: STIPULATION TL: Prohibit surface use and surface-disturbing and disruptive activities during the following time period(s) in the identified big game HPH:</p> <ul style="list-style-type: none"> • Elk and mule deer severe winter range and winter concentration areas - December 1 to April 30; • Pronghorn winter concentration areas - January 1 to April 30; • Bighorn sheep winter range - November 1 to April 30; • Bighorn sheep production areas - Rocky Mtn April 15 - June 30, Desert February 1 to May 1; • Elk production (calving) areas - May 15 to June 30; <p>Alternative B would add 1,340,000 acres of TL to big game HPH for a total of 8,260,000 TL acres (64 percent of the decision area).</p> <p>See Appendix E for full stipulation language, including waivers, exceptions, and modifications. Management activities and access should be limited or avoided in big game HPH, Timing</p>	Same as Alternative B.	Same as Alternative B and C. Factoring areas closed to leasing under Alternative D, this stipulation would result in a total of 4,435,000 acres of TL (34 percent of the decision area). See Appendix E for full stipulation language, including waivers, exceptions, and modifications.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
17. (cont.)	<ul style="list-style-type: none"> • Rocky Mountain /Desert Bighorn Sheep: November 1 to April 30; • Elk: December 1 to April 30; <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, UFO: TL-11 Prohibit surface occupancy and surface-disturbing and disruptive activities in mapped big game production areas as follows:</p> <ul style="list-style-type: none"> • Elk and moose May 15 to June 30 • Desert bighorn sheep: February 1 to May 1 • Rocky Mountain Bighorn Sheep April 15 to June 30 <p>TL-8 Prohibit surface use and surface-disturbing and disruptive activities during the following time period(s) in big game crucial winter habitat, as mapped in the RMP, BLM’s GIS database, or other maps provided by local, state, federal, or tribal agencies that are analyzed and accepted by the BLM: crucial winter range, severe winter range and winter concentration areas.</p> <ul style="list-style-type: none"> • Elk, mule deer, and moose: December 1 to April 15 • Pronghorn: January 1 to March 31 • Rocky Mountain and desert bighorn sheep: November 1 to April 15 <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, WRFO: WR-TL-12: All defined big game severe winter ranges within the WRFO will be subject to a timing limitation from December 1 through April 30 which will be applied through lease stipulations or as COAs that could extend up to 120 days. Timing limitations will typically be applied regardless of weather conditions (i.e., address of chronic influences).</p> <p>WR-TL-13: All defined big game summer range areas within the WRFO will be subject to a timing limitation from May 15 through August 15 which will be applied through lease stipulations or as COAs that could extend up to 90 days.</p> <p>WR-TL-14: All defined big game winter range and winter concentration areas will be subject to deferrals of up to 60 days within the period of December 1 through April 30 in stratified zones of seasonal use (refined set of seasonal use timeframes developed in coordination with CPW). Timing limitations will typically be applied regardless of weather conditions (i.e., address of chronic influences).</p> <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, GJFO: TL-20: Prohibit surface occupancy and use, surface-disturbing activities, and intensive human activities from December 1 to May 1 to protect big game winter range as mapped by the CPW. Certain areas and/or routes within big game winter range may be closed to foot, horse, motorized, and/or mechanized travel from December 1 to May 1.</p>	<p>limitation periods may be reduced based on coordination with CPW (e.g., mild winters, late hunting seasons, etc.).</p>	<p>(See above.)</p>	<p>(See above.)</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
17. (cont.)	<p>TL-22: Prohibit surface occupancy and use, surface-disturbing activities, and intensive human activities in pronghorn wintering habitat from January 1 to March 31.</p> <p>Big Game Production TL CO: No surface use is allowed during the following time period(s) in big game production areas, as mapped in the Resource Management Plan, BLM's GIS database or other maps provided by local, state, federal or tribal agencies that are analyzed and accepted by the BLM: Prohibit activities, including motorized travel, elk production areas from May 15 to June 15; in antelope production areas from April 15 to June 30; in Rocky Mountain bighorn sheep production areas from April 15 to June 30; in Moose production areas from April 15 to June 30; and in desert bighorn sheep production areas from February 1 to May 1.</p> <p>ALLOWABLE USE: STIPULATION NSO/SSR, GJFO: NSO-34: Prohibit surface occupancy and use and surface-disturbing activities in elk production areas year-round.</p> <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, RGFO: No surface use is allowed during the following time period(s) on the lands described below. This stipulation does not apply to operation and maintenance of production facilities.</p> <ul style="list-style-type: none"> • Rocky Mountain bighorn sheep lambing – May 1 to July 15 <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, TRFO: 3.10.1: No surface use is allowed during the following time period(s): In areas mapped as big game parturition areas for:</p> <ul style="list-style-type: none"> • Pronghorn antelope fawning areas (on SJNF and TRFO lands this includes the overall range for the species): May 1 through July 1 • Elk calving areas: May 15 through June 30 • Rocky Mountain bighorn sheep lambing: April 15 through June 30 • Desert bighorn sheep lambing: February 1 through May 1 <p>3.10.3: No surface use is allowed during the following time period(s): In mapped big game severe winter range, winter concentration areas, and mule deer critical winter habitat:</p> <ul style="list-style-type: none"> • Pronghorn antelope: December 1 through April 30 • Rocky Mountain bighorn sheep: November 1 through April 15 • Desert bighorn sheep: December 1 through April 15 • Mule deer: December 1 through April 30 • Elk: December 1 through April 30 	(See above.)	(See above.)	(See above.)

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
17. (cont.)	<p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, GGNCA: Uncompahgre Basin RMP #UB-4: To protect crucial deer and elk winter ranges from activities that would cause these species to abandon areas of crucial winter forage and cover for less suitable ranges, all development activities (exploration, drilling, etc.) will not be authorized from November 15 to April 30. Exceptions to this limitation may be authorized in writing by the BLM’s Authorized Officer. The affected portions of this lease are (legal description to be appended to lease).</p> <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, SLVFO: No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities: May 15 to July 15. For the purpose of (reasons): Protecting pronghorn antelope range from activities which would force antelope into less suitable range during fawning season; San Luis Resource Management Plan (decision RCO 1-1)</p> <p>No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities. December 15 to March 31. For the purpose of (reasons): Protecting crucial deer, elk, antelope, or bighorn sheep winter range from activities that would cause these species to abandon areas of crucial winter cover and forage for less suitable ranges; San Luis Resource Management Plan (decisions RCO 1-1, 2-1, and 7-1).</p> <p>ALLOWABLE USE: STIPULATION TL/SEASONAL CLOSURE, LSFO: Big Game Species (mule deer, elk, pronghorn antelope, and bighorn sheep): Crucial winter habitat will be closed to surface disturbing activities from December 1 to April 30, with the intent that this stipulation will be applied after the big game hunting season. In the case that hunting season extends later, exceptions will be applied according to Appendix B. Big game birthing areas will be closed to surface disturbing activities for the following species and during the following periods: elk calving (April 16 to June 30), pronghorn antelope fawning (May 1 to July 15), and bighorn sheep lambing (May 1 to July 15).</p>	(See above.)	(See above.)	(See above.)
18.	<p>ALLOWABLE USE – STANDARD LEASE TERMS: BLM-administered mineral estate will be open to fluid mineral leasing, exploration, and production subject to the lease terms and applicable lease stipulations as shown in existing Record of Decisions.</p>	Same as Alternative A. No change to standard lease terms and conditions.	Same as Alternative A. No change to standard lease terms and conditions.	Same as Alternative A. No change to standard lease terms and conditions.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
19.	Existing thresholds among RMP and sage-grouse plans.	Same as Alternative A. No similar action.	<p>ALLOWABLE USE – CONTROLLED SURFACE USE (CSU): Consider and apply a 3% surface disturbance threshold for new leasing decisions and associated stipulations where big game use may decline if surface disturbance exceeds 3%. Manage authorized uses to limit the amount of public land surface disturbance within big game HPH to a maximum of 3% of the total surface area of that big game HPH within the data analysis unit (DAU). Manage HPH by DAU on public lands so that discrete anthropogenic disturbances (whether temporary or permanent) cover less than 3% of big game HPH on BLM-administered surface lands within the decision area. Private lands do not apply to the surface disturbance threshold calculation.</p> <p>Anthropogenic features include but are not limited to paved highways, graded gravel roads, transmission lines, substations, wind turbines, solar developments, oil and gas wells, geothermal wells and associated facilities, pipelines, mines. The following would be excluded from the disturbance threshold calculation:</p> <p>(Private land is excluded)</p> <p>See Appendix G for Disturbance Threshold Guidance. The footprint of the project is consistent with the disturbance management protocols identified in this plan.</p> <p>In areas where development does not exceed 3%, after first avoiding HPH, locate projects in proximity to existing oil and gas development and along access roads to cluster development and reduce footprint of new development. Avoid dispersed development where negative impacts to big game are anticipated.</p> <p>In big game HPH where the disturbance threshold is already exceeded from any source, further oil and gas anthropogenic disturbance may be permitted in accordance with valid existing rights and the BLM’s waiver, exception, and modification criteria (where flexibility is afforded to split-estate lands). See Appendix E for the full waiver, exception, and modification criteria for new leasing.</p> <p>For an area to no longer be considered disturbed under the threshold, the site must reach reclamation standards required by the approved APD.</p>	<p>ALLOWABLE USE – CONTROLLED SURFACE USE (CSU): Consider and apply a 3% surface disturbance threshold for new leasing decisions and associated stipulations where big game use may decline if surface disturbance exceeds 3%. Manage authorized uses to limit the amount of surface disturbance within big game HPH to a maximum of 3% of the total surface area of that big game HPH within the data analysis unit (DAU), regardless of land ownership. Manage big game HPH by DAU so that discrete anthropogenic disturbances (whether temporary or permanent) cover less than 3% of HPH (i.e., disturbance threshold for each DAU by HPH).</p> <p>Anthropogenic features include but are not limited to paved highways, graded gravel roads, transmission lines, substations, wind turbines, solar developments, oil and gas wells, geothermal wells and associated facilities, pipelines, mines. The following would be excluded from the disturbance threshold calculation:</p> <ul style="list-style-type: none"> • Existing developed agriculture. • Developed private lands that are no longer used by big game for crucial seasonal migrations (e.g., towns, airports, reservoirs) would be excluded. However, other dispersed disturbances would be considered (e.g., cabins, access roads, community gravel pits, etc.). <p>See Appendix H for Disturbance Threshold Guidance. The footprint of the project is consistent with the disturbance management protocols identified in this plan.</p> <p>In areas where development does not exceed 3%, after first avoiding HPH, locate projects in proximity to existing oil and gas development and along access roads to cluster development and reduce footprint of new development. Avoid dispersed development where negative impacts to big game are anticipated.</p> <p>In areas where the disturbance threshold is already exceeded from any source, oil and gas leasing will not be open for further development in accordance with valid existing rights and waiver, exception, and modification criteria. Compared to Alternative C, these exceptions are more restrictive; BLM could authorize further oil and gas-related disturbances in very few circumstances. See Appendix E for the full waiver, exception, and modification criteria.</p> <p>For an area to no longer be considered disturbed under the threshold, the site must reach reclamation standards required by the approved APD.</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
20.	—	—	<p>MANAGEMENT ACTION – RECLAMATION - Guideline: Prioritize and reclaim/restore anthropogenic disturbances so that 3% or less of the total DAU is disturbed within 5 years, or until enough big game HPH has been restored to maintain the area under this threshold, subject to valid existing rights. For an area to no longer be considered disturbed under the threshold, disturbances need to be reclaimed, where technically and legally feasible (e.g., valid existing rights, split estate lands) consistent with BLM reclamation standards. The objective of long-term restoration/reclamation is to make big game HPH areas with disturbance least impactful for critical big game seasonal migratory patterns and habitat use.</p>	<p>MANAGEMENT ACTION: Require reclamation/restoration of big game HPH as a viable long-term goal to reclaim/restore anthropogenic disturbances so that 3% or less of the total DAU is disturbed within 5 years, or until enough big game HPH has been restored to maintain the area under this threshold, subject to valid existing rights. For an area to no longer be considered disturbed under the threshold, disturbances need to be reclaimed, where technically and legally feasible (e.g., valid existing rights, split estate lands). The objective of long-term restoration/reclamation is to make big game HPH areas with disturbance least impactful for critical big game seasonal migratory patterns and habitat use.</p> <p>In HPH, to keep habitat disturbance at a minimum, a phased development approach should be applied to fluid mineral operations, wherever possible, consistent with the rights granted under the lease. Disturbed big game HPH areas should be reclaimed within 6 months of well plugging, per Onshore Order #1 (XII. B.).</p>
21.	<p>MANAGEMENT ACTION, WRFO: In wildlife movement corridors defined by CPW, modified siting of surface facilities and application of activity restrictions (i.e., up to 60-day activity deferment) would be used, where appropriate, as a management tool to enable secure big game movement between and within seasonal ranges.</p> <p>ALLOWABLE USE: STIPULATION CSU/SSR, UFO: CSU-62: Surface occupancy or use may be restricted in big game winter, migration, and production areas, as mapped in the RMP, BLM’s GIS database, or other maps constituting the best available information as provided by local, state, federal, or tribal agencies that are accepted by the BLM.</p> <p>Prior to surface disturbance within big game severe winter range/winter concentration areas, migration, and production areas, the BLM will require the applicant to develop a mitigation plan in coordination with BLM and CPW, in conformance with applicable state requirements, rules, and regulations, as a component of the Application for Permit to Drill– Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the mitigation plan (with conditions, as appropriate) or has determined, after coordination with CPW, that a mitigation plan is unnecessary. The mitigation plan must demonstrate, to the Authorized Officer’s satisfaction, that the overall function and suitability of big game winter ranges, migration, and production areas will not be impaired. This may include special design, construction, and implementation measures, including relocation of operations by more than 200 meters (656 feet). Measures included in the Surface Use Plan of Operations may include, but are not limited to, limitations</p>	<p>MANAGEMENT ACTION: New oil and gas locations in big game HPH require a BLM-approved Wildlife Mitigation Plan or other BLM-approved conservation plan and compensatory mitigation plan consistent with state oil and gas regulations. This may include special design, construction, and implementation measures, including relocation of operations by more than 200 meters (656 feet). Measures included in the Surface Use Plan of Operations may include, but are not limited to, limitations to surface disturbance density through efficient planning of facilities, roads, and well locations; minimization of routine truck traffic associated with well/facility visits through use of remote sensing/control and pipelines to transport liquids; avoidance of visits during certain hours during the winter season; and limitations on noise.</p>	Same as Alternative B.	Same as Alternative B. and C.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
21. (cont.)	to surface disturbance density through efficient planning of facilities, roads, and well locations; minimization of routine truck traffic associated with well/facility visits through use of remote sensing/control and pipelines to transport liquids; avoidance of visits during certain hours during the winter season; and limitations on noise. ALLOWABLE USE: STIPULATION CSU/SSR, GJFO: CSU-10: Require proponents of surface-disturbing activities to implement specific measures to mitigate impacts of operations on wildlife and wildlife habitat within high-value or essential wildlife habitat. Measures will be determined through biological surveys, onsite inspections, effects of previous actions in the area, and BMPs.	(See above.)	(See above.)	(See above.)
22.	Existing guidance for development plans would be maintained in existing RMPs, if applicable. Such as WRFO RMPA to encourage industry to submit development plans that would direct time referenced, managed activities intended to concentrate development, promote effective reclamation, and to reduce the cumulative adverse resource effects attributable to oil and gas activities.	Same as Alternative A.	Same as Alternative A.	MANAGEMENT ACTION: In Non-HPH Areas, require a mitigation plan where activities have the potential to be disruptive to big game.
23.	—	ALLOWABLE USE: Allow for the use of conservation measures not identified in this document following analysis in a site-specific NEPA document (see Yates Petroleum Corp., 176 IBLA 144 (2008) and William P. Maycock, 177 IBLA 1 (2009)).	Same as Alternative B.	Same as Alternative B and C.
24.	—	No similar action.	No similar action.	—
Leased Federal Oil and Gas- BLM Surface – Allocations, Allowable Uses, and Management Actions				
25.	—	MANAGEMENT ACTION: Apply conditions of approval (COAs) to operational approvals (e.g., APDs) as determined necessary by the authorized officer to protect other resources and values within the terms, conditions and stipulations of the lease contract. Within big game HPH on leased federal fluid mineral estate, apply these COAs when approving APDs, consistent with applicable law and lease terms. See Appendix E for examples of COAs.	Same as Alternative B.	Same as Alternative B and C.
26.	—	MANAGEMENT ACTION: When authorizing development of oil and gas fluid mineral resources in HPH, work with the operator to minimize impacts to HPH, such as locating facilities in non-HPH areas first.	Same as Alternative B.	Same as Alternative B and C.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
27.	<p>ACTION, LSFO: Medium Priority Habitats, Existing Leases For existing oil and gas leases at the time of the ROD, participation in this approach will be voluntary. A valid existing lease conveys certain rights of development to the leaseholder. A stipulation cannot be added to an existing lease after the lease is issued. Oil and gas operators could opt into an agreement to limit surface disturbance to 5 percent of the project area and submit a Plan of Development (POD) which illustrates a strategy to keep large blocks of habitat undeveloped. In return, BLM will grant exceptions to big game and sage-grouse timing limitation stipulations, allowing larger windows for development (drilling, completions and construction). If a proposal and/or operator meets both criteria, BLM will grant an exception to big game winter range and sage-grouse nesting and critical winter range timing stipulations for all APDs in the project area (as described below), allowing a larger window for development. Until these criteria are met, timing limitation stipulations will apply as stated on leases. This agreement does not pertain to the NSO stipulation around sage-grouse leks or timing stipulations for raptors and other species, which will remain in effect. For these stipulations, as well as stipulations on leases which are not subject to this voluntary agreement, BLM could grant exceptions, modifications, or waivers through normal procedures as described in Appendix B. The agreement must be adhered to for the life of the leases in the project area. Approval of exceptions to big game and sage-grouse timing limitation stipulations for year-round drilling will require active monitoring for compliance with the conditions of approval outlined in the voluntary agreement. Operators must continually meet these criteria throughout development of the project area, or the authorization for the exception of timing stipulations will terminate. Compliance history will be a factor in approving this tradeoff for future development. If an operator were to breach the agreement, BLM will not allow the same operator to enter into this agreement again. For operators who choose not to opt into this voluntary approach in medium potential habitats, BLM will require habitat protection BMPs. Appropriate BMPs will be required as COAs on drilling applications on existing leases within medium priority habitats not enrolled in a voluntary surface disturbance limiting agreement. BMPs could include, but will not be limited to, the practices.</p> <p>High Priority Habitats, Existing Leases: The approach will be the same as medium priority habitats. For existing oil and gas leases at the time of the ROD, participation in this approach will be voluntary. If an operator chooses to opt into an agreement, they will have to develop a plan which keeps surface disturbance below 5 percent and creates large refuges of undeveloped habitat. As an incentive to enter into this approach, BLM will grant an exception to big</p>	<p>MANAGEMENT ACTION: In big game HPH areas, when evaluating an APD on an existing lease, ensure that operators avoid, minimize, and mitigate surface disturbances and disruptive activities consistent with the rights granted in the lease. Selection and application of these measures shall be based on current science and research on the effects to big game seasonal habitats and movement.</p> <p>For proposed operations in HPH, the Surface Use Plan of Operations (SUPO) (see 43 CFR 3162.3-1(f)) shall address, at a minimum, the road and drill pad location, details of pad construction, methods for containment and disposal of waste material, plans for surface reclamation, and other pertinent data. Data pertinent for evaluating potential impacts to big game, may include, but are not necessarily limited to, the anticipated noise, amount of disturbance, mechanical movement (e.g., pump jacks), permanent and temporary facilities, ancillary pads, pipelines, powerlines, traffic, phases of development over time, offsite mitigation, and expected periods of use associated with the proposed project. Seasonal habitats or project features related to potential big game impacts that are not addressed in the SUPO based on site-specific or project-specific considerations would be analyzed through an environmental assessment for the proposed action. The BLM will work with project proponents in these situations to promote measurable big game objectives such as, but not limited to, consolidation of project related infrastructure to reduce habitat fragmentation and loss and to promote effective conservation of big game HPH and connectivity areas that support population management objectives set by the State. In cases where federal oil and gas leases have been issued with stipulations varying from Alternative B for the conservation of big game, being provided in the applicable RMPA decision, as amended, their inclusion as permit COAs would be considered when approving oil and gas exploration and development activities through completion of the environmental record of review (43 CFR 3162.5 and 36 CFR 228.108), including appropriate documentation of compliance with NEPA.</p>	<p>MANAGEMENT ACTION: In big game HPH areas when approving the Surface Use Plan of Operation (SUPO) portion of the APD on existing leases, work with operators to avoid, minimize, and mitigate surface disturbances and disruptive activities consistent with the rights granted in the lease. On BLM surface lands, encourage compliance by lessees and operators with the decisions of the RMPA to be incorporated as design features.</p> <p>Existing fluid minerals leases under BLM surface will not be modified with the same flexibility afforded to existing leases on split-estate lands. Apply COAs to the APD based on site-specific conditions, current science, and coordination among the leaseholder and BLM.</p>	Same as Alternative B.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
27. (cont.)	<p>game and sage-grouse timing stipulations if the operator complies with the two criteria described below. For operators who choose not to opt into this voluntary approach in high potential habitats, BLM will require habitat protection BMPs. Appropriate BMPs will be required as COAs on drilling applications on existing leases within high priority habitats not enrolled in a voluntary surface disturbance limiting agreement. BMPs could include, but will not be limited to, the practices listed in Section 2.6 (special status species management).</p> <p>ACTION, GREATER SAGE-GROUSE FINAL SUPPLEMENTAL EIS (2020): P-MR-8: Within 1 mile of active leks, disturbance, disruptive activities and occupancy are precluded. If it is determined that this restriction would render the recovery of fluid minerals infeasible or uneconomic, considering the lease as a whole, or where development of existing leases requires that disturbance density exceeds 1 disturbance per 640 acres, and/or 3 percent disturbance cap, use the criteria below to site proposed lease activities to meet Greater Sage-Grouse habitat objectives and require mitigation as described in Appendix G [of the 2015 Final EIS] (Greater Sage-Grouse Mitigation Strategy).</p>	(See above.)	(See above.)	(See above.)
28.	—	<p>MANAGEMENT ACTION - Guideline: On existing leases, operators should be encouraged to reduce disturbance within HPH. At the time of approval of the Surface Use Plan of Operation portion of the Application for Permit to Drill, terms and conditions should be included to reduce disturbance to big game and their habitat, where appropriate and feasible and consistent with the rights granted to the lessee.</p>	<p>MANAGEMENT ACTION - Guideline: On existing leases, operators should be encouraged to reduce disturbance within HPH. At the time of approval of the Surface Use Plan of Operation portion of the Application for Permit to Drill, Required and Preferred Design Features and BMPs should be included to reduce disturbance to big game HPH where appropriate and feasible and consistent with the rights granted to the lessee.</p>	Same as Alternative C.
29.	—	<p>MANAGEMENT ACTION: In HPH, when wells are successfully plugged and abandoned and/or facilities are decommissioned and removed from a site, require reclamation measures to ensure short-term ecological stability and functionality and to meet long-term big game HPH objectives as COAs to either the Notice of Intent to Abandon or Subsequent Report to Plug and Abandon).</p>	Same as Alternative B.	<p>MANAGEMENT ACTION: Same as Alternative B and a reclamation bond would be required on all projects that is commensurate with the scope, scale, and size of the project within HPH. Partial bonding may be appropriate.</p>
30.	—	<p>MANAGEMENT ACTION: Locate compressor stations on portions of a lease that are non-HPH and where there would be no direct, indirect, or cumulative effects on big game or HPH. If this is not possible, work with the operator to use mufflers, sound insulation, or other design features to reduce noise and light.</p> <p>In HPH, place infrastructure in already disturbed locations to the extent feasible.</p>	Same as Alternative B.	Same as Alternative B.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
31.	—	MANAGEMENT ACTION – Guideline: On existing leases in HPH, when surface occupancy cannot be restricted due to valid existing rights or development requirements, disturbance and surface occupancy should be limited to areas least harmful to big game, based on vegetation, topography, or other habitat features.	MANAGEMENT ACTION – Guideline: On existing leases in HPH, when surface occupancy cannot be restricted due to valid existing rights or development requirements, disturbance and surface occupancy should be limited to areas least harmful to big game, based on vegetation, topography, or other habitat features. Avoid overdevelopment on private lands.	Same as Alternative B.
32.	—	MANAGEMENT ACTION Encourage use of multi-well pad locations and directional and horizontal drilling to reduce surface disturbance.	Same as Alternative B.	Same as Alternative B.
33.	—	Same as Alternative A.	MANAGEMENT ACTION: On leases in HPH, consider and encourage master development plans for oil and gas when projects involve potential high disturbance in HPH.	MANAGEMENT ACTION: To ensure comprehensive planning relative to big game conflicts, Master Development Plans would be required to be completed during planning and review of projects involving multiple proposed disturbances within a lease or HPH. Development plans will be required to conform to objectives of this plan to minimize disturbance through multi-well development, co-location and expansion of existing facilities, clustering locations to retain unfragmented HPH, etc.
Leased Federal Oil and Gas-Split-Estate – Management Actions				
34.	GJFO: RECREATION PARKS NSO CO: Prohibit surface occupancy and use within the boundaries of the following county parks, state parks, state wildlife areas, federal wildlife refuges, and/or National Park Service units: <ul style="list-style-type: none"> • Horsethief Canyon State Wildlife Area (1,400 acres) • Jerry Creek Reservoir State Wildlife Area (870 acres) • Plateau Creek State Wildlife Area (1,400 acres) • Highline State Park (350 acres) • Vega State Park (2,000 acres) 	MANAGEMENT ACTION: Where the federal government owns the mineral estate and the surface is under nonfederal ownership (e.g. state or private land surface ownership) (“split estate”), the same COAs, conservation measures and design features that are applicable to the development of federal mineral estate under BLM-administered surface lands within big game HPH would apply to the maximum extent permissible under existing authorities and consistent with lease terms, in coordination with the mineral lessee and surface owner.	MANAGEMENT ACTION: Apply appropriate COAs, conservation measures and design features to the maximum extent permissible under existing authorities and consistent with lease terms, in coordination with the mineral lessee and surface owner. Where the federal government owns the surface and the mineral estate is in non-federal ownership, appropriate BMPs would be applied to surface development. See Appendix E for examples of BMPs.	MANAGEMENT ACTION: Same as Alternative B. Where the federal government owns the mineral estate and the surface is non-federal ownership, the same conservation measures would be applied as those applied on public land.

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
Exceptions to lease stipulations – Leased and Unleased Oil and Gas Fluid Mineral Estate				
35.	<p>Exceptions, waivers, and modifications (WEMs) to lease stipulations, COAs, and terms and conditions (T&C), etc. for big game will continue to be considered on a case-by-case basis consistent with approved RMPs.</p>	<p>ALLOWABLE USE: Unleased - WEMs: The BLM would allow oil and gas leasing consistent and subject to the leasing stipulations and density restrictions identified in Alternative B. Allow for Exceptions, Waivers, and Modifications in big game HPH by the Authorized Officer.</p> <p>The Authorized Officer may grant an exception to an oil and gas lease stipulation, including NSO, where the proposed action:</p> <ul style="list-style-type: none"> • Would have negligible or nominal direct, indirect, or cumulative effects on big game or HPH is proposed to be undertaken as an alternative to a similar action occurring on a nearby parcel subject to a valid federal oil and gas lease existing as of the date of this RMP amendment, and would provide a clear conservation benefit to big game or areas of public lands. • In areas of mixed ownership where federal minerals underlie less than 20 percent of the total surface of the lease. • Exceptions based on conservation benefit must also include measures sufficient to allow the BLM to conclude that such benefits will endure for the duration of the proposed action's impacts. <p>The Authorized Officer may NOT grant an exception unless the BLM, in coordination with CPW, finds that the proposed action satisfies the above. Such finding shall initially be made by a team of one field biologist or other expert from each respective agency. In the event the initial finding is not unanimous, the finding may be elevated to the appropriate senior official for final resolution. In the event their finding is not unanimous, the exception will not be granted.</p>	<p>ALLOWABLE USE: Unleased – WEMs: The BLM would allow oil and gas leasing consistent and subject to the leasing stipulations, density restrictions, and disturbance limitations identified in Alternative C. Allow for exceptions, waivers, and modifications to lease stipulations by the Authorized Officer with flexibility afforded to lands in the decision area where the federal government owns the mineral estate and the surface is under nonfederal ownership (e.g. private land surface ownership).</p> <p>The Authorized Officer may consider and allow for Exceptions, Waivers, and Modifications where:</p> <ul style="list-style-type: none"> • The restriction will result in a larger cumulative impact to the resource of concern than avoidance. • Exceedances of density or disturbances thresholds would not have a cumulative adverse effect to big game habitat in accordance with best available science, or contingent on development remaining within the density or disturbance thresholds. • The proposed action would have negligible or nominal direct, indirect, or cumulative effects on big game populations or HPH. • Managing for a 3% disturbance threshold is determined to not have a benefit to big game populations or HPH for a given area based on best available science and local conditions (e.g., landscape diversity and structure, land ownership patter, level of existing disturbance, herd adaptation and characteristics such as level of use, existing fragmentation of HPH, forage availability), as approved by BLM in coordination with CPW. • Another disturbance or density threshold has been determined appropriate for the area, in which the threshold has been approved by BLM in coordination with CPW. • Areas of mixed ownership where federal minerals underlie less than 50 percent of the total surface of the lease. 	<p>ALLOWABLE USE: Unleased – WEMs: The BLM would allow oil and gas leasing consistent and subject to the leasing stipulations, density restrictions, and disturbance limitations identified in Alternative D. Allow for exceptions, waivers, and modifications to lease stipulations in big game HPH by the State Director, except no waivers or modifications to a NSO stipulation will be granted.</p> <p>For all other non-NSO stipulation requirements of Alternative D, allow for Exceptions, Waivers, and Modifications with the following exception criteria where the proposed action:</p> <ul style="list-style-type: none"> • Would have negligible or nominal direct, indirect, or cumulative effects on big game or HPH. • Is proposed to be undertaken as an alternative to a similar action on a nearby parcel subject to a valid federal oil and gas lease existing as of the date of this RMP amendment, and would provide a clear conservation benefit to big game or areas of public lands. • Another disturbance or density threshold has been determined appropriate for the area and approved by BLM in coordination with CPW. • In an area of mixed ownership where federal minerals underlie less than 20 percent of the total surface of the lease. • Exceptions based on conservation benefit must also include measures sufficient to allow the BLM to conclude that such benefits will endure for the duration of the proposed action's impacts.
36.	—	<p>ALLOWABLE USE - Unleased - WEMs: If an Exception, Waiver, or Modification is granted by the Authorized Officer, then apply appropriate ground disturbance and mitigation standards.</p>	<p>ALLOWABLE USE - Unleased - WEMs: If an Exception, Waiver, or Modification is granted by the Authorized Officer, require appropriate conservation measures as conditions of approval, and coordinate with operators to encourage appropriate design features. When applying appropriate ground disturbance and mitigation standards, flexibility will be afforded to split-estate lands where the surface is held in private ownership.</p>	<p>ALLOWABLE USE - Unleased - WEMs: If an Exception, Waiver, or Modification is granted by the State Director, then apply appropriate ground disturbance and mitigation standards with the addition that exceptions would be contingent on development remaining within the thresholds for cumulative adverse effects to big game (evaluated by total lease holdings within a DAU).</p>

Line #	Alternative A (No Action)	Alternative B (Conservation and Cooperation)	Alternative C (Enhanced Conservation; Balanced Use for Split-Estate)	Alternative D (Greatest Conservation)
37.	—	No similar action.	No similar action.	MANAGEMENT ACTION: As existing fluid mineral leases expire or terminate, parcels within big game HPH in identified areas exceeding the 3% surface disturbance threshold would not be offered for lease, including in areas of mixed (e.g., checkerboard) Federal and private surface and/or mineral ownership. In this case, BLM may consider a plan amendment to open the big game HPH area for new leasing. The plan must demonstrate long-term benefits to big game HPH or migratory movement in the proposed area through mitigation (prior to issuing the lease) including lease stipulations, offsite mitigation, etc., and avoid short-term losses that threaten achievement of big game objectives.
38.	—	<i>No similar action because no additional closures are proposed.</i>	—	ALLOWABLE USE: Unleased – WEMs: When there is an opportunity for the BLM to influence conservation measures where surface and/or mineral ownership is not entirely federally owned (such as in checkerboard ownership), BLM may consider a plan amendment to close big game HPH areas to new leasing. The plan must demonstrate long-term benefits to big game HPH or migratory movement in the proposed area through mitigation (prior to issuing the lease) including lease stipulations, offsite mitigation, etc., and avoid short-term losses that threaten achievement of objectives for big game.
39.	Lands and Realty Management Actions Associated with Oil and Gas Fluid Minerals Infrastructure/Associated Facilities			
40.		ALLOWABLE USE: Stipulations identified in Alternative B could be applied as Terms and Conditions to new oil and gas-associated authorizations and rights of ways (e.g. ROW approvals for roads, pipelines, and ancillary facilities). When in big game HPH, apply terms and conditions to oil and gas land use authorizations to ensure development and operation of oil and gas occurs in an environmentally responsible manner.	ALLOWABLE USE: Stipulations identified in Alternative C could be applied as Terms and Conditions to new oil and gas-associated authorizations and rights of ways (e.g. ROWs approvals for roads, pipelines, and ancillary facilities).When in big game HPH, apply the minimum amount of terms and conditions necessary to oil and gas land use authorizations to meet demand.	ALLOWABLE USE: Stipulations identified in Alternative B could be applied as Terms and Conditions to new oil and gas-associated authorizations and rights of ways (e.g. ROWs approvals for roads, pipelines, and ancillary facilities). Avoid oil and gas-related authorizations in big game HPH.
41.	Management Decisions for oil and gas ROWs in existing RMPs would be carried forward in the RMPA.	ALLOWABLE USE: Areas subject to NSO under Alternative B would be classified as avoidance areas for new oil and gas-associated land use authorizations. The remainder of the decision area would be classified as open to land use authorizations, subject to existing RMP decisions and goals and objectives of this plan.	Same as Alternative B.	ALLOWABLE USE: Areas subject to closure, NSO, CSU, or TL under Alternative D would be classified as exclusion areas for new oil and gas-associated land use authorizations.

2.9 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Table 2-9 below presents a summary of the environmental consequences of each alternative considered in this EIS. A detailed analysis of each alternative for the resources below is presented in Chapter 3.

Table 2-9. Summary of Environmental Consequences

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Physical Environment				
Geology and Fluid Minerals	Leasing and development of fluid minerals would continue at a similar rate and in a similar manner to current conditions. Existing RMPs include stipulations intended to protect all resources, not just big game, and these stipulations would be carried forward under Alternative A as well as all of the action alternatives.	The CSU associated with the density disturbance threshold could increase development costs and could require a change in mitigation locations. Encouraging the use of master development plans could improve development efficiency by obliging operators to consider the most efficient layout and order of development, but could also increase planning time and costs associated with development. The application of major constraints would be approximately the same as under Alternative A, and minor constraints would be similar, so impacts on fluid minerals resources would be approximately the same as under Alternative A.	Impacts from the density disturbance threshold would be the same as described for Alternative B. The application of the 3 percent surface disturbance threshold could also result in increased costs of development associated with avoiding, or seeking waivers, exceptions, and modifications in areas where the 3 percent surface disturbance threshold has been reached, and if waivers, exceptions, and modifications are not granted, oil and gas development might be prevented from occurring in some areas or pushed onto adjacent private lands. Requiring master development plans and clustering development would likely result in increased drilling time and costs associated with using directional or horizontal drilling in place of vertical drilling, or increased costs associated with mitigation if directional drilling is not feasible.	Impacts from the density disturbance threshold would be the same as described for Alternative B. Impacts from requiring master development plans and clustering development would be the same as described for Alternative C. Closure of additional areas having no known, low, or moderate oil and gas development potential within big game HPH is not expected to result in a large reduction in future oil and gas production. This is because most future oil and gas development is expected to occur in high oil and gas development potential areas and the closures would be in areas with no known, low, or moderate oil and gas development potential. Calculating the 3 percent surface disturbance threshold based on disturbance on all land ownership types would mean that development of federal fluid minerals would be less likely to occur in areas with existing density at or above the threshold.
Air Quality and Related Values, and Greenhouse Gas Emissions	<i>To be completed when the impacts analysis for air quality is finished.</i>	<i>To be completed when the impacts analysis for air quality is finished.</i>	<i>To be completed when the impacts analysis for air quality is finished.</i>	<i>To be completed when the impacts analysis for air quality is finished.</i>
Climate	<i>To be completed when the impacts analysis for climate is finished.</i>	<i>To be completed when the impacts analysis for climate is finished.</i>	<i>To be completed when the impacts analysis for climate is finished.</i>	<i>To be completed when the impacts analysis for climate is finished.</i>
Noise and Acoustic Environment	Noise generated from oil and gas activities would continue to occur in areas of current and future development. Specific timing limitations or site-specific operation hours would continue and help mitigate noise generated from oil and gas activities where they are applied. NSO and CSU stipulations in areas open to fluid mineral leasing would continue to help mitigate sound pollution from oil and gas activities in the decision area. Timing limitations could help to mitigate potential noise pollution to big game species on 67.5 percent of open fluid mineral leasing areas that occur in HPHs by limiting disturbances to certain hours of the day; prevent development over a period, seasonal restrictions, or reproductive seasons.	Additional NSO, CSU, and TL stipulations would help mitigate noise pollution generated from oil and gas industry and associated transportation activities. These additional stipulations would reduce noise impacts on human and nonhuman populations compared with Alternative A. Alternative B would have a 181.4 percent and 22.9 percent increase in CSU or timing limitations compared with Alternative A.	Impacts on noise and the acoustic environment under Alternative C would be similar to those as described under Alternative B.	Closing 60.9 percent of big game HPH to fluid mineral leasing under Alternative D would lead to over a three-fold increase in closed fluid mineral leasing areas in big game HPH compared with Alternative A. There would be a decrease in noise pollution in big game HPH from drilling infrastructure because more acres would be closed to the development of fluid minerals. Big game species would have a larger area to travel without the interference of noise pollution from oil and gas activities, resulting in an overall quieter soundscape compared with Alternative A.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Soil Resources	<p>The amount of authorized and pending oil and gas facilities open to fluid mineral leasing under Alternative A falls largely in fragile soils areas. Areas that are closed to leasing or have the most restrictive NSO stipulations that would prevent surface disturbance to potentially fragile soils cover the fewest acres under Alternative A.</p> <p>Areas closed to oil and gas leasing from recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSR designations would limit impacts to soils in those areas.</p>	<p>Impacts to fragile soils would be less than Alternative A, due to the “1 in 640” surface disturbance density evaluation that would decrease impacts in HPH, in addition to the inclusion of more acres of fragile soils with CSU limitations.</p> <p>Areas closed to oil and gas leasing from recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSR designations are the same as under Alternative A.</p>	<p>Impacts to soils are expected to be the same as Alternative B, as there are no changes to closures or major constraints (NSOs) or moderate stipulations (CSU and TL) acreages. The 3 percent disturbance threshold under Alternative C would limit impacts across a landscape scale, and the potential for impacts to fragile soils would be dispersed across a larger area.</p> <p>There would be no change in areas closed to oil and gas leasing from recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSR designations as compared to Alternative A.</p>	<p>Alternative D includes the most acres of fragile soils that would be protected from oil and gas development by closure and NSO. Moderate stipulations (CSU and TL) under Alternative D that would limit the degree of impacts to fragile soils cover more acres than Alternative A, though fewer than Alternatives B and C.</p> <p>Alternative D would include the greatest number of areas closed to oil and gas leasing from designations such as recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSRs. These protective designations would also cover the most acres of fragile soils under Alternative D.</p>
Biological Resources				
Big Game Species	<p>NSO, CSU, and TL stipulations would continue to be attached to oil and gas leases, and management emphasis for big game would continue to be defined for some areas according to objectives set forth in existing RMPs. However, planning and prioritization would lack the regional focus provided by the other action alternatives, and big game habitats would continue to be managed with less recognition of regional contexts and current CPW and ECMC recommendations. Therefore, big game abundance, distribution, habitat permeability, and condition would continue to be variable by field office across BLM Colorado.</p>	<p>The increase in acres subject to NSO, CSU, and TL stipulations under Alternative B would reduce impacts on big game, such as habitat fragmentation, mortality, injury, or displacement, from oil and gas development compared with Alternative A. The surface disturbance density limitation would help to reduce fragmentation and increase permeability of HPH.</p>	<p>The impacts from NSO, CSU, and TL stipulations and the surface disturbance density evaluation would be the same as those described for Alternative B. The 3 percent surface disturbance threshold would reduce impacts to big game and HPH by reducing habitat fragmentation, increasing habitat permeability, and helping to mitigate impacts from direct and indirect habitat loss to a greater extent than under Alternatives A or B.</p>	<p>Impacts from the surface disturbance density evaluation would be the same as those described for Alternative B. Closing additional areas to oil and gas development would protect over half of each big game HPH type in the decision area from disturbance and habitat degradation associated with oil and gas development.</p> <p>Incorporating private lands into the 3 percent surface disturbance threshold and providing less flexibility for waivers, exceptions, and modifications would result in the most stringent restrictions on fluid mineral leasing within big game HPH in the decision area and would therefore provide the most protection to big game and HPH out of all the alternatives.</p>
Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds	<p>The continuation of new leases and permits and oil and gas development activities would result in habitat loss and fragmentation and the potential for injury, mortality, disturbance, and displacement to special status species and other wildlife. Management within existing RMPs would reduce the likelihood for impacts. Under Alternative A, 456,000 acres of greater sage-grouse management area and 137,000 acres of Gunnison sage-grouse habitat would remain closed to fluid mineral leasing. Designated and proposed critical habitat for five special status species, covering 165,000 acres, would remain closed to fluid mineral leasing.</p>	<p>The increase in areas subject to NSO, CSU, and TL stipulations would increase protections to wildlife and special status species, particularly those species associated with pinyon-juniper, upland big sagebrush, and mountain shrub vegetation types compared with Alternative A. The total acres open and closed to fluid mineral leasing would remain the same as Alternative A.</p> <p>The surface disturbance density evaluation would help maintain large blocks of connected habitat with minimal disturbance, which would reduce the potential for loss of habitat features and functionality compared with Alternative A.</p>	<p>The impacts from NSO, CSU, and TL stipulations and the surface disturbance density evaluation would be the same as those described for Alternative B. The total acres open and closed to fluid mineral leasing would remain the same as Alternative A.</p> <p>The 3 percent surface disturbance threshold would further reduce impacts on special status species and other wildlife compared with Alternatives A and B by reducing the overall level of habitat loss, fragmentation, and disturbance. However, private lands would not apply to the surface disturbance threshold calculation, so disturbances in these areas could detract from overall habitat availability, connectiveness, and functionality. Further, waivers, exceptions, and modifications to the 3 percent surface disturbance threshold could increase impacts to wildlife and special status species by contributing to disturbance and habitat loss or alterations.</p>	<p>The closure of additional areas to fluid mineral leasing under Alternative D would result in closures of 848,000 acres of greater sage-grouse habitat management areas and 696,000 acres of Gunnison sage-grouse habitat. Designated and proposed critical habitat for seven special status species, covering 663,000 acres, would be closed to fluid mineral leasing.</p> <p>Impacts from the surface disturbance density evaluation would be the same as those described for Alternative B. Incorporating private lands into the surface disturbance threshold and reducing flexibility for waivers, exceptions, and modifications under this alternative would result in a lower overall level of disturbance and the potential for impacts such as behavioral disturbance and habitat alterations would be reduced compared with Alternative C. Overall, Alternative D would have the most stringent restrictions on fluid mineral leasing in the decision area and would therefore provide the most protection to wildlife and special status species out of all the alternatives.</p>

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Vegetation	In areas open to fluid mineral leasing, vegetation would continue to be affected from oil and gas development across BLM-administered lands in Colorado through such impacts as vegetation removal, degradation of vegetation conditions, and facilitation of invasive plant introduction and spread. There would continue to be new leases and permits which could increase the overall impact on vegetation across the decision area.	Impacts from managing areas as open and closed to fluid mineral leasing would be the same as described for Alternative A. The surface disturbance density limitation would protect vegetation from surface disturbance due to oil and gas development to a greater extent than Alternative A. Vegetation condition would be maintained overall compared to the No Action Alternative.	Impacts from managing areas as open and closed to fluid mineral leasing would be the same as described for Alternative A. Impacts from the surface disturbance density limitation would be the same as described for Alternative B. The addition of the 3 percent disturbance threshold in Alternative C would limit impacts on vegetation across a landscape scale, and the potential for disturbance would be dispersed across a larger area. When compared with Alternative A, the concentration of localized disturbance would increase impacts on individual plants, but would decrease impacts across vegetation populations and communities.	Alternative D would propose additional closures to oil and gas development. Similar to Alternative C, Alternative D would implement the 3 percent surface disturbance threshold with a more restrictive application, including less flexibility for waivers, exceptions, and modifications. When compared to Alternative A and the other action alternatives, Alternative D would reduce the impacts on vegetation from oil and gas development to the greatest extent.
Social Systems				
Native American Religious Concerns	Under all alternatives, ongoing trends including oil and gas development, better access, increasing recreational use, and more human activity in the planning area could result in direct disturbance or alterations to resources important to tribal communities today. Under all alternatives, oil and gas closures and stipulations like NSO, CSU, and TL could reduce impacts on Native American religious concerns or tribal interests, although this could also reduce Tribes' access to sacred sites or areas of economic and resource rights. The severity of impacts will be determined by federally recognized Tribes defining what is culturally or spiritually important to them. Under all alternatives, the BLM would continue to manage BLM-administered lands and resources in a manner that accommodates Native American communities, including their religious traditions, practices, and beliefs.			
	Under Alternative A, the potential for disturbance and access impacts from leasing and ongoing development would not change, and there would continue to be new leasing and permitting in areas open to leasing. Management under Alternative A would produce the greatest impacts among the alternatives.	Under Alternative B, the acreage closed to leasing would be the same as those under Alternative A, however, areas open to leasing with NSO, CSU, and TL stipulations would increase and the surface disturbance density evaluation would limit the density of potential disturbances and facilitate avoidance of locations or resources important to Tribes. Alternative B would produce fewer impacts compared to Alternative A.	Under Alternative C, The potential for impacts on access, resources use, and sacred sites would be similar to Alternative B. The addition of a 3 percent disturbance threshold may facilitate further avoidance of disturbance in areas where resources may be present. Alternative C would produce fewer impacts compared to Alternatives A and B.	Under Alternative D, the fewest acres would be open to oil and gas development and the restrictions on fluid mineral leasing would be greatest among the alternatives. Alternative D would produce the fewest impacts on Native American religious concerns and tribal interests out of all the alternatives.
Cultural and Paleontological Resources	Under Alternative A, the potential for impacts from leasing and ongoing development would not change, and there would continue to be new leasing and permitting in areas that are open to it. Surface disturbing activities related to permitted mineral development could have direct and indirect impacts on cultural and paleontological resources. Alternative A would produce the greatest impacts on cultural and paleontological resources among the alternatives.	Under Alternative B, the number of acres closed to mineral leasing would be the same as those under Alternative A and the potential for impacts on cultural and paleontological resources would be similar to Alternative A. However, areas open to mineral leasing with NSO, CSU, and TL stipulations would increase, reducing the potential for future surface disturbance associated with oil and gas development. Additionally, the surface disturbance density evaluation would limit the density of potential disturbances and facilitate avoidance of cultural and paleontological resource locations. Alternative B would produce fewer impacts compared to Alternative A.	Under Alternative C, the potential for ground-disturbing impacts on cultural and paleontological resources would be similar to Alternative B because the acreage closed to leasing, the acreage subject to stipulations, and the surface disturbance density evaluation would be the same. The addition of a 3 percent disturbance threshold may further facilitate avoidance of ground disturbance in areas where cultural and paleontological resources may be present. Alternative C would produce fewer impacts compared to Alternatives A and B.	Under Alternative D, the fewest acres would be open to oil and gas development and the most stringent restrictions for fluid mineral leasing among the alternatives would be adopted, including the surface disturbance density evaluation and 3 percent disturbance threshold. Alternative D would have the least potential for impacts on cultural and paleontological resources, compared to the other alternatives.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Socioeconomics	<p>On average, from 2030 to 2034, oil and gas revenue and well development in the state of Colorado is expected to result in about 19,548 jobs, \$2.9 billion in labor income, and \$6.7 billion in net economic output per year. The severance tax revenue under Alternative A could range from about \$41 million (from 2025 to 2029, with 2 percent rate) to \$130 million (from 2045 to 2050, with 5 percent rate), on average. The revenue from royalties, on average, is projected to be about \$343 million from 2025 to 2029 and \$433 million from 2045 to 2050.</p>	<p>The increase in acres subject to NSO, CSU, and TL stipulations and the surface disturbance density limitation might result in less production on federal lands and reduced mineral royalties. This could result in a reduction in regional net economic output, labor income, and employment, as compared to Alternative A.</p> <p>The increase in land subject to stipulations might increase the need for more horizontal and directional drilling, which might increase the cost and expenditures for drilling and well completion. This would result in higher net economic output, more jobs, and higher labor income.</p> <p>Under Alternative B, the reduction in oil and gas production, compared with Alternative A, could lead to a reduction in royalty revenue ranging from about \$230 thousand per year in 2045-2050 to \$5.9 million per year in 2030-2034, on average. Revenue from severance tax could decrease by a range of about \$28 thousand per year (from 2045 to 2050, with 2 percent rate) to about \$1.8 million (from 2030 to 2034, with 5 percent rate), on average, compared with Alternative A.</p>	<p>Impacts from stipulations and the surface disturbance density limitation would be the same as described for Alternative B. The three percent disturbance threshold could further limit the development of oil and gas on federal lands.</p>	<p>Impacts from the surface disturbance density limitation would be the same as described for Alternative B. Incorporating private lands into the three percent disturbance threshold may result in further reductions oil and gas development on federal and non-federal lands. The increase in acres closed to mineral leasing could result in a decrease in wells developed on federal lands. Compared to Alternative A, the reduction in oil and gas production could lead to a reduction in royalty revenue of as much as about \$6 million per year from 2030-2034, on average. This difference of royalty revenue under Alternative B compared with Alternative A would likely drop to a difference of about \$250 thousand per year from 2045-2050, as production per well is expected to diminish. Revenue from severance tax could reduce, under Alternative B, by about \$31 thousand per year (from 2045 to 2050, with 2 percent rate) to \$1.8 million (from 2030 to 2034, with 5 percent rate), on average.</p>
Environmental Justice	<p>Human health impacts could include increases in air pollution and degradation in air quality due to increases in fossil fuel use as a result of increased oil and gas developments. EJ communities, especially low-income populations, tend to live closer to more oil and gas developments, which means that these EJ populations would likely be disproportionately impacted by the continued development (McKenzie et al. 2016).</p> <p>Under Alternative A, with continued well development, big game habitat may be reduced, which could decrease availability of big game for subsistence. Due to the importance of subsistence on Tribes, EJ communities would be disproportionately impacted from reduced access to big game habitats.</p>	<p>The increase in the acreage of NSO, CSU, and TL stipulations and the surface disturbance density limitation under Alternative B could reduce the number of wells developed, which could reduce the impacts to the surrounding communities from well development and oil and gas operations, such as noise and visual resources, human health, and access to cultural, historical, and subsistence resources.</p> <p>If the management decisions under Alternative B were to result in reduced federal mineral development, then there could be a reduction in community revenue from federal royalty revenue and state tax distributions as well as other mineral related revenues. The potential for impacts would be the greatest in those communities which meet EJ qualifications.</p>	<p>Under Alternative C, the impacts on EJ communities from reduced adverse visual, noise, health effects, and subsistence use would likely be similar to those described under Alternative B. The three percent disturbance threshold could further limit the development of oil and gas on federal lands, which could support greater increases in human health impacts and subsistence use. EJ populations would likely benefit more than other populations due to their proximity to oil and gas developments and the importance of subsistence use to their cultural heritage, traditions, well-being, and livelihoods.</p>	<p>As a result of the density threshold and the increase in acres closed to leasing, more operators might decide to forgo oil and gas development on federal and non-federal lands, compared to the rest of the alternatives. If there are more reductions in oil and gas production and development, there could be greater impacts on the surrounding EJ communities stemming from reductions in visual and noise disturbance, reductions in air and water pollution, and improvements in subsistence use than under Alternative A. These impacts would likely benefit EJ communities more than other populations due their proximity to sites of oil and gas development.</p> <p>The reduction in federal mineral development could lead to a reduction in federal royalty revenue, state tax distributions, other mineral related revenues, and jobs associated with mineral development. This might adversely affect the local communities if there aren't other opportunities for revenue and jobs in the area.</p>

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Recreation	Impacts on the potential for future recreational opportunities and experiences would continue on 2,537,000 acres of recreation management areas, 162 miles of National Trails, and 146,000 acres of NLCS units that would remain open to fluid mineral leasing. Oil and gas development would limit the places available for recreation and the sights and sounds from oil and gas would take away from the naturalness and solitude of the environment, having on visitors' experiences. However, an increase in oil and gas leasing development would likely promote the construction of new roads open to the public which would increase access to recreation.	Under Alternative B, there would be 3,143,000 acres of recreation management areas, 250 miles of National Trails, and 312,000 acres of NLCS units that would be open to fluid mineral leasing. Although there would be an overall increase in acres open to fluid mineral leasing, these include increases in NSO, CSU, and TL stipulations, which would result in more restrictive management of oil and gas leasing and therefore recreational opportunities, experiences, and access would ultimately increase.	Impacts would be similar to those described for Alternative B. The addition of the 3 percent surface threshold would further reduce oil and gas development, enhancing recreational opportunities, experiences, and access in the decision area.	Fewer acres of recreation management areas (1,370,674 acres) would be open to leasing under Alternative D than Alternative A, and fewer acres of NLCS units (305,000 acres) would be open to leasing under Alternative D than Alternatives B and C, but not A. The number of miles of National Trails open to leasing would remain similar to Alternative A under Alternative D. Management would also include the most restrictive application of the 3 percent threshold. The additional closures and more restrictive management would cause Alternative D to have the most positive impact on recreational opportunities, experiences, and access of all the alternatives.
Travel and Transportation	Under all alternatives, the BLM would not change any travel designations in the decision area due to the scope of this RMPA/EIS. Anticipated future oil and gas development could result in an increase of oil and gas roads, with associated changes to the existing travel network. However, overall access is not expected to change, and no adverse effects on travel and transportation would occur.			
Visual Resources	Visual resources would continue to be impacted from oil and gas development by disrupting the form, line, color, and texture of the landscape, but would vary depending on VRM class objectives. Dust and artificial light from operations would decrease the visual distance and hide views and scenery from human observation. There would continue to be new leases and permits, but the impacts on visual resources would remain at their current level.	Impacts on visual resources from oil and gas development under Alternative B would be reduced by the increase in NSO, CSU, and TL stipulations and the surface disturbance density evaluation. Dust and artificial light would be limited to those areas of new and existing oil and gas development and their impact would be greatly decreased in the rest of the HPH.	Impacts from NSO, CSU, and TL stipulations and the surface disturbance density evaluation would be the same as described for Alternative B. The effects from dust and artificial light would be the same as under Alternative B, but would have the potential to be more dispersed with the landscape level scale of the 3 percent disturbance threshold.	Additional closures to oil and gas development under Alternative B would leave more areas free of oil and gas development, so there would be less of an overall impact on visual resources across the decision area from surface disturbances and construction of artificial structures. Fewer oil and gas developments would cause less disturbance to the line, color, and texture of the landscape and less artificial light and dust.
Lands and Realty	Land use authorizations would continue to follow the existing approved RMPs, as amended. Permits, leases, and ROWs would continue to be approved for oil and gas activities in the decision area based on planning guidance dependent on RMP jurisdiction. There would continue to be a lack of consistency across the decision area pertaining to oil and gas approvals, BMPs, and related big game HPH protections and stipulations.	Compared with Alternative A, the impact of management actions under Alternative B on lands and realty would be the limiting of available locations for land use authorizations by guiding oil and gas activities outside of HPH. Overall, Alternative B would likely result in fewer oil and gas-related land use authorizations than under Alternative A.	Impacts would be similar to those described for Alternative B, but the 3 percent surface disturbance threshold would further increase the complexity of implementation-level decision-making and could slow down the process of issuing land use authorizations for oil and gas development.	Impacts on lands and realty from Alternative D would be similar to Alternative C, but would be more acute due to increased closure of available land and a more restrictive application of the 3 percent surface disturbance threshold. As a result, there would be fewer opportunities for oil and gas-related land use authorizations within the decision area and, therefore, fewer authorizations administered by the BLM.

This page intentionally left blank.

Chapter 3. Affected Environment and Environmental Consequences

3.1 INTRODUCTION

The following sections describe current conditions and alternative-based impacts for each resource topic. The purpose of the affected environment sections is to describe the existing biological, physical, and socioeconomic characteristics of the planning area. The environmental consequences sections are analyses of the potential direct, indirect, and cumulative impacts, including human uses, that could result from implementing the alternatives described in **Chapter 2**. Maps not included directly in the text are provided in **Appendix D**, Maps. Acreage figures and other numbers are approximated using GIS technology and do not reflect exact measurements.

3.1.1 Cumulative Impacts

Evaluating potential cumulative impacts considers incremental impacts that could occur from implementing the alternatives together with impacts from past, present, and reasonably foreseeable future actions. These evaluations involve determinations that often are complex and, to some degree, subjective.

Cumulative Analysis Method

The cumulative impacts discussion that follows considers the alternatives in the context of the broader human environment, specifically actions that occur outside the scope or geographic area covered by the RMPA/EIS. The cumulative impact analysis is limited to important issues of national, regional, or local significance; therefore, not all resources identified for the direct and indirect impact analysis in the RMPA/EIS are analyzed for cumulative impacts.

Because of the programmatic nature of an RMPA/EIS and cumulative impacts assessment, the analysis tends to be broad and generalized. This allows BLM to examine the impacts that could occur from a reasonably foreseeable management scenario, combined with other reasonably foreseeable activities or projects; consequently, this assessment is primarily qualitative for most resources because of a lack of detailed project-scaled information at the planning stage.

Quantitative information is used whenever available and as appropriate to portray the magnitude of an impact. The analysis assesses the magnitude of cumulative impacts by comparing the environment in its baseline condition with the expected impacts of the alternatives and other actions in the same geographic area. The magnitude of an impact is determined through a comparison of anticipated conditions against the baseline, as depicted in the affected environment, or the long-term resilience of a resource or social system.

The following factors were considered in this cumulative impact assessment:

- Federal, Tribal, nonfederal, and private actions
- Potential for combined impacts or combined interaction between impacts
- Potential for impacts across political and administrative boundaries
- Other spatial and temporal characteristics of each affected resource
- Comparative scale of cumulative impacts across alternatives

Temporal and spatial boundaries used in the cumulative analysis are developed on the basis of resources of concern and actions that might contribute to an impact. The baseline year for the cumulative impacts analysis is 2023. The time frame of the cumulative effects analysis is the life of the RMPA, which is 20 years.

Spatial boundaries for cumulative impact analysis vary and are larger for resources that are mobile or that migrate, such as big game, compared with stationary resources, such as soil. Occasionally, spatial boundaries can be contained in the planning area. Spatial boundaries were developed to facilitate the analysis and are included in **Table 3-1** below.

Table 3-1. Cumulative Impacts Analysis Areas by Resource

Resource Category	Cumulative Impacts Analysis Area
Physical Environment	
Air Quality	Airsheds overlapping the planning area
Geology and Fluid Minerals	The planning area and all mineral estate within the planning area
Climate	Airsheds overlapping the planning area
Noise and Acoustic Environment	Sensitive receptors within the planning area
Soil Resources	Planning area
Paleontological Resources	Planning area
Biological Resources	
Big Game Species and Habitat	Big game HPH within the planning area
Special Status Species and Other Wildlife, including Terrestrial, Mammals, Fish, Aquatic Species, and Migratory Birds	Planning area
Vegetation	Planning area
Social and Economic Systems	
Native American Religious Concerns	Planning area
Cultural Resources	Planning area
Socioeconomics and Environmental Justice	Planning area
Recreation	Decision area
Visual Resources	Decision area
Lands, Realty, and Cadastral Survey	Planning area

Past, Present, and Reasonably Foreseeable Future Actions

Projects and activities identified as having the greatest likelihood to generate potential cumulative impacts when added to the Big Game Habitat Conservation RMPA/EIS alternatives are displayed in **Table 3-3**.

Table 3-2. Past, Present, and Reasonably Foreseeable Future Actions

Topic	Description
Oil and gas development	Past, present, and continued oil and gas leasing and development on BLM-administered lands as well as other federal and private, state, county, or local government lands.
Other mineral development	Development of other minerals such as locatable minerals, coal, nonenergy leasables, and salables.
Lands, realty, and cadastral survey	Land use authorizations for ROWs.
Livestock grazing and agriculture	Past, present, and continued on BLM-administered and other lands, including infrastructure such as fences, stock ponds, etc. Generally, demand has remained stable over the past 10 years.

Topic	Description
Travel and transportation	Continued use of roads and trails, both by motorized and nonmotorized users.
Recreation	Possible increase in use with increased populations in Colorado and interest in using public lands for recreation.
Road construction	Road construction and road maintenance have occurred in association with timber harvesting, historic vegetation treatments, energy development, and mining on BLM-administered lands, private lands, State of Colorado lands, and National Forest System lands. The bulk of new road building is occurring for community expansion and energy development. Road construction is expected to continue.
Vegetation treatments	Past, present, and continued treatments to improve habitat, reduce hazardous fuels, and remove invasive weeds.
Land use planning efforts	Ongoing and expected planning efforts for several BLM districts in Colorado, such as the Eastern Colorado RMP, the Uncompahgre Field Office RMPA and Northwest District RMPA, and for the Forest Service, such as the Grand Mesa Uncompahgre and Gunnison National Forests, which may constrain oil and gas development.
Greater and Gunnison sage-grouse planning efforts	These efforts could also result in decisions that constrain certain uses such as mineral development, ROW authorizations, and grazing, in certain habitats where these species occur. These habitats overlap to some extent with big game HPH.
Fire and fuels management	Continued risk for catastrophic wildfire, though agencies have been working to reduce this risk through vegetation management.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Geology and Fluid Minerals

Issue 1: How would new moderate constraints (timing limitations [TLs] and controlled surface use [CSU] stipulations), and new major constraints (no surface occupancy [NSO] and areas closed to leasing [no leasing, NL]), three percent density threshold, aligning with ECMC rules (I in 640), and requirements for master development plans and wildlife mitigation plans affect oil and gas development?

Issue 2: How would geophysical exploration activities be affected under the proposed alternatives?

Issue 3: How would new stipulations, conservation measures, and development limitations affect geology?

Issue 4: How would demand for mineral materials be impacted under the proposed alternatives?

Analytical Methods and Assumptions

Indicators for Geology and Fluid Minerals

- The number of acres of each field office that have more restrictive management in the form of closures, constraints, or stipulations than existing management, in areas with potential for oil and development, especially in areas with high potential.
- Acres within Data Analysis Units (DAUs) that have high potential habitat (HPH) near or above the 3 percent surface disturbance threshold.
- Acres within HPH that are near or above the 1 per 640 acres anthropogenic disturbance threshold.

- Reduced demand for mineral materials due to changes in management resulting in reduced need for use in the construction of new roads and well pads.

Analysis Methods

- Compare density of existing well pads or surface disturbance in federal mineral estate with the development potential layer to identify areas where development is likely to occur and create estimates of the increase in density or number of new wells likely.
- Examine areas closed to leasing, and areas subject to stipulations to determine where development would be prevented or reduced and where it would be displaced to non-federal minerals or non-federal surface.
- Compare areas with prevention or reduction of new wells to the number/density of expected new wells to determine total reduction.

Evaluate whether other management such as density and surface disturbance limitations and requirements to develop master development plans and wildlife mitigation plans, would result in impacts on fluid mineral development.

- Identify and evaluate impacts on areas with existing leases that would be subject to closure to new leasing or other stipulations.
- Identify areas where some stipulations would not apply or would not have an impact because the overlying surface estate is not administered by the BLM.

Assumptions

While geothermal resources are managed within the fluid minerals program, geothermal management would not be affected by the action alternatives.

Stipulations for activities associated with fluid mineral development would be applied as specified to new oil and gas leases.

Scope of the Analysis

The scope of the analysis includes the direct impacts of the proposed management on fluid mineral leasing, development, and exploration on BLM-administered lands, as well as indirect and cumulative impacts on fluid mineral development, impacts on the demand for mineral materials, and impacts on geology on both BLM-administered lands and non-BLM-administered lands.

Affected Environment

Minerals and geology are discussed in the context of proposed management decisions which would apply only to oil and gas; the proposed management decisions could also result in impacts on mineral materials, helium, and geothermal resources which are also discussed below.

- Oil and gas.

Minerals and Geology

Oil and Gas

Oil and gas are produced from 12 main basins in Colorado: the Denver Julesburg, the North Park, the Sand Wash, the Piceance, the Uintah, the Paradox, the San Juan, the San Luis, the South Park, the Raton, the Canyon City Embayment, and the Hugoton. Much of the state production is from conventional vertical well development, but unconventional horizontal development, such as hydraulic fracturing, is becoming

increasingly common in fields that contain reservoirs that are difficult to develop using conventional techniques. The primary targets of unconventional development are the Wattenberg and Denver Julesburg Horizontal Niobrara fields within the Denver Julesburg Basin; the North Park Horizontal Niobrara in the North Park Basin; the Sulphur Creek, Piceance Creek, Grand Valley, Rulison, Mamm Creek, Mancos shale, Piceance Horizontal Niobrara, Vega, and Plateau fields in the Piceance Basin; the Ignacio Blanco field in the San Juan Basin; the Florence-Canon City field in the Canyon City Embayment; and the Purgatoire River and Sheep Mountain fields in the Raton Basin.

The decision area for fluid minerals is approximately 13,010,000 acres; it includes all BLM-administered surface lands and approximately 4.6 million acres of split-estate private, local government, and state surface lands overlying federal mining. It does not include National Forest System land and other federal land where consent to lease from another agency is required or where the BLM does not make planning decisions about oil and gas management or other uses. The decision area therefore does not include federal mineral estate under national parks or national forests. **Table 3-3**, below, shows the surface estate management overlying the federal subsurface decision area. Several areas of the decision area have fragmented ownership patterns with mixed federal-private surface overlying federal mineral estate, or with mixed private mineral and federal mineral estate. This checkerboard ownership results in small land parcels where BLM administered surface lands are limited and in areas with complex ownership patterns where the BLM has minimal influence over management on the landscape. Checkerboard ownership, including that within HPH, is most prevalent on the eastern plains of Colorado (within the BLM Royal Gorge Field Office). The most (45 percent of) split-estate lands within HPH are within the Colorado River Valley Field Office, and the second-most (26 percent of) split-estate lands within HPH are within the Little Snake Field Office (BLM GIS 2022). In these areas surface management allocations and stipulations may be less effective in providing desired protection to big game species because in some cases operators would be able to relocate operations to private surface. BLM has limited authority to control surface uses except those related to federal oil and gas development authorizations.

Table 3-3. Surface Management of the Federal Subsurface Decision Area

Surface Management of the Federal Subsurface Estate	Type	Acres
BLM	Federal	8,317,000
Private	Nonfederal	4,338,000
Local	Nonfederal	257,000
State	Nonfederal	61,000
National Park Service, National Recreation Area	Federal	34,000
Bureau of Reclamation	Federal	3,000
Total	—	13,010,000

Source: BLM GIS 2022

Oil and gas development potential is not distributed evenly across the decision area. **Table 3-4**, below, shows the acres of the decision area by the development potential rank. **Figure 3-1, Appendix D, Oil and Gas Development Potential**, shows the development potential of the rating geographically. The development potential rating is derived from Reasonably Foreseeable Development Scenarios that were prepared for individual field offices at different times and using different methodologies and assumptions, as a result development potential is relative to the potential within each field office and may not be directly comparable across field offices.

Table 3-4. Oil and Gas Development Potential in the Decision Area

Development Potential Rating	Acres
High	4,805,000
Medium	1,300,000
Low	4,280,000
No known potential or not analyzed	2,625,000
Total	13,010,000

Source: BLM GIS 2022

Much of the development of BLM-administered mineral estate in the Decision Area has occurred in the White River Field Office, Colorado River Valley Field Office, Little Snake Field Office, and Grand Junction Field Office, as shown in **Table 3-5**, below, which shows the number of drilled wells in the decision area by BLM field office, note that not all of these wells are still active.

Table 3-5. Oil and Gas Wells by BLM Field Office in the Decision Area

BLM Field Office	Number of Existing Wells
Colorado River Valley Field Office	3,454
Grand Junction Field Office	1,183
Gunnison Field Office	0
Kremmling Field Office	409
Little Snake Field Office	1,351
Royal Gorge Field Office	955
San Luis Valley Field Office	6
Tres Rios Field Office	906
Uncompahgre Field Office	142
White River Field Office	6,061
Grand Total	14,467

Source: BLM GIS 2022

There are 1,954,000 acres within active oil and gas leases in the decision area; of these, 437,000 acres are not yet producing and 1,517,000 acres are held by production (**Figure 3-2, Appendix D**, Leasing Areas in Open and Closed to Fluid Mineral Leasing). An additional 150,000 acres of leases are pending. The acres of authorized and pending leases, and unleased acres in the decision area by field office are shown in **Table 3-6**, below. Pending leases are leases which have been sold but not yet issued. Pending leases would need to be modified as necessary to align with applicable planning decisions before issuance, affected lessees who decline to accept the modified lease terms could obtain a refund. Existing leases would continue to be managed under their terms (which reflect decisions in the RMP in effect when they were issued). If existing leases are relinquished, expire due to lack of diligent development, or are terminated or cancelled, future leasing of those areas would be subject to the management decisions resulting from this RMPA process. The BLM will continue to apply COAs to protect other resources and values to development approvals, as appropriate. COAs that conserve big game HPH may be applied, consistent with applicable law and lease terms. Pending leases would be rejected or approved with stipulations applied.

Stipulations developed during the land use planning process, such as NSO, CSU, and TL, place restrictions on fluid mineral development to protect resources. Stipulations are only applied where appropriate in each lease parcel. For example, a CSU leasing stipulation to protect riparian areas would only apply to riparian areas within that lease, not necessarily the entire lease area.

Table 3-6. Acres Unleased and Acres of Pending and Existing Leases by Status Within the Decision Area by Field Office

BLM Field Office and Leasing Status	Acres
Colorado River Valley Field Office	
Authorized	119,000
Held or extended by production	99,000
Not held by production	21,000
Pending	0
Unleased	661,000
Grand Junction Field Office	
Authorized	315,000
Held or extended by production	252,000
Not held by production	62,000
Pending	0
Unleased	1,132,000
Gunnison Field Office	
Authorized	0
Pending	0
Unleased	829,000
Kremmling Field Office	
Authorized	84,000
Held or extended by production	58,000
Not held by production	26,000
Pending	17,000
Unleased	544,000
Little Snake Field Office	
Authorized	202,000
Held or extended by production	152,000
Not held by production	50,000
Pending	39,000
Unleased	1,693,000
Royal Gorge Field Office	
Authorized	207,000
Held or extended by production	66,000
Not held by production	140,000
Pending	140,000
Unleased	2,559,000
San Luis Valley Field Office	
Authorized	0
Pending	0
Unleased	616,000
Tres Rios Field Office	
Authorized	233,000
Held or extended by production	230,000
Not held by production	3,000
Pending	0
Unleased	714,000
Uncompahgre Field Office	
Authorized	42,000
Held or extended by production	0
Not held by production	42,000

BLM Field Office and Leasing Status	Acres
Pending	0
Unleased	1,092,000
White River Field Office	
Authorized	750,000
Held or extended by production	615,000
Not held by production	134,000
Pending	10,000
Unleased	1,013,000

Source: BLM GIS 2022

"Fee/fee/federal" wells are those that are initially drilled on non-federal surface into private mineral estate, and at least some portion of the horizontal well bore penetrates and is completed in federal mineral estate. In fee/fee/federal situations, the approval of the APD for the well extension into federal minerals is the federal action that requires a NEPA analysis. Depending on whether changes to an existing well pad or construction of a new well pad are proposed, the BLM must analyze the proposed action's impacts differently. The Permanent Instruction Memorandum 2018-014 Directional Drilling into Federal Mineral Estate from Well Pads on Non-Federal Locations (BLM 2018) clarifies how the BLM must analyze impacts from approving an APD under NEPA, depending on the specific land and mineral ownerships associated with the proposed well. In some cases, off-site surface impacts associated with other activities or non-federal authorizations that cannot be regulated by the BLM may occur. As a result, NSO, CSU, and TL stipulations may have a limited effect on the development of federal minerals where wells can be drilled on non-federal surface estate (**Figure 3-3, Appendix D, Oil and Gas Wells and Leasing Areas**).

Helium

Helium is a nonrenewable resource which is recovered from produced natural gas. Helium is a critical component in many fields including scientific research, medical technology, high-tech manufacturing, space exploration, and national defense. It is found in recoverable quantities in only a few locations around the world, many of which are being depleted. Accordingly, the US has important economic and national security interests in ensuring a reliable supply of helium (BLM 2023c). Some oil and gas fields in the planning area have sufficiently high helium concentrations in the produced natural gas stream to allow for helium recovery.

Geothermal

Federal lands in Colorado do not have any existing geothermal infrastructure but does have known geothermal potential. The National Renewable Energy Laboratory conducts ongoing studies to identify areas and sites with favorable conditions for geothermal development based on technological advances.

Carbon Capture/Storage

Carbon capture and storage sequesters carbon dioxide (CO₂) emissions. CO₂ removed or prevented from entering the atmosphere can be sequestered over the long term under a confining layer or in exhausted oil and gas reservoirs. No commercial scale carbon sequestration is currently occurring in Colorado. The economics of carbon sequestration will dictate the future feasibility of the practice in Colorado and elsewhere. Under BLM policy carbon sequestration in federal decision area would be authorized under right-of-way authorizations (BLM 2022r). Captured CO₂ can also be used for enhanced oil recovery operations. CO₂ enhanced recovery is an industry practice used to recover additional oil, usually from mature fields that have declined in production. CO₂ is injected into the reservoir to produce oil that would otherwise be unrecoverable. Injected CO₂ remains sequestered in the reservoir. Enhanced oil recovery projects are

occurring or being explored in Colorado currently (National Energy Technology Laboratory 2010). Depending on the economic and geologic conditions, this practice can be attractive for oil and gas producers.

Mineral Materials

Mineral materials include common varieties of construction materials and aggregates, such as sand, gravel, cinders, roadbed, and ballast material. These materials occur widely across the decisions and planning areas.

Reasonably Foreseeable Trends and Planned Actions

Development of oil and gas resources is dependent on global resource prices which can be impacted by a variety of factors such as changes in demand, geopolitical instability, new technology, and the availability of alternative energy sources. Areas with a high potential rating, and areas with existing and historical development are more likely to be the focus of future development interest.

Environmental Consequences

Issue 1: How would new moderate constraints (timing limitations [TLs] and CSU stipulations), and new major constraints (no surface occupancy [NSO] and areas closed to leasing), three percent density threshold, aligning with ECMC rules (1 per 640 acres), and requirements to create master development plans and wildlife mitigation plans as operators develop oil and gas fields affect oil and gas development?

A variety of management measures were considered under the proposed alternatives. **Table 3-7** shows the acres and percent of the decision area proposed by alternative including acres closed to oil and gas leasing, and acres of applied stipulations under each alternative.

Table 3-7. Fluid Mineral Leasing Management and Stipulation Acres and Percentage by Alternative in the Decision Area

	Alternative A	Percent A	Alternative B	Percent B	Alternative C	Percent C	Alternative D	Percent D
Closed to fluid mineral leasing	1,792,000	13.8	1,792,000	13.8	1,792,000	13.8	5,727,000	44.0
Total open to leasing	11,218,000	86.2	11,218,000	86.2	11,218,000	86.2	7,284,000	56.0
Total Acres	13,010,000	100	13,010,000	100	13,010,000	100	13,010,000	100
Open, subject to no surface occupancy (NSO)	2,706,000	20.8	2,878,000	22.1	2,878,000	22.1	1,903,000	14.6
Open, subject to controlled surface use (CSU)	3,407,000	26.2	8,182,000	62.9	8,182,000	62.9	4,252,000	32.7
Open, subject to timing limitation (TL)	6,920,000	53.2	8,259,000	63.5	8,259,000	63.5	4,531,000	34.8

Source: BLM GIS 2023

All minerals are withdrawn from operation of the mineral leasing laws in Browns Canyon National Monument (RMP 2020), Dominguez-Escalante National Conservation Area (RMP 2017), and McInnis

Canyons National Conservation Area (RMP 2004). As a result, these areas are not part of the decision area. There would be no changes to management and no changes to impacts on mineral resources in these areas under any of the alternatives.

Existing RMPs contain stipulations intended to protect all resources, not just big game, and these stipulations would remain in effect under Alternative A as well as all of the action alternatives.

Under all alternatives, CSU and TL stipulations would result in moderate constraints on the development of oil and gas in the planning area. Moderate constraints would not prevent development or result in changes in the availability of fluid mineral resources in the planning area for development but could increase costs or limit the time of year or duration of some development activities.

The application of a CSU stipulation that would limit the density of development activities to 1 per 640 acres and a CSU stipulation that would limit development in areas with more than 3 percent anthropogenic surface disturbance would prevent or slow development of oil and gas resources in these areas. Under some Alternatives the impacts on oil and gas development could be reduced because of allowances for mitigation as a substitute for the limitation, or the issuance of waivers, exceptions, or modifications from the CSUs.

Under all alternatives, major constraints such as closing an area to leasing or applying NSO stipulations could result in substantial impacts on oil and gas resource development in the planning area. The impacts of closing areas to leasing would include a reduction in the amount of oil and gas resources eligible for leasing, development, and productive use. The impacts of applying NSO stipulations would vary by the location and size of the area with NSO stipulations; in locations where NSO stipulations are applied to small areas or where BLM-administered lands with NSO stipulations are interspersed with private or non-federal lands, oil and gas resources could still be developed from adjacent non-NSO areas, but the need for directional or horizontal drilling could increase the costs of drilling. In areas where geologic characteristics make horizontal drilling the standard method of development, such as tight shale gas formations, smaller areas of NSO stipulations would have little impact, but in areas where conventional drilling is common this would increase development costs, potentially to the point where developing NSO areas is no longer profitable. In locations where NSO stipulations are applied to large contiguous blocks of the planning area, much of the NSO area would be beyond the reach of directional and horizontal drilling techniques and thus would not be able to be developed without technological advances, resulting in a reduction in the amount of oil and gas resources produced from the planning area.

Under Alternative B, aligning with conservation measures developed by the ECMC would mitigate new development locations in HPH for elk, mule deer, pronghorn, and bighorn sheep, and mitigate indirect impacts in areas where the existing density of oil and gas locations is greater than one pad or linear mile of routes per square mile. Under Alternatives C, and D, aligning with conservation measures developed by the ECMC would mitigate new development locations in HPH for elk, mule deer, pronghorn, and bighorn sheep, and limit development in areas where the existing density of oil and gas locations is greater than one pad or linear mile of routes per square mile. This would reduce the areas available for oil and gas development, but waivers, exceptions, and modifications could be issued to allow development in these areas in many cases; see the analysis, below, for more detail regarding how the proposed management would differ by alternative.

Under all alternatives, recovery of helium would be indirectly affected by closing areas to fluid mineral leasing or applying restrictions to oil and gas development. Since helium is recovered as a portion of the natural gas stream, closing areas to fluid mineral leasing, as well as the application of NSO, CSU or TL stipulations that

would prevent or reduce the development of natural gas, would consequently prevent or reduce the extraction of helium resources.

Issue 2: How would geophysical exploration activities be affected under the proposed alternatives?

Geophysical exploration activities under Alternatives A, B, and C, would not be directly impacted by the proposed management actions, such as closures of certain areas to oil and gas leasing, and lease stipulations that restricts development actions. Geophysical exploration activities for oil and gas exploration might be indirectly impacted by some management actions because exploration may not be useful in areas that are closed to leasing or in large NSO areas that are not readily accessible for development. Under Alternative D, except in limited circumstances, no new geophysical exploration permits would be issued within HPH, See the Alternative D heading below for information about impacts on geophysical exploration activities under that alternative.

Issue 3: How would new stipulations, conservation measures, and development limitations affect geology?

The implementation of new stipulations, conservation measures, and development limitations under the action alternatives could result in indirect changes to the level of impacts on important geologic features or areas in some areas where the level of physical disturbance associated with development might be reduced. It is impossible to estimate the magnitude or nature of these changes at the planning stage because impacts that might occur or be prevented would be highly dependent on the specific locations of development which cannot be determined at this stage. Impacts to geologic features will be assessed at the project level. Because geology is not targeted for protection in this plan the planning decisions might prevent development in geologically important areas or displace development into geologically important areas that do not overlap with HPH. Alternatives that result in lower levels of development might result in less damage to geologically important areas but the difference in the magnitude of impacts by alternative cannot be meaningfully estimated at this time.

Issue 4: How would demand for mineral materials be impacted under the proposed alternatives?

Mineral materials are needed for building fluid mineral infrastructure, such as roads and well pads. In areas where fluid mineral development is subject to major constraints such as closure to leasing or NSO stipulations, or where the 3 percent disturbance threshold or 1/640 threshold has been reached, fewer mineral materials would be likely be needed. However, if development is not reduced by constraints or stipulations and is instead displaced to lands not administered by the BLM, or other lands not subject to those constraints, mineral material demand would not change. In areas with minor constraints the demand for mineral materials would stay about the same, in some cases the need to avoid certain areas under CSU might require a longer road to be built. Requirements to cluster development would reduce the need for mineral materials by co-locating more infrastructure in one place. This would reduce the total amount of access road that would need to be constructed, and reduce the amount of redundant equipment required allowing for less total well pad area (for example in a scattered development each single well pad might need a generator for power, but in a clustered development one generator could supply power to all wells and equipment on a pad with several wells).

Alternative A

Alternative A reflects the management decisions and language retained in existing RMPs. These RMPs include stipulations intended to protect all resources, not just big game, and these stipulations would remain in effect

under Alternative A. Stipulations related to other resources would remain in effect under all of the action alternatives.

Table 3-8, shows the fluid mineral management allocations under Alternative A by oil and gas development potential rating, within each Field Office in the planning area. The management allocation 'Open CSU-TL' in the table indicates that an area is open to leasing with both CSU and TL stipulations applied.

Under Alternative A, barring changes to outside factors such as oil and gas prices, leasing and development of fluid minerals would continue at a similar rate and in a similar manner to current conditions.

Table 3-8. Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative A

Field Office, Development Potential, and Management	Acres
COLORADO RIVER VALLEY FIELD OFFICE	2,087,000
High	570,000
Closed	47,000
Open CSU	153,000
Open NSO	67,000
Open Standard	174,000
Open TL	129,000
Medium	505,000
Closed	39,000
Open CSU	126,000
Open CSU-TL	28,000
Open NSO	82,000
Open Standard	137,000
Open TL	92,000
Low	933,000
Closed	51,000
Open CSU	246,000
Open CSU-TL	8,000
Open NSO	158,000
Open Standard	303,000
Open TL	167,000
No known potential or not analyzed	80,000
Closed	1,000
Open CSU	24,000
Open CSU-TL	1,000
Open NSO	16,000
Open Standard	28,000
Open TL	9,000
GRAND JUNCTION FIELD OFFICE	2,611,000
High	1,124,000
Closed	47,000
Open CSU	245,000
Open CSU-TL	2,000
Open NSO	98,000
Open Standard	487,000
Open TL	245,000

Field Office, Development Potential, and Management	Acres
Medium	173,000
Closed	1,000
Open CSU	36,000
Open CSU-TL	1,000
Open NSO	15,000
Open Standard	74,000
Open TL	46,000
Low	1,098,000
Closed	246,000
Open CSU	220,000
Open NSO	58,000
Open Standard	376,000
Open TL	197,000
No known potential or not analyzed	217,000
Closed	217,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
GUNNISON FIELD OFFICE	931,000
High	0
Medium	0
Low	127,000
Open CSU	1,000
Open NSO	1,000
Open Standard	122,000
Open TL	2,000
No known potential or not analyzed	803,000
Closed	0
Open CSU	40,000
Open NSO	50,000
Open Standard	706,000
Open TL	7,000
KREMMLING FIELD OFFICE	1,243,000
High	295,000
Closed	33,000
Open CSU-TL	50,000
Open NSO	61,000
Open Standard	79,000
Open TL	72,000
Medium	68,000
Closed	4,000
Open CSU-TL	3,000
Open NSO	6,000
Open Standard	45,000
Open TL	10,000

Field Office, Development Potential, and Management	Acres
Low	594,000
Closed	63,000
Open CSU-TL	79,000
Open NSO	92,000
Open Standard	238,000
Open TL	122,000
No known potential or not analyzed	286,000
Closed	34,000
Open CSU	0
Open CSU-TL	27,000
Open NSO	29,000
Open Standard	149,000
Open TL	47,000
LITTLE SNAKE FIELD OFFICE	4,768,000
High	3,794,000
Closed	208,000
Open CSU	324,000
Open CSU-TL	420,000
Open NSO	596,000
Open Standard	1,160,000
Open TL	1,085,000
Medium	418,000
Closed	47,000
Open CSU	2,000
Open CSU-TL	45,000
Open NSO	57,000
Open Standard	142,000
Open TL	125,000
Low	171,000
Closed	80,000
Open CSU	0
Open CSU-TL	3,000
Open NSO	10,000
Open Standard	50,000
Open TL	28,000
No known potential or not analyzed	385,000
Closed	103,000
Open CSU	2,000
Open CSU-TL	9,000
Open NSO	17,000
Open Standard	144,000
Open TL	109,000
ROYAL GORGE FIELD OFFICE	4,050,000
High	77,000
Open CSU	0
Open NSO	4,000
Open Standard	47,000
Open TL	27,000

Field Office, Development Potential, and Management	Acres
Medium	266,000
Open CSU	0
Open NSO	43,000
Open Standard	167,000
Open TL	56,000
Low	2,774,000
Closed	1,000
Open CSU	16,000
Open NSO	62,000
Open Standard	2,110,000
Open TL	586,000
No known potential or not analyzed	934,000
Closed	1,000
Open CSU	15,000
Open NSO	33,000
Open Standard	501,000
Open TL	384,000
SAN LUIS VALLEY FIELD OFFICE	1,218,000
High	853,000
Closed	17,000
Open NSO	9,000
Open Standard	420,000
Open TL	408,000
Medium	0
Open Standard	0
Open TL	0
Low	229,000
Closed	0
Open NSO	11,000
Open Standard	110,000
Open TL	108,000
No known potential or not analyzed	136,000
Closed	2,000
Open CSU	0
Open NSO	7,000
Open Standard	66,000
Open TL	61,000
TRES RIOS FIELD OFFICE	1,811,000
High	1,260,000
Closed	58,000
Open CSU	339,000
Open CSU-TL	1,000
Open NSO	140,000
Open Standard	407,000
Open TL	315,000

Field Office, Development Potential, and Management	Acres
Medium	545,000
Closed	23,000
Open CSU	138,000
Open CSU-TL	5,000
Open NSO	63,000
Open Standard	193,000
Open TL	123,000
Low	5,000
Open CSU	2,000
Open NSO	1,000
Open Standard	2,000
Open TL	1,000
No known potential or not analyzed	1,000
Closed	0
Open CSU	0
Open NSO	0
Open Standard	1,000
Open TL	0
UNCOMPAHGRE FIELD OFFICE	2,689,000
High	180,000
Closed	0
Open CSU	52,000
Open NSO	25,000
Open Standard	63,000
Open TL	40,000
Medium	1,247,000
Closed	0
Open CSU	358,000
Open NSO	150,000
Open Standard	393,000
Open TL	346,000
Low	1,098,000
Closed	2,000
Open CSU	328,000
Open NSO	140,000
Open Standard	350,000
Open TL	277,000
No known potential or not analyzed	165,000
Open CSU	45,000
Open NSO	25,000
Open Standard	56,000
Open TL	39,000
WHITE RIVER FIELD OFFICE	4,730,000
High	4,115,000
Closed	84,000
Open CSU	529,000
Open CSU-TL	68,000
Open NSO	485,000
Open Standard	1,475,000
Open TL	1,475,000

Field Office, Development Potential, and Management	Acres
Medium	99,000
Closed	2,000
Open CSU	11,000
Open CSU-TL	0
Open NSO	17,000
Open Standard	35,000
Open TL	34,000
Low	515,000
Closed	52,000
Open CSU	108,000
Open CSU-TL	41,000
Open NSO	63,000
Open Standard	126,000
Open TL	126,000
No known potential or not analyzed	1,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0

Source: BLM GIS 2023

* Fluid mineral stipulations may overlap

Alternative B

Under Alternative B, the BLM’s management would focus on aligning with conservation measures developed by the ECMC to avoid, minimize, and mitigate impacts of fluid mineral development on elk, mule deer, pronghorn, and bighorn sheep in HPH. The BLM would apply various stipulations, including a CSU surface density limitation to either limit surface disturbance density to one per 640 acres (i.e., one well pad per square mile and one linear mile of routes per square mile) or to mitigate the impacts of oil and gas development. The application of this CSU could result in increased costs associated with developing and implementing mitigation in areas where existing density of development is high and new infrastructure could not be co-located on existing development locations. This alternative does not restrict impacts from surface disturbing activities in HPH, rather objectives are set to minimize or compensate for impacts.

Under Alternative B, the use of master development plans for oil and gas would be encouraged but not required when projects involve high disturbance in HPH. The use of master development plans could improve development efficiency by obliging operators to consider the most efficient layout and order of development, but could also increase planning time and costs associated with development.

Under this alternative, the application of major constraints would be approximately the same as under Alternative A, No Action, and minor constraints would be similar, so impacts on fluid minerals resources would be approximately the same as under Alternative A. Compared to Alternative A, the addition of the 1 per 640 surface disturbance CSU under Alternative B would result in the need for changes to the locations of infrastructure or the development of mitigation in some areas. **Table 3-9**, shows the fluid mineral management allocations under Alternative B by oil and gas development potential rating, within each Field Office in the planning area.

Table 3-9. Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative B

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
COLORADO RIVER VALLEY FIELD OFFICE	2,211,000
High	591,000
Closed	47,000
Open CSU	164,000
Open NSO	67,000
Open Standard	174,000
Open TL	138,000
Medium	520,000
Closed	39,000
Open CSU	133,000
Open CSU-TL	28,000
Open NSO	82,000
Open Standard	137,000
Open TL	100,000
Low	1,014,000
Closed	51,000
Open CSU	280,000
Open CSU-TL	8,000
Open NSO	158,000
Open Standard	303,000
Open TL	214,000
No known potential or not analyzed	87,000
Closed	1,000
Open CSU	26,000
Open CSU-TL	1,000
Open NSO	16,000
Open Standard	28,000
Open TL	14,000
GRAND JUNCTION FIELD OFFICE	2,882,000
High	1,267,000
Closed	47,000
Open CSU	369,000
Open CSU-TL	2,000
Open NSO	100,000
Open Standard	487,000
Open TL	262,000
Medium	196,000
Closed	1,000
Open CSU	57,000
Open CSU-TL	1,000
Open NSO	15,000
Open Standard	74,000
Open TL	47,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Low	1,203,000
Closed	246,000
Open CSU	314,000
Open NSO	58,000
Open Standard	376,000
Open TL	209,000
No known potential or not analyzed	217,000
Closed	217,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
GUNNISON FIELD OFFICE	2,236,000
High	0
Medium	0
Low	324,000
Open CSU	108,000
Open NSO	3,000
Open Standard	122,000
Open TL	90,000
No known potential or not analyzed	1,912,000
Closed	0
Open CSU	642,000
Open NSO	66,000
Open Standard	706,000
Open TL	498,000
KREMMLING FIELD OFFICE	1,757,000
High	342,000
Closed	33,000
Open CSU	42,000
Open CSU-TL	50,000
Open NSO	62,000
Open Standard	79,000
Open TL	77,000
Medium	133,000
Closed	4,000
Open CSU	37,000
Open CSU-TL	3,000
Open NSO	6,000
Open Standard	45,000
Open TL	38,000
Low	839,000
Closed	63,000
Open CSU	169,000
Open CSU-TL	79,000
Open NSO	95,000
Open Standard	238,000
Open TL	196,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
No known potential or not analyzed	444,000
Closed	34,000
Open CSU	94,000
Open CSU-TL	27,000
Open NSO	29,000
Open Standard	149,000
Open TL	111,000
LITTLE SNAKE FIELD OFFICE	5,712,000
High	4,435,000
Closed	208,000
Open CSU	905,000
Open CSU-TL	420,000
Open NSO	597,000
Open Standard	1,160,000
Open TL	1,146,000
Medium	549,000
Closed	47,000
Open CSU	121,000
Open CSU-TL	45,000
Open NSO	57,000
Open Standard	142,000
Open TL	136,000
Low	230,000
Closed	80,000
Open CSU	43,000
Open CSU-TL	3,000
Open NSO	10,000
Open Standard	50,000
Open TL	45,000
No known potential or not analyzed	498,000
Closed	103,000
Open CSU	104,000
Open CSU-TL	9,000
Open NSO	17,000
Open Standard	144,000
Open TL	120,000
ROYAL GORGE FIELD OFFICE	5,532,000
High	117,000
Open CSU	29,000
Open NSO	4,000
Open Standard	47,000
Open TL	38,000
Medium	377,000
Open CSU	80,000
Open NSO	46,000
Open Standard	167,000
Open TL	84,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Low	3,611,000
Closed	1,000
Open CSU	650,000
Open NSO	150,000
Open Standard	2,110,000
Open TL	700,000
No known potential or not analyzed	1,427,000
Closed	1,000
Open CSU	414,000
Open NSO	76,000
Open Standard	501,000
Open TL	434,000
SAN LUIS VALLEY FIELD OFFICE	1,683,000
High	1,179,000
Closed	17,000
Open CSU	318,000
Open NSO	12,000
Open Standard	420,000
Open TL	413,000
Medium	0
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
Low	327,000
Closed	0
Open CSU	95,000
Open NSO	13,000
Open Standard	110,000
Open TL	110,000
No known potential or not analyzed	177,000
Closed	2,000
Open CSU	40,000
Open NSO	7,000
Open Standard	66,000
Open TL	62,000
TRES RIOS FIELD OFFICE	1,873,000
High	1,300,000
Closed	58,000
Open CSU	355,000
Open CSU-TL	1,000
Open NSO	147,000
Open Standard	407,000
Open TL	331,000
Medium	565,000
Closed	23,000
Open CSU	154,000
Open CSU-TL	5,000
Open NSO	63,000
Open Standard	193,000
Open TL	128,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Low	6,000
Open CSU	2,000
Open NSO	1,000
Open Standard	2,000
Open TL	1,000
No known potential or not analyzed	1,000
Closed	0
Open CSU	0
Open NSO	0
Open Standard	1,000
Open TL	0
UNCOMPAHGRE FIELD OFFICE	2,698,000
High	180,000
Closed	0
Open CSU	52,000
Open NSO	25,000
Open Standard	63,000
Open TL	40,000
Medium	1,254,000
Closed	0
Open CSU	358,000
Open NSO	151,000
Open Standard	393,000
Open TL	352,000
Low	1,098,000
Closed	2,000
Open CSU	328,000
Open NSO	141,000
Open Standard	350,000
Open TL	278,000
No known potential or not analyzed	166,000
Open CSU	45,000
Open NSO	25,000
Open Standard	56,000
Open TL	40,000
WHITE RIVER FIELD OFFICE	5,554,000
High	4,900,000
Closed	84,000
Open CSU	1,314,000
Open CSU-TL	68,000
Open NSO	485,000
Open Standard	1,475,000
Open TL	1,475,000
Medium	121,000
Closed	2,000
Open CSU	32,000
Open CSU-TL	0
Open NSO	17,000
Open Standard	35,000
Open TL	35,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Low	533,000
Closed	52,000
Open CSU	125,000
Open CSU-TL	41,000
Open NSO	63,000
Open Standard	126,000
Open TL	126,000
No known potential or not analyzed	1,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0

Source: BLM 2023

* Fluid mineral stipulations may overlap

Alternative C

Under Alternative C, the BLM would align with the same conservation measures developed by the ECMC as under Alternative B, and additionally would implement a 3 percent surface disturbance threshold based on the amount of anthropogenic disturbance on BLM lands in HPH for each DAU. Alternative C provides flexibility in waivers, exceptions, and modifications for where 3 percent may not be an appropriate threshold. In areas where the existing density of development is high and new infrastructure could not be located on existing development locations, the application of the CSU surface disturbance density evaluation to either limit surface disturbance density to one well pad per 640 acres or to mitigate the impacts for oil and gas development, could result in increased costs for development of oil and gas associated with developing mitigation. The application of the 3 percent surface disturbance threshold could also result in increased costs of development associated with avoiding, or seeking waivers, exceptions, and modifications in areas where the 3 percent surface disturbance threshold has been reached, and if waivers, exceptions, and modifications are not granted, oil and gas development might be prevented from occurring in some areas or pushed onto adjacent private lands (either split estate or fee mineral). **Appendix L** shows the acres of HPH, acres of existing disturbance, and acres of disturbance for the 3 percent disturbance threshold, for each DAU.

Under Alternative C, a master development plan would be required to be completed during planning and review of projects involving multiple proposed disturbances within a lease or HPH. The master development plans would be required to conform to objectives of this planning effort to cluster development. Depending on a variety of factors, a master development plan could improve development efficiency by requiring operators to consider the most efficient layout and order of development but could also increase planning time and costs associated with development. In areas where oil and gas are located in conventional accumulations, and development would typically occur using conventional vertical wells located to target structural traps, the requirement to focus on clustering development would likely result in increased drilling time and costs associated with using directional or horizontal drilling in place of vertical drilling, or increased costs associated with mitigation if directional drilling is not feasible. Most development of conventional oil and gas resources in Colorado occurs in the Grand Junction, Royal Gorge, Tres Rios, and White River Field Offices. In the development of unconventional oil and gas resources, clustering developments can occur without significant impact to the development, in many cases, because these types of developments normally use directional and horizontal wells which can be drilled outward in different directions from a central well pad. Most of the development of unconventional oil and gas resources in Colorado occurs in the Little Snake, White River, Grand Junction, Colorado River Valley, Tres Rios, and Royal Gorge Field Offices.

Under Alternative C, oil and gas development would be reduced compared to Alternative A, especially in areas with high levels of existing anthropogenic surface disturbance and conventional oil and gas accumulations.

Table 3-10, shows the fluid mineral management allocations under Alternative C by oil and gas development potential rating, within each Field Office in the planning area.

Table 3-10. Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative C

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
COLORADO RIVER VALLEY FIELD OFFICE	2,211,000
High	591,000
Closed	47,000
Open CSU	164,000
Open NSO	67,000
Open Standard	174,000
Open TL	138,000
Medium	520,000
Closed	39,000
Open CSU	133,000
Open CSU-TL	28,000
Open NSO	82,000
Open Standard	137,000
Open TL	100,000
Low	1,014,000
Closed	51,000
Open CSU	280,000
Open CSU-TL	8,000
Open NSO	158,000
Open Standard	303,000
Open TL	214,000
No known potential or not analyzed	87,000
Closed	1,000
Open CSU	26,000
Open CSU-TL	1,000
Open NSO	16,000
Open Standard	28,000
Open TL	14,000
GRAND JUNCTION FIELD OFFICE	2,882,000
High	1,267,000
Closed	47,000
Open CSU	369,000
Open CSU-TL	2,000
Open NSO	100,000
Open Standard	487,000
Open TL	262,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Medium	196,000
Closed	1,000
Open CSU	57,000
Open CSU-TL	1,000
Open NSO	15,000
Open Standard	74,000
Open TL	47,000
Low	1,203,000
Closed	246,000
Open CSU	314,000
Open NSO	58,000
Open Standard	376,000
Open TL	209,000
No known potential or not analyzed	217,000
Closed	217,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
GUNNISON FIELD OFFICE	2,236,000
High	0
Medium	0
Low	324,000
Open CSU	108,000
Open NSO	3,000
Open Standard	122,000
Open TL	90,000
No	1,912,000
Closed	0
Open CSU	642,000
Open NSO	66,000
Open Standard	706,000
Open TL	498,000
KREMMLING FIELD OFFICE	1,757,000
High	342,000
Closed	33,000
Open CSU	42,000
Open CSU-TL	50,000
Open NSO	62,000
Open Standard	79,000
Open TL	77,000
Medium	133,000
Closed	4,000
Open CSU	37,000
Open CSU-TL	3,000
Open NSO	6,000
Open Standard	45,000
Open TL	38,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Low	839,000
Closed	63,000
Open CSU	169,000
Open CSU-TL	79,000
Open NSO	95,000
Open Standard	238,000
Open TL	196,000
No known potential or not analyzed	444,000
Closed	34,000
Open CSU	94,000
Open CSU-TL	27,000
Open NSO	29,000
Open Standard	149,000
Open TL	111,000
LITTLE SNAKE FIELD OFFICE	5,712,000
High	4,435,000
Closed	208,000
Open CSU	905,000
Open CSU-TL	420,000
Open NSO	597,000
Open Standard	1,160,000
Open TL	1,146,000
Medium	549,000
Closed	47,000
Open CSU	121,000
Open CSU-TL	45,000
Open NSO	57,000
Open Standard	142,000
Open TL	136,000
Low	230,000
Closed	80,000
Open CSU	43,000
Open CSU-TL	3,000
Open NSO	10,000
Open Standard	50,000
Open TL	45,000
No known potential or not analyzed	498,000
Closed	103,000
Open CSU	104,000
Open CSU-TL	9,000
Open NSO	17,000
Open Standard	144,000
Open TL	120,000
ROYAL GORGE FIELD OFFICE	5,532,000
High	117,000
Open CSU	29,000
Open NSO	4,000
Open Standard	47,000
Open TL	38,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Medium	377,000
Open CSU	80,000
Open NSO	46,000
Open Standard	167,000
Open TL	84,000
Low	3,611,000
Closed	1,000
Open CSU	650,000
Open NSO	150,000
Open Standard	2,110,000
Open TL	700,000
No known potential or not analyzed	1,427,000
Closed	1,000
Open CSU	414,000
Open NSO	76,000
Open Standard	501,000
Open TL	434,000
SAN LUIS VALLEY FIELD OFFICE	1,683,000
High	1,179,000
Closed	17,000
Open CSU	318,000
Open NSO	12,000
Open Standard	420,000
Open TL	413,000
Medium	0
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
Low	327,000
Closed	0
Open CSU	95,000
Open NSO	13,000
Open Standard	110,000
Open TL	110,000
No known potential or not analyzed	177,000
Closed	2,000
Open CSU	40,000
Open NSO	7,000
Open Standard	66,000
Open TL	62,000
TRES RIOS FIELD OFFICE	1,873,000
High	1,300,000
Closed	58,000
Open CSU	355,000
Open CSU-TL	1,000
Open NSO	147,000
Open Standard	407,000
Open TL	331,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Medium	565,000
Closed	23,000
Open CSU	154,000
Open CSU-TL	5,000
Open NSO	63,000
Open Standard	193,000
Open TL	128,000
Low	6,000
Open CSU	2,000
Open NSO	1,000
Open Standard	2,000
Open TL	1,000
No known potential or not analyzed	1,000
Closed	0
Open CSU	0
Open NSO	0
Open Standard	1,000
Open TL	0
UNCOMPAHGRE FIELD OFFICE	2,698,000
High	180,000
Closed	0
Open CSU	52,000
Open NSO	25,000
Open Standard	63,000
Open TL	40,000
Medium	1,254,000
Closed	0
Open CSU	358,000
Open NSO	151,000
Open Standard	393,000
Open TL	352,000
Low	1,098,000
Closed	2,000
Open CSU	328,000
Open NSO	141,000
Open Standard	350,000
Open TL	278,000
No known potential or not analyzed	166,000
Open CSU	45,000
Open NSO	25,000
Open Standard	56,000
Open TL	40,000
WHITE RIVER FIELD OFFICE	5,554,000
High	4,900,000
Closed	84,000
Open CSU	1,314,000
Open CSU-TL	68,000
Open NSO	485,000
Open Standard	1,475,000
Open TL	1,475,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
Medium	121,000
Closed	2,000
Open CSU	32,000
Open CSU-TL	0
Open NSO	17,000
Open Standard	35,000
Open TL	35,000
Low	533,000
Closed	52,000
Open CSU	125,000
Open CSU-TL	41,000
Open NSO	63,000
Open Standard	126,000
Open TL	126,000
No known potential or not analyzed	1,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0

Source: BLM 2023

* Fluid mineral stipulations may overlap

Alternative D

Under Alternative D, the BLM would target more restrictive oil and gas management by applying major constraints; it would close fluid mineral leasing in those areas identified as having no known, low, or moderate oil and gas development potential within HPH. Approximately 44.8 percent of the planning area would be closed to fluid mineral leasing in Alternative D, compared to 13.8 percent in Alternative A. Because most future oil and gas development is expected to occur in high oil and gas development potential areas and the closures would be in areas with no known, low, or moderate oil and gas development potential, this closure is not expected to result in a large reduction in future oil and gas production. A limited amount of leasing and development that might have occurred in moderate, low, and no know development potential areas would be prevented from occurring within HPH, but moderate, low, and no know development potential areas outside of HPH would mostly still be available for leasing, and most high potential areas would still be available for leasing within HPH.

Under Alternative D, the BLM would implement the same conservation measures developed by the ECMC as under Alternative B and additionally would implement a 3 percent surface disturbance threshold in HPH similar to Alternative C. However, under Alternative D the 3 percent surface disturbance threshold on development would be calculated based on anthropogenic disturbance on all lands within HPH for each DAU regardless of ownership, and would allow less flexibility for waivers, exceptions, and modifications than would exist under Alternative C. Calculating the 3 percent surface disturbance threshold based on disturbance on all land ownership types would mean that development of federal fluid minerals would be less likely to occur in areas with existing density at or above the threshold, in these areas the BLM would apply stipulations preventing development on BLM-administered lands, in areas with checkerboard or other mixed land ownership pattern, development of private lands and minerals could continue to occur. The implementation of the 3 percent surface disturbance threshold could result in increased costs of development associated with seeking waivers, exceptions, and modifications, or locating development to avoid HPH in areas that have reached the 3 percent surface disturbance threshold. Further, under this

alternative, waivers, exceptions, and modifications would be more restrictive and less likely to be granted, which would result in oil and gas development not occurring in some areas where resources could not be developed by avoiding areas which have reached the 3 percent surface disturbance threshold. **Appendix L** shows the acres of HPH, acres of existing disturbance, and acres of disturbance for the 3 percent disturbance threshold, for each DAU.

Under Alternative D, the requirement to complete a Master Development Plan during planning and review of projects involving multiple proposed disturbances within a lease or HPH, and the requirement to focus on clustering development would be the same as described for Alternative C.

Generally Alternative D would result in a reduction of oil and gas leasing and development on BLM-administered lands compared to Alternative A. Impacts of Alternative D on fluid mineral resources would vary based on how much HPH is in each field office, how much of the HPH in the decision area is leased, how much of the HPH within a field office is identified as having high development potential, and the existing density of existing disturbance and development. The proposed stipulations and constraints would not apply to existing leases, although the 3 percent disturbance threshold and 1 in 640 limitation would apply at APD approval to the extent consistent with lease terms. Because area with no known, low, or moderate oil and gas development potential within HPH would be closed to future leasing under this Alternative, field offices with more high development potential area or less HPH would experience lower levels of impacts on fluid mineral resources relative to field offices with limited high development potential area or large amounts of HPH. **Table 3-11** shows the fluid mineral management allocations under Alternative D by oil and gas development potential rating, within each Field Office in the planning area.

Table 3-11. Fluid Mineral Management by Oil and Gas Development Potential for BLM Field Offices Under Alternative D

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
COLORADO RIVER VALLEY FIELD OFFICE	1,428,000
High	591,000
Closed	47,000
Open CSU	164,000
Open NSO	67,000
Open Standard	174,000
Open TL	138,000
Medium	295,000
Closed	119,000
Open CSU	54,000
Open CSU-TL	13,000
Open NSO	31,000
Open Standard	57,000
Open TL	22,000
Low	487,000
Closed	256,000
Open CSU	75,000
Open CSU-TL	6,000
Open NSO	38,000
Open Standard	98,000
Open TL	14,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
No known potential or not analyzed	56,000
Closed	14,000
Open CSU	14,000
Open CSU-TL	1,000
Open NSO	10,000
Open Standard	16,000
Open TL	2,000
GRAND JUNCTION FIELD OFFICE	2,440,000
High	1,267,000
Closed	47,000
Open CSU	369,000
Open CSU-TL	2,000
Open NSO	100,000
Open Standard	487,000
Open TL	262,000
Medium	100,000
Closed	46,000
Open CSU	12,000
Open CSU-TL	1,000
Open NSO	11,000
Open Standard	28,000
Open TL	2,000
Low	856,000
Closed	405,000
Open CSU	155,000
Open NSO	29,000
Open Standard	216,000
Open TL	51,000
No known potential or not analyzed	217,000
Closed	217,000
Open CSU	0
Open NSO	0
Open Standard	0
Open TL	0
GUNNISON FIELD OFFICE	885,000
High	0
Medium	0
Low	125,000
Closed	107,000
Open CSU	1,000
Open NSO	1,000
Open Standard	15,000
Open TL	0
No known potential or not analyzed	760,000
Closed	615,000
Open CSU	27,000
Open NSO	26,000
Open Standard	92,000
Open TL	0

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
KREMMLING FIELD OFFICE	1,003,000
High	342,000
Closed	33,000
Open CSU	42,000
Open CSU-TL	50,000
Open NSO	62,000
Open Standard	79,000
Open TL	77,000
Medium	53,000
Closed	41,000
Open CSU-TL	1,000
Open NSO	1,000
Open Standard	8,000
Open TL	1,000
Low	386,000
Closed	231,000
Open CSU-TL	24,000
Open NSO	27,000
Open Standard	69,000
Open TL	34,000
No known potential or not analyzed	222,000
Closed	128,000
Open CSU	0
Open CSU-TL	9,000
Open NSO	10,000
Open Standard	55,000
Open TL	20,000
LITTLE SNAKE FIELD OFFICE	5,060,000
High	4,435,000
Closed	208,000
Open CSU	905,000
Open CSU-TL	420,000
Open NSO	597,000
Open Standard	1,160,000
Open TL	1,146,000
Medium	217,000
Closed	168,000
Open CSU	0
Open CSU-TL	6,000
Open NSO	7,000
Open Standard	21,000
Open TL	16,000
Low	133,000
Closed	122,000
Open CSU	0
Open CSU-TL	0
Open NSO	1,000
Open Standard	7,000
Open TL	3,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
No known potential or not analyzed	275,000
Closed	207,000
Open CSU	0
Open CSU-TL	5,000
Open NSO	6,000
Open Standard	41,000
Open TL	17,000
ROYAL GORGE FIELD OFFICE	3,209,000
High	117,000
Open CSU	29,000
Open NSO	4,000
Open Standard	47,000
Open TL	38,000
Medium	237,000
Closed	70,000
Open CSU	10,000
Open NSO	45,000
Open Standard	97,000
Open TL	16,000
Low	2,301,000
Closed	613,000
Open CSU	41,000
Open NSO	48,000
Open Standard	1,498,000
Open TL	102,000
No known potential or not analyzed	553,000
Closed	408,000
Open CSU	8,000
Open NSO	9,000
Open Standard	95,000
Open TL	34,000
SAN LUIS VALLEY FIELD OFFICE	1,394,000
High	1,179,000
Closed	17,000
Open CSU	318,000
Open NSO	12,000
Open Standard	420,000
Open TL	413,000
Medium	0
Closed	0
Low	125,000
Closed	96,000
Open NSO	0
Open Standard	15,000
Open TL	14,000
No known potential or not analyzed	91,000
Closed	42,000
Open CSU	0
Open NSO	0
Open Standard	26,000
Open TL	22,000

Big Game Corridors RMPA/EIS Field Office and Development Potential	Acres*
TRES RIOS FIELD OFFICE	1,551,000
High	1,300,000
Closed	58,000
Open CSU	355,000
Open CSU-TL	1,000
Open NSO	147,000
Open Standard	407,000
Open TL	331,000
Medium	247,000
Closed	166,000
Open CSU	11,000
Open NSO	20,000
Open Standard	50,000
Open TL	1,000
Low	3,000
Closed	2,000
Open CSU	0
Open NSO	0
Open Standard	0
No known potential or not analyzed	1,000
Closed	0
Open CSU	0
Open NSO	0
Open Standard	1,000
UNCOMPAHGRE FIELD OFFICE	1,169,000
High	180,000
Closed	0
Open CSU	52,000
Open NSO	25,000
Open Standard	63,000
Open TL	40,000
Medium	454,000
Closed	336,000
Open CSU	22,000
Open NSO	21,000
Open Standard	57,000
Open TL	19,000
Low	449,000
Closed	279,000
Open CSU	51,000
Open NSO	30,000
Open Standard	73,000
Open TL	16,000
No known potential or not analyzed	86,000
Closed	32,000
Open CSU	13,000
Open NSO	9,000
Open Standard	24,000
Open TL	9,000

Big Game Corridors RMPA/EIS Field Office and Development Potential		Acres*
WHITE RIVER FIELD OFFICE		5,193,000
High		4,900,000
Closed		84,000
Open CSU		1,314,000
Open CSU-TL		68,000
Open NSO		485,000
Open Standard		1,475,000
Open TL		1,475,000
Medium		40,000
Closed		33,000
Open CSU		1,000
Open NSO		1,000
Open Standard		3,000
Open TL		3,000
Low		252,000
Closed		153,000
Open CSU		24,000
Open CSU-TL		11,000
Open NSO		13,000
Open Standard		25,000
Open TL		25,000
No known potential or not analyzed		0
Closed		0

Source: BLM 2023

* Fluid mineral stipulations may overlap

Issue 3: How would geophysical exploration activities be affected under the proposed alternatives?

Under Alternative D, no new geophysical exploration permits would be issued within HPH, except to obtain exploratory information for areas subject to valid existing rights adjacent to or within HPH. In the case of these exceptions, geophysical operations would only be allowed using helicopter-portable methods and in accordance with permit stipulations. Compared to the other alternatives, this would prohibit most geophysical exploration in HPH which makes up much of the decision area. This would make it difficult for operators to characterize the attributes and extent of oil and gas accumulations, which would make planning new oil and gas developments difficult for operators and would decrease recovery efficiency.

Cumulative Impacts

The cumulative impact analysis area used to analyze cumulative impacts on mineral extraction is the planning area, regardless of mineral ownership. The closures, restrictions, and stipulations considered in the alternatives and discussed in the context of the decision areas for analyzing direct and indirect impacts are analyzed here in the context of the entire planning area to assess cumulative impacts. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect fluid mineral leasing and development include, past, present, and continued oil and gas leasing and development on BLM-administered lands as well as on other federal and private lands. The development of other minerals including locatable minerals, coal, nonenergy leasables, and salable minerals, which could interfere with oil and gas development and increase anthropogenic disturbance in areas where the disturbance cap would be applied. The greater and Gunnison sage-grouse planning efforts, which would, in certain habitats where these species occur, also constrain mineral fluid development; as well

as certain uses that would indirectly impact fluid mineral development such as ROW authorizations. Sage-grouse habitats overlap to some extent with big game HPH. The ongoing and expected RMP efforts for several BLM districts in Colorado, such as the Eastern Colorado RMP, and potential amendments, such as for the Uncompahgre Field Office and Northwest District, which may constrain oil and gas development.

Under all alternatives, the locations and intensity of development would likely experience changes in some areas due to implementation of the alternatives.

Under Alternative A, closures to fluid mineral leasing applied in the BLM-administered federal mineral estate decision area would continue to cover approximately 1,792,000 acres or 13.8 percent of the decision area, and much of the area remaining open to leasing would remain subject to existing stipulations, which exist for the protection of a wide variety of resources, but some of which would provide direct, indirect, or incidental protections to HPH and big game species.

Under Alternative B, closures to fluid mineral leasing applied in the BLM-administered federal mineral estate decision area would cover approximately 1,792,000 acres or 13.8 percent of the decision area, and much of the area remaining open to leasing would be subject to stipulations and anthropogenic disturbance thresholds. BLM-administered federal fluid minerals in HPH areas with levels of anthropogenic disturbance that are already above or where additional development would cause the area to reach the 1 in 640 disturbance threshold, particularly areas assessed as having high or moderate oil and gas development potential, would experience the highest levels of impacts although the allowance for offsite compensatory mitigation could reduce or mitigate the impacts on fluid minerals in some cases.

Under Alternative C, closures to fluid mineral leasing applied in the BLM-administered federal mineral estate decision area would cover approximately 1,792,000 acres or 13.8 percent of the decision area, and much of the area remaining open to leasing would be subject to stipulations and anthropogenic disturbance thresholds. BLM-administered federal fluid minerals in HPH areas with levels of anthropogenic disturbance that are already above or will reach the 1 in 640 disturbance threshold and the 3 percent disturbance threshold, particularly areas assessed as having high or moderate oil and gas development potential, would experience the highest levels of impacts although the issuance of waivers, exemptions, and modifications would reduce or mitigate the impacts in some cases.

Under Alternative D, the BLM would apply the most restrictive management of fluid mineral leasing and development in the decision areas, particularly in HPH areas assessed as having medium, low and no known oil and gas development potential, as well as in HPH areas of high development potential with levels of anthropogenic disturbance that are already above or will reach the 1 in 640 disturbance threshold and the 3 percent disturbance threshold, where the issuance of waivers, exemptions, and modifications would be limited under Alternative D. Closures to leasing applied in the BLM-administered federal mineral estate decision area would cover approximately 5,726,000 acres or 44.0 percent of the decision area, and much of the area remaining open to leasing would be subject to stipulations and anthropogenic disturbance thresholds.

Under all alternatives, mineral resources in some NSO areas could still be accessed by directional or horizontal drilling from areas with no NSO stipulation. Mineral resources in areas with CSU and TL stipulations could generally continue to be accessed with minor changes to operations such as shifts in location or timing of development activities. However, under all alternatives, stipulations or management actions that increase the costs or difficulties associated with developing fluid minerals on BLM-administered federal mineral estate in the decision area could result in a reduction in the total production of oil and gas

resources, and would have some level of displacement effects, on to private, state, or Tribal minerals; or to federal mineral resources in non-HPH areas.

3.2.2 Air Quality and Related Values, and Greenhouse Gas Emissions

Issue 1: What are the potential impacts to air pollutant concentrations and air quality related values that could be associated with direct and indirect foreseeable resource activities including upstream, midstream and downstream oil and gas emissions sources for the baseline future scenario (no action alternative) compared to the action alternatives?

Issue 2: For the foreseeable future (up to 10 years), at what levels could BLM managed activities and emissions sources potentially affect vegetation and ecosystems in big game habitat areas?

Issue 3: What are the potential differences in cumulative greenhouse gas (GHG) emissions levels and corresponding climate impacts (including social costs) that could be associated with direct and indirect foreseeable oil and gas emissions sources for the baseline future scenario (no action alternative) compared to the most restrictive alternative?

Affected Environment

This section incorporates by reference the pertinent affected environment sections of the Final EISs:

- 2014 Colorado River Valley Field Office (CRVFO) – Sections 3.2.1 and 3.2.2 (BLM 2014a)
- 2015 Grand Junction Field Office (GJFO) – Sections 3.2.1 and 3.2.2 (BLM 2015a)
- 2014 Kremmling Field Office (KFO) – Section 3.2.1 (BLM 2014b)
- 2011 Little Snake Field Office (LSFO) – Section 3.1.2 (BLM 2011b)
- 2013 Tres Rios Field Office (TRFO) – Section 3.12 (BLM 2013)
- 2019 Uncompahgre Field Office (UFO) – Sections 3.1.1 and 3.1.2 (BLM 2019c)
- 2015 White River Field Office (WRFO) – Section 3.2.1 (BLM 2015g)

For the those sections being incorporated, historical air pollutant concentration and related values data trends are up to approximately year 2012. To supplement these historical trends data for year 2012 and beyond, the following sources contain similar data and information. Except for the Denver / Front-Range urban corridor and adjacent areas in northeast Colorado, the counties, and areas within and adjacent to proposed action big game corridor habitat areas continue to be in attainment of the national and state-level ambient air quality standards. The BLM Colorado currently operates three air quality monitoring stations in Colorado collecting ozone, nitrogen oxides (NO_x) and particulate matter (PM) concentrations in remote areas near federal oil and gas operations; the data collected at these stations support Colorado Department of Public Health and Environment (CDPHE) air quality attainment demonstrations in addition to assessments for NEPA.

- Air pollutant concentration data
 - U.S. Environmental Protection Agency’s (EPA’s) Air Data website (EPA 2023a)
 - CDPHE – 2021 Air Quality Data Report (CDPHE 2022a)
 - BLM Colorado’s air quality monitoring network (BLM 2023a)
- Visibility monitoring and deposition trend data
 - Interagency Monitoring of Protected Visual Environments (IMPROVE) website (Colorado State University [CSU] 2023a)
 - Federal Environmental Database – Colorado State University (CSU 2023b)

- Volatile Organic Compounds (VOCs) and HAPs trends data
 - Garfield County 2020 Air Quality Monitoring Report (Garfield County Public Health Department 2021)
 - Weld County VOC trends (Ramboll 2020)
- GHG emissions and climate data
 - BLM 2021 Annual GHG Report (BLM 2022q)
- Colorado oil and gas statistics and air quality modeling study (BLM 2023b)
 - BLM Colorado’s Comprehensive Air Resource Protection Protocol (CARPP)
 - BLM Colorado Air Resource Management Modeling Study (CARMMS)
 - BLM Colorado Annual Air Resources Report, 2020 Report Year

In accordance with BLM Colorado’s CARPP, the BLM Colorado developed an Annual Report (2.0) as a comprehensive assessment tool to assist in the preparation of NEPA assessments. The Annual Report (AR) provides data and information on the state of the atmosphere (air pollutant concentration trends, air quality related values, etc.) and oil and gas development (current regulations, rates for drilling and production, emission inventories, etc.) for each applicable Colorado field office or planning area. The report also places this information in the context of the Colorado Air Resource Management Modeling Study (CARMMS 2.0), which provides cumulative analyses of air quality and air quality related value (AQRV) impacts for multiple projected oil and gas development scenarios with varying emissions levels in Colorado out through year 2025. The above referenced documents are available on BLM Colorado’s website at: <https://www.blm.gov/programs/natural-resources/soil-air-water/air/colorado>

The AR provides an overview of the affected environment parameters and baseline conditions in Section 2.0, Affected Environment – This section of the report is incorporated by reference. It describes and defines the applicable general and oil- and gas-specific air quality regulations as well as the authority for such laws; provides a basic overview of the science and issues associated with the various types of air pollutants (criteria, hazardous, and greenhouse gases), air quality related values (visibility, deposition, and ozone), any applicable metrics for analysis, and the contexts for analysis relative to various air related geographic designations (attainment, non-attainment, Class I airsheds, etc.), and provides for all available pollutant monitoring data and location-based national emission inventory data. This section is referenced to introduce air resource concepts, several acronyms, and to provide background for the analysis in this EA. For example, the AR discusses ozone and describes that the atmosphere chemically forms ozone via interactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight and under certain meteorological conditions (NO_x and VOCs are ozone precursors). Ozone formation is highly dependent on meteorological conditions, including temperature, wind speed, and solar radiation and in the lower atmosphere is harmful to human health and vegetation. As described in final rule for the current ozone NAAQS, the current standard provides increased protection from other effects of potential public welfare significance, including crop yield loss and visible foliar injury (EPA 2015). Nitrogen deposition can cause chemical changes in soils that affect soil microorganisms and plants. Although nitrogen is an essential plant nutrient, excess nitrogen from atmospheric deposition can stress ecosystems by favoring some plant species and inhibiting the growth of others. Critical loads are a level of atmospheric pollutant deposition below which negative ecosystem effects are not likely to occur (NPS 2023).

Air Quality and Related Values, and GHG Emissions – Recent Trends

Air quality for any region is influenced by the amount of pollutants released within the vicinity and upwind of the region, and it can be highly dependent upon the chemical and physical properties of the contaminants.

Additionally, an area’s topography or terrain (mountains and valleys) and weather—such as wind speed and direction, temperature, air pressure (the resulting turbulence), rainfall, and cloud cover—can all have a direct influence on how pollutants accumulate, form, or disperse in the local environment. Transportation is another important consideration, as some pollutants can be transported far from their origin (e.g., ozone, secondary particulate matter less than 2.5 microns in diameter [PM2.5], or mercury).

The following table provides EPA’s 2017 and 2020 National Emissions Inventory (NEI) annual emissions levels for Colorado and shows that anthropogenic emissions originating from Colorado are decreasing (EPA 2023b). This strongly suggests that Colorado-based emissions sources are contributing less to air pollution and global GHG concentrations.

Table 3-12. EPA NEI – 2017 and 2020 Annual Emissions – Colorado

NEI ID	Nox	VOC	PM2.5	CO2	CH4
2017 NEI – Colorado – All Sectors	216,882	589,690	61,991	79,888,864	69,244
2020 NEI – Colorado – All Sectors	154,937	562,270	58,366	71,345,513	58,746

* Units: tons per year (TPY).

* NEI annual emissions levels do not include wildfires.

As a result of these declining state-level emissions trends, VOC (ozone precursor) concentrations have been decreasing around Colorado suggesting that any increase or lack of decrease in ozone concentrations could be attributed to external transport into Colorado or natural conditions (winter-time events, wildfires, stratospheric intrusions, etc.). The environmental consequences section provides an air quality modeling source apportionment impact discussion that includes specific contributions associated with ozone transport into Colorado. For the most part, air pollutant concentrations and related values (including nitrogen deposition) have remained constant for many Colorado-based monitors over the past five (5) years (EPA 2023a, CSU 2023b). Rural-based air pollutant monitors continue to show concentrations below current state and federal standards and annual nitrogen deposition values below ecosystem critical loads. The following two tables show ozone concentrations and annual nitrogen deposition loads for the last five (5) years of valid data for locations in western Colorado near big game habitat areas, respectively.

Table 3-13. Ozone Concentrations (2018 – 2022)

Station ID / Location	2018	2019	2020	2021	2022
Glenwood Springs	0.065	0.057	0.063	0.065	0.059
Gunnison National Forest	0.069	0.066	0.066	0.065	0.064
Weminuche Wilderness Area - Shamrock Station	0.071	0.059	0.063	0.066	0.063
Rangely Golf Course (BLM monitor)	0.068	0.064	0.065	0.069	0.062

Source: EPA Air Data website (EPA 2023a)

4th max. 8-hour average concentration (parts per million [ppm])

8-hour average ozone National Ambient Air Quality Standard (NAAQS): 0.07 ppm

Table 3-14. Annual Nitrogen Deposition (2017 – 2021)

Station ID / Location	2017	2018	2019	2020	2021
Gothic	1.503	1.233	1.036	1.385	1.508
Mesa Verde National Park	1.525	1.451	1.565	0.995	1.869
Buffalo Pass – Summit Lake – Routt County	2.655	2.219	1.968	1.402	2.434
Four Mile Park – Garfield County	1.755	1.276	1.282	1.204	1.992

Source: Federal Environmental Database (CSU 2023b)

Units: kilograms per hectare per year (kg/ha/yr)

Annual nitrogen deposition critical loads range from 3 – 4 kg/ha/yr for Colorado-based ecosystems.

A CDPHE air quality monitoring station in Platteville, Colorado in southwestern Weld County has shown a significant decrease in air pollutant concentrations of VOCs since 2013. The Platteville station is in an area that has a high density of oil and gas development and operations. Decreases in measured VOC concentrations at the Platteville station have been generally consistent with estimated decreases in VOC emissions between 2011 and 2017 reported by the Regional Air Quality Control Council. The Platteville station data indicates that VOC concentrations have been generally decreasing since 2013, a trend that is important for several reasons. Declines in VOC concentrations can be used to assess emissions inventory trends and to help predict potential changes in ozone formation chemistry. To assess emissions inventory trends, the annual average concentrations of individual compounds measured at the Platteville station were evaluated for the 2013 to 2018 period. The annual average concentrations of propane, n-butane and benzene, VOC compounds emitted by the oil and gas industry, decreased by 68, 71, and 56 percent, respectively, between 2013 and 2018. The significant reductions in VOC concentrations not only have the potential to decrease ozone formation, but also suggest reduced potential for exposure to HAPs for many areas in the Denver metro including disadvantaged communities (Ramboll 2020).

Methane (CH₄) concentrations in northeastern Colorado (i.e., Denver-Julesburg Basin) have decreased substantially from peak concentrations recorded in 2013. Decreased methane concentrations in atmospheric measurements are corroborated by comparison with ground-based measurements, which also show significant decreases in methane concentrations for northeast Colorado. The decreases occurred despite increased oil and gas production in the area since 2013 (Ramboll 2021).

A recent Garfield County 2020 Air Quality Monitoring Report shows that ambient concentrations of VOCs and HAPs have continued to decrease over the historical 2008 to 2020 reporting period. Likewise, light alkanes (primary components of raw natural gas) have also decreased over this period, strongly suggesting that ambient methane (main component of raw natural gas) concentrations have also decreased at the Garfield County monitoring sites (Garfield County Public Health Department 2021). The Piceance Basin in northwest Colorado (includes Garfield, Mesa and Rio Blanco counties) continues to have the highest level of federal oil and gas activity in Colorado. BLM Colorado currently operates two air quality monitoring stations in the Piceance Basin including the station currently located at Rangely Golf Course.

The following table shows the total estimated GHG emissions from fossil fuels at the global, national, and state scales over the last five years of readily available data (note: data for year 2021 are not yet readily available for all scales). Emissions are shown in megatonnes (Mt, one million metric tons) per year of carbon dioxide equivalent (CO₂e). Chapter 3 of the BLM Annual GHG Report provides additional information on GHGs and an explanation of CO₂e (BLM 2022r) and is incorporated here by reference. State and national energy-related CO₂ emissions include emissions from fossil fuel use across all sectors (residential, commercial, industrial, transportation, and electricity generation) and are released at the location where the

fossil fuels are consumed. These baseline Colorado totals account for new oil and gas development and operations that began since the records of decisions were issued for the existing resource management plans.

Table 3-15. Global, U.S., and Colorado GHG Emissions 2015 - 2020 (Mt CO₂e/yr)

Scale	2016	2017	2018	2019	2020
Global	36,465.6	36,935.6	37,716.2	37,911.4	35,962.9
U.S.	5,077.0	5,005.5	5,159.3	5,036.0	4,535.3
Colorado	102.8	103.2	104.3	106.3	104.4

Source: BLM Annual GHG Report (BLM 2022r), Chap. 6, Table 6-1 (Global and U.S.) and Table 6-3 (State). Year 2020 from CDPHE 2021 GHG Report (CDPHE 2021).

Mt (megatonne) = one million metric tons

Additional data and information on current state, national, and global GHG emissions, as well as the methodology and parameters for estimating emissions from BLM fossil fuel authorizations and cumulative GHG emissions, are included in the online BLM Annual GHG Report (see Chapters 4, 5, and 6 [BLM 2022r]).

Oil and Gas Production Data, Ozone, Air Quality Related Values and GHG Emissions - Reasonably Foreseeable Future Trends

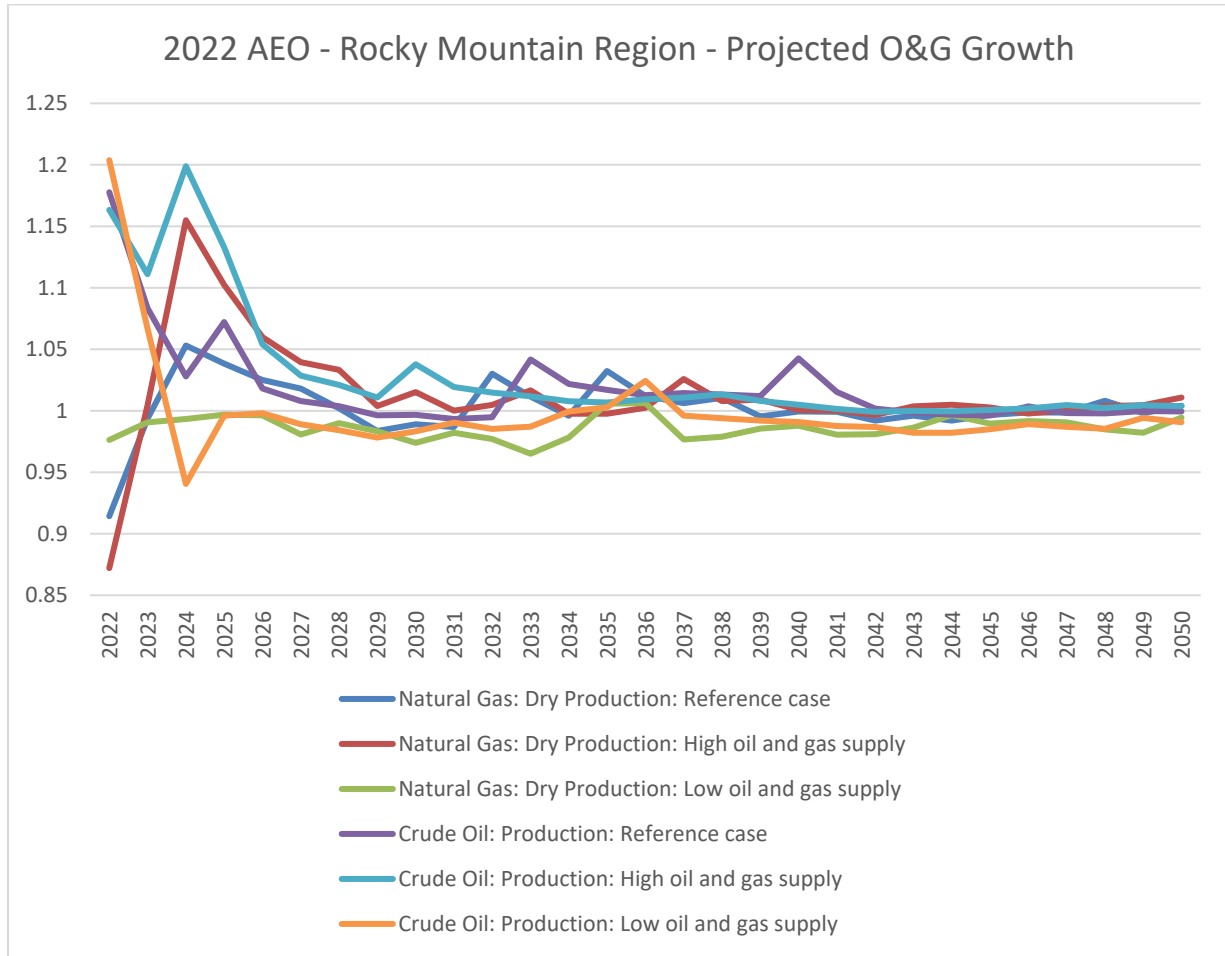
Federal oil and gas development in Colorado is expected to continue at its current pace (i.e., below the rate of full reasonably foreseeable development rates for all BLM Colorado planning areas for the foreseeable future. The BLM does not anticipate significant shifts in petroleum market dynamics (e.g., supply and demand), or changes in development/recovery technologies, newly discovered resources/plays, or political influences (tax or regulatory incentives), that would significantly affect development rates in Colorado. Continued federal oil and gas field development, operation of well site equipment, and associated vehicle traffic would result in minor cumulative contributions to atmospheric air pollutants. Natural gas and condensate produced from federal oil and gas development would be refined to produce a wide range of fuel products for consumer or commercial use. According to the Energy Information Administration (EIA), approximately seven percent of fossil fuels are consumed for non-combustion use in the U.S. (EIA 2018), and these non-combustion products are important to society. For example, natural gas is a critical raw material in the production of ammonia, which has been described as one of the four most essential materials for modern civilization, along with cement, steel and plastics (Smil 2022).

The development, extraction, processing and combustion of all projected oil and gas would generate air pollutants, which may be controlled through regulations such as emission standards or applicable air permit requirements. The CDPHE Air Quality Control Commission recently updated its Regulation 7 to include additional emissions reduction, leak detection, and reporting requirements specific to new and existing oil and gas related operations in disproportionately impacted communities. These new updates include increases in leak detection and repair frequency, additional well unloading emissions control requirements, more frequent and expedited combustion device testing, more stringent emissions intensity target levels with enhanced best management practice reporting, and additional pigging and blowdown requirements (CDPHE 2022b). Most states and countries around the world do not have as many oil and gas regulations that reduce field-level emissions as Colorado, which suggests that on a per unit oil and gas production (per cubic foot, per barrel, etc.) basis, upstream and midstream (field-level) emissions likely are lower in Colorado than most other locations where oil and gas are produced (COGA 2020).

A static year-to-year production level or an overall increase in total annual oil and gas production for a region / basin suggests that sustaining the current rate of new oil and gas development or even increasing

the level of new development and operations would be needed to offset production declines with current / existing oil and gas wells. The following plot shows Energy Information Administration (EIA) 2022 Annual Energy Outlook (AEO) oil and gas production year-to-year “growth” projections for the Rocky Mountain Region through year 2050 for the AEO reference case and high and low oil and gas supply scenarios (EIA 2022c). Values greater than one for the figure indicate positive oil and gas growth relative to the previous year and as expected, the largest growth would occur with the high oil and gas supply scenario. Existing wells would need to be “stimulated” or new wells would need to be developed in order to maintain existing oil and gas production levels (values equal one) or meet any projected growth (values greater than one).

Figure I. 2022 AEO Oil and Gas Growth Factors – Rocky Mountain Region



Source EIA 2022c

To support NEPA analyses, the BLM Rocky Mountain region states offices (North Dakota, South Dakota, Montana, Wyoming, Utah, Colorado and New Mexico) have conducted a regional modeling study projecting potential air quality and related values (nitrogen deposition, etc.) impacts for future years 2028 and 2032 (Ramboll 2023a, 2023b). Ozone modeling results for the 2028 scenario are being used here to describe the reasonably foreseeable affected environment. The 2028 scenario (Scenario A) for the Regional Modeling Study assumes that the annual average new oil and gas development rate for years 2014-2019 would continue for the following nine years (2020-2028). The 2032 scenario (Scenario B) future oil and gas emissions are based on production growth following 2022 AEO projection trajectories depending on location (basin and

state) where some parts of Colorado follow the high oil and gas supply growth trajectory (as shown above) and other geographic areas follow the reference or low oil and gas projection pathways.

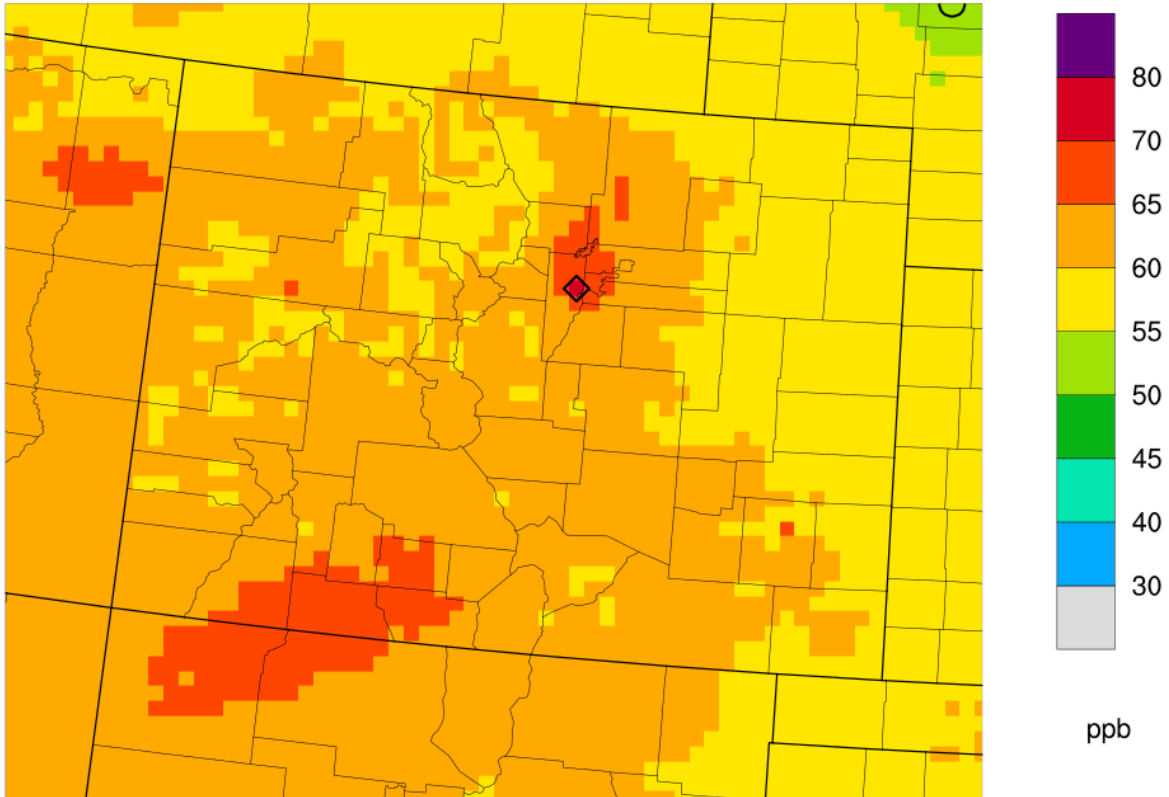
The following figure shows modeled year 2028 ozone cumulative concentrations for Colorado. As shown in the plot, ozone concentrations are predicted to be below the ozone 8-hour NAAQS (70 ppb) for all areas in Colorado except the Denver metro. These future predicted concentration levels are lower than recent historical and existing levels for most areas in Colorado and if realized, would be a result of emissions reductions associated with electricity generating unit (EGU) closures or switching over to natural gas from coal, and cleaner mobile sources and other anthropogenic emissions sources due to policy and regulation. The 2028 modeling scenario utilized the Intermountain West Data Warehouse (IWDW) 2028OTBa2 emissions estimates for all non-oil and gas and coal related sources including EGU and mobile sources (IWDW 2021). The 2028OTBa2 annual NO_x emissions estimates for Colorado-based EGU and mobile sources are approximately 32 and 25 percent of the IWDW modeling platform 2014 annual NO_x emissions levels for the same Colorado source sectors, respectively, suggesting that the Colorado-based anthropogenic driven impacts associated with these two relatively high emitting sectors would be lower for future year 2028 when compared to those for year 2014. More details and information regarding the emissions inventories, assumptions applied and predictions for the BLM Regional Modeling Study are provided in the following environmental consequences section.

The BLM Regional Modeling Study will be used in combination with CARMMS for future federal project-level assessments under the revised resource management plans (RMPs). In addition to modeling source groups separately for assessing potential impacts associated with “direct” emissions sources, the BLM CARMMS and regional modeling study include cumulative air quality impact analyses that account for the indirect downstream effects of non-GHG air emissions from future federal oil and gas end-use and combustion. As described in the following environmental consequences section, BLM modeling studies suggest that, in general, direct (upstream/midstream) and indirect (midstream/downstream) air quality and related value impacts from federal authorized activities including oil and gas development, operations, and production are expected to decrease or be minimal throughout Colorado at locations where federal oil and gas is produced and used (e.g., combusted), including within low-income and minority communities.

In the 2019 legislative session Colorado passed House Bill 19-1261, the Climate Action Plan to Reduce Pollution, which includes science-based targets of reducing statewide GHG pollution 26 percent by 2025, 50 percent by 2030, and 90 percent by 2050 from 2005 levels. As part of the Plan, state agencies were directed to develop a Greenhouse Gas Pollution Reduction Roadmap (Colorado Energy Office 2021). The Roadmap’s 2019 Action Scenario is a “business as usual” scenario that is based on laws, regulations, policies, and programs in place when the CDPHE 2021 GHG Report (CDPHE 2021) was developed. The 2019 scenario shows that Colorado, with no additional legislation, regulation, or policy measures, would be on a path to reduce emissions by approximately 16 percent by 2025 and 25 percent by 2030. The GHG Roadmap identifies sectoral changes and additional measures needed to reach the 26 percent reduction by 2025, 50 percent reduction by 2030, and 90 percent reduction by 2050. As previously described, the CDPHE recently (since the Roadmap was prepared) updated its oil and gas regulations to further reduce GHG (primarily methane) emissions.

Figure 2. BLM Regional Modeling Study – Scenario A – Predicted 2028 Cumulative Ozone Concentrations

**Figure CO.O3.1
4th High Daily Max 8 Hour Avg Ozone
Cumulative, CO**



◇ $\max(39,35) = 70.3$ ppb
○ $\min(64,54) = 53.6$ ppb

In 2022, high prices for natural gas and demand exceeding supply caused some countries to reactivate or delay planned closures of coal fired power plants (Reuters 2022). In the future, renewable energy is anticipated to become a larger part of the U.S. energy mix, reducing energy-related carbon emissions. It has been estimated that a 35 percent integration of wind and solar energy into the Western United States electric grid would lead to an additional 25-45 percent reduction in carbon emissions (BLM 2022r). The World Energy Outlook (WEO) 2021 predicts that global oil and gas demand will continue to increase through year 2030 for the “State Policies Scenario” and will be similar to year 2020 levels for the “Announced Pledges Scenario” in year 2030; only under the WEO 2021 “Net Zero” scenario does global oil and gas demand decline. Even under that scenario, decline would not begin until year 2026 and would require additional legislation, regulation, and policy measures (IEA 2021).

Environmental Consequences

Adverse impacts on air quality are those that increase emissions of air pollutants—including criteria pollutants, HAPs, and sulfur and nitrogen compounds—that can affect air pollutant concentrations, visibility,

and atmospheric deposition. Impacts on these components are affected by the magnitude and spatial and temporal distribution of the primary and precursor emissions and their interactions with local and regional meteorological conditions and topographic features. Beneficial impacts are those that decrease emissions, from either control measures or a reduction in activities that generate emissions. In the planning areas, the resources that have the largest potential for air quality impacts are mineral resources, primarily oil and gas.

The primary quantitative indicators used to assess impacts on air quality and related values, and GHG emissions are:

- Predicted air pollutant (including GHGs) emission levels relative to current and foreseeable baseline levels;
- Predicted air pollutant cumulative concentrations relative to ambient air quality standards and source group or project-level contributions relative to significant impact levels; and
- Predicted visibility and deposition levels relative to agency planning goals and guidance.

Indicators for other emission-generating activities and events (including prescribed fire and wildfire) on public lands are based on the anticipated acreage affected or level of intensity for each activity that would occur under each alternative. Where emissions cannot be reasonably estimated quantitatively, or data are unavailable, potential impacts on air quality and related values are compared and discussed qualitatively.

This air resources analysis incorporates by reference the BLM Regional Modeling Study to describe potential air quality and related values (visibility and deposition) impacts for the RMPA alternatives. **Appendix I** provides a comprehensive technical support document (TSD) with details for projected oil and gas emissions (including GHGs) levels and the modeling study focusing on the potential impacts that could be associated with projected new Colorado-based federal oil and gas development and operations. The following subsections provide an overview and summary of data and information based on the TSD.

Projected Federal Oil and Gas Emission Estimates Across Alternatives

For the Regional Modeling Study, BLM developed a detailed oil and gas emissions inventory for circa 2032 federal oil and gas development and operations using historical production and development data, U.S. Energy Information Administration future projections and area/basin-specific emissions calculators. This emissions inventory is being used as-is for the no-action Alternative A (details describing differences for the no-action Alternative A and BLM Regional Modeling Study 2032 oil and gas emissions inventories are provided below). For the action alternatives (Alternatives B, C, and D) emissions inventories, the no-action Alternative A emissions inventory was revised (reduced) based on stipulation/restriction information associated with the RMPA action alternatives. The emission inventories include criteria air pollutants, VOCs, HAPs and GHG from new and existing oil and gas sources. Annual GHG emissions are also developed for each year from 2025 to 2050. Section 2.1.1 of **Appendix I** provides more detail regarding how the emissions inventories were developed for the BLM Regional Modeling Study and alternatives for this EIS.

Section 2.2.2.1 of **Appendix I** provides data and information regarding the levels of criteria air pollutants (and precursors) emissions for the no-action Alternative A. Section 2.2.3 of **Appendix I** provides estimates for Alternative B and C, and Section 2.2.4 provides air pollutant (criteria and precursor) emissions estimates for Alternative D. As described in **Appendix I**, the “new” versus “existing” oil and gas development cut-off year is different between the 2032 inventories for the BLM Regional Modeling Study and the RMPA alternatives since new wells begin starting year 2025 for the alternatives as opposed to year 2020 for the 2032 modeling study inventories. New versus existing emissions levels differ between the two future baseline inventories in that existing oil and gas emissions are larger for the RMPA no-action Alternative A when

compared to existing emissions levels for the Regional Modeling Study, but new oil and gas emissions levels for the no-action Alternative A are lower than those assumed for the BLM Regional Modeling Study year 2032 inventories; the total (new plus existing) emissions levels for both future baseline scenarios are equal. The following two tables, **Table 3-16** and **Table 3-17** (taken from **Appendix I**) show oil and gas related criteria pollutants (and precursor) emissions differences / changes for the action alternatives (Alternatives B, C, and D) when compared to emissions levels for the no-action Alternative A. As shown in the tables, the largest reductions in future federal oil and gas related emissions would occur in the White River Field Office, which is consistent with BLM's conclusions about which Colorado federal oil and gas areas are most likely to be impacted by RMPA stipulations/restrictions (see **Tables 3-8** through **3-11** for oil and gas development potential by BLM Field Office for each alternative). Similar tables for hazardous air pollutants (HAPs) can be found in **Appendix I** (see Section 2.2.2.2) similar to criteria air pollutants, the largest HAPs emissions reductions for the action alternatives would occur in White River FO.

Table 3-16. New Federal Oil and Gas Criteria Air Pollutant and Precursor Emissions under Alternatives B and C in Colorado in 2032 by BLM Field Office in Tons/year and Corresponding Percent Change from the No Action Alternative

Field Office	NOx	VOC	CO	SOx	PM ₁₀	PM _{2.5}
Colorado River Valley FO	771.3 (-1.86%)	428.9 (-1.44%)	344.1 (-2.06%)	1.0 (-0.22%)	25.2 (-2.63%)	25.2 (-2.63%)
Grand Junction FO	258.6 (-1.98%)	166.1 (-1.69%)	133.3 (-1.84%)	1.1 (-0.07%)	9.2 (-2.60%)	9.2 (-2.60%)
Gunnison FO	.6 (-38.52%)	.2 (-38.52%)	.2 (-38.52%)	.0 (-38.52%)	.0 (-38.52%)	.0 (-38.52%)
Kremmling FO	5.8 (-0.92%)	6.7 (-0.47%)	4.8 (-0.61%)	.0 (-0.65%)	.2 (-0.98%)	.2 (-0.98%)
Little Snake FO	84.7 (-3.81%)	233.7 (-6.44%)	73.3 (-2.72%)	.3 (-0.17%)	1.7 (-7.96%)	1.7 (-7.98%)
Royal Gorge FO	901.2 (-0.44%)	958.7 (-0.38%)	636.8 (-0.38%)	4.7 (-0.02%)	40.4 (-0.44%)	39.6 (-0.45%)
San Luis Valley FO	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)
Tres Rios FO	621.8 (-0.37%)	146.1 (-1.48%)	502.1 (-0.25%)	3.1 (-0.05%)	10.2 (-0.78%)	10.1 (-0.78%)
Uncompahgre FO	5.0 (-0.03%)	7.3 (-0.01%)	2.3 (-0.02%)	.0 (0.00%)	.2 (-0.03%)	.2 (-0.04%)
White River FO	304.5 (-26.41%)	341.3 (-29.03%)	183.1 (-20.84%)	44.3 (-0.03%)	18.5 (-21.98%)	18.4 (-22.08%)
Statewide total	2,953.4 (-4.50%)	2,289.1 (-6.94%)	1,879.9 (-3.28%)	54.6 (-0.04%)	105.7 (-5.85%)	104.6 (-5.90%)

Table 3-17. New Federal Oil and Gas criteria Air Pollutant and Precursor Emissions under Alternative D in Colorado in 2032 by BLM Field Office in Tons/year and Corresponding Percent Change from the No Action Alternative

Field Office	NO _x	VOC	CO	SO _x	PM ₁₀	PM _{2.5}
Colorado River Valley FO	771.2 (-1.86%)	428.8 (-1.46%)	344.0 (-2.08%)	1.0 (-0.22%)	25.2 (-2.64%)	25.2 (-2.64%)
Grand Junction FO	257.2 (-2.52%)	165.5 (-2.04%)	132.6 (-2.34%)	1.1 (-0.08%)	9.1 (-3.31%)	9.1 (-3.31%)
Gunnison FO	.6 (-38.53%)	.2 (-38.53%)	.2 (-38.53%)	.0 (-38.53%)	.0 (-38.53%)	.0 (-38.53%)
Kremmling FO	5.8 (-1.63%)	6.7 (-0.80%)	4.8 (-1.07%)	.0 (-1.13%)	.2 (-1.75%)	.2 (-1.75%)
Little Snake FO	84.2 (-4.41%)	233.6 (-6.50%)	73.1 (-2.97%)	.3 (-0.19%)	1.6 (-9.39%)	1.6 (-9.43%)
Royal Gorge FO	901.2 (-0.45%)	958.7 (-0.38%)	636.7 (-0.38%)	4.7 (-0.02%)	40.4 (-0.44%)	39.6 (-0.45%)
San Luis Valley FO	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)	.0 (0.00%)
Tres Rios FO	618.6 (-0.88%)	145.6 (-1.80%)	499.5 (-0.78%)	3.1 (-0.18%)	10.2 (-1.08%)	10.1 (-1.07%)
Uncompahgre FO	5.0 (-0.04%)	7.3 (-0.01%)	2.3 (-0.03%)	.0 (0.00%)	.2 (-0.04%)	.2 (-0.05%)
White River FO	304.0 (-26.51%)	341.1 (-29.05%)	182.9 (-20.90%)	44.3 (-0.03%)	18.5 (-22.07%)	18.4 (-22.17%)
Statewide total	2,947.7 (-4.68%)	2,287.6 (-7.00%)	1,876.1 (-3.48%)	54.6 (-0.05%)	105.6 (-5.98%)	104.5 (-6.04%)

BLM Regional Air Quality Modeling – 2032 Scenario

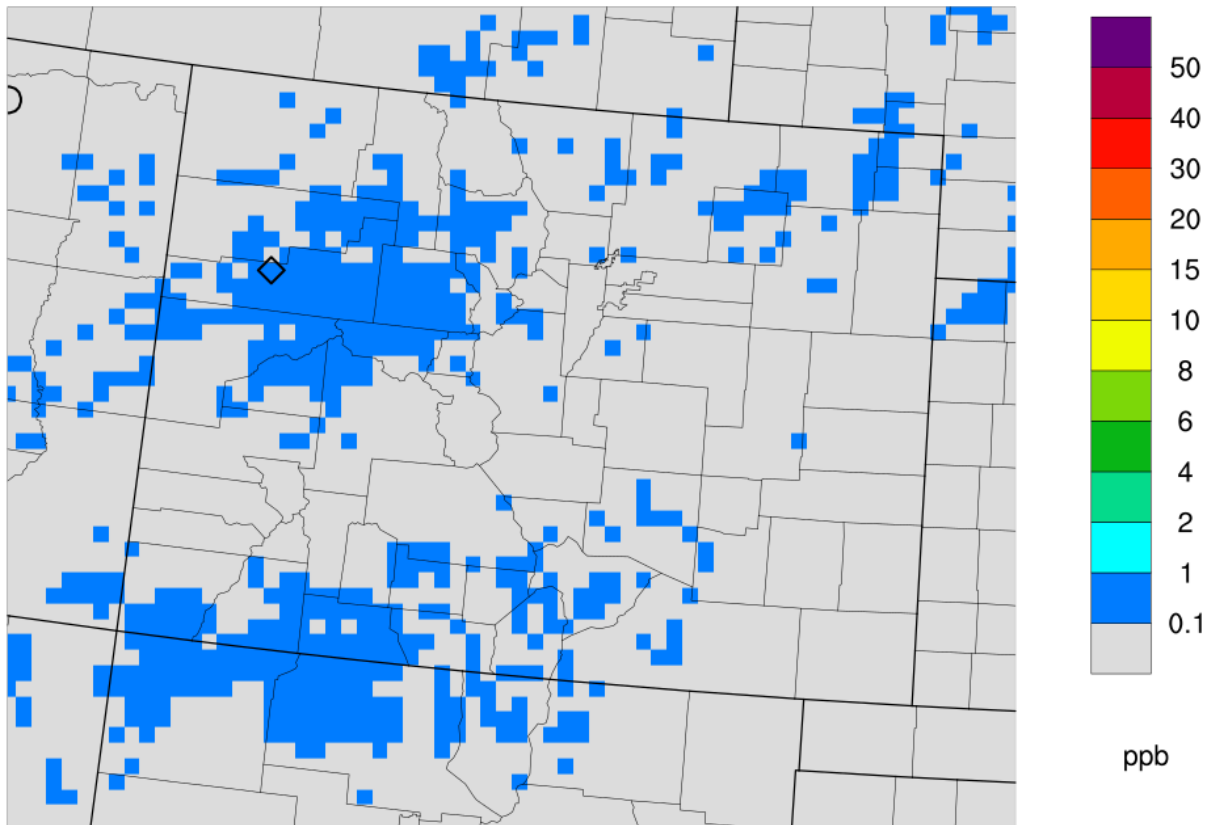
Section 2.1.2 of **Appendix I** further introduces the BLM Regional Modeling Study with sub-sections providing details regarding the photochemical grid modeling completed for the study. As described in Section 2.1.2.3, source apportionment modeling for new federal oil and gas (oil and gas developed 2020-2032) was completed for two geographical areas: Royal Gorge Field Office (RGFO) and western Colorado (all BLM Colorado Field Offices other than RGFO). Section 2.2 begins discussion of the modeled impacts for the BLM Regional Modeling Study. As described in the previous sub-section above, new federal oil and gas 2032 emissions levels for the no-action Alternative A are lower than those assumed for the BLM Regional Modeling Study year 2032 inventories due to different “cut-off” years for designating new versus existing oil and gas development/operations. This means that the modeled impacts presented in this sub-section for the 2032 modeling study would be over-estimates for describing potential air quality and related values impacts for the no-action Alternative A (and action alternatives).

As described in **Appendix I**, for the BLM Regional Modeling Study 2032 scenario, air quality impacts from the new and existing oil and gas emission sources (federal and non-federal) are all well below the NAAQS. For the Study, impacts due to new federal oil and gas emissions sources in the western Colorado FOs are larger than those associated with Royal Gorge FO sources for 1-hour NO₂, 8-hour O₃, 1-hour SO₂, and 3-hour SO₂. Royal Gorge FO sources contribute at higher impact levels for 24-hour PM₁₀, 24-hour PM_{2.5}, and annual PM_{2.5}. New federal oil and gas in Western Colorado FOs contributes 10.56 ppb to 1-hour NO₂ (11 percent of NAAQS), 0.76 ppb to 8-hour O₃ (1 percent of NAAQS), 0.12 ppb to 1-hour SO₂ (<1 percent of NAAQS), and 0.07 ppb to 3-hour SO₂ (<1 percent of NAAQS). New federal oil and gas in the Royal

Gorge FO contributes $0.32 \mu\text{g}/\text{m}^3$ to 24-hour PM_{10} (<1 percent of NAAQS), $0.27 \mu\text{g}/\text{m}^3$ to 24-hour $\text{PM}_{2.5}$ (<1 percent of NAAQS), and $0.06 \mu\text{g}/\text{m}^3$ to annual $\text{PM}_{2.5}$ (<1 percent of NAAQS). For Class I areas, the maximum concentration contributions from new Colorado-based federal oil and gas emissions sources are lower than the statewide maximums as described for all criteria air pollutants. The following figure shows 8-hour O_3 contributions from new (2020-2032 development) federal oil and gas development and operations in western Colorado FOs.

Figure 3. Eight-Hour Ozone Contributions from New Federal Oil and Gas Development and Operations in Colorado

Figure CO.03.6
4th High Daily Max 8 Hour Avg Ozone
OilGas_NewFed_WesternCO



As shown in the plot above, the largest modeled 8-hour O_3 contribution due to new (2020-2032 development) federal oil and gas in western Colorado is predicted to occur in the south-central part of the White River FO near Colorado River Valley FO. Not shown here, but the highest modeled levels of NO_2 1-hour concentration contributions due to new federal oil and gas sources in western Colorado FOs are also located in the White River and Colorado River Valley FOs. Plots for all air pollutants and deposition can be found in **Appendix I**.

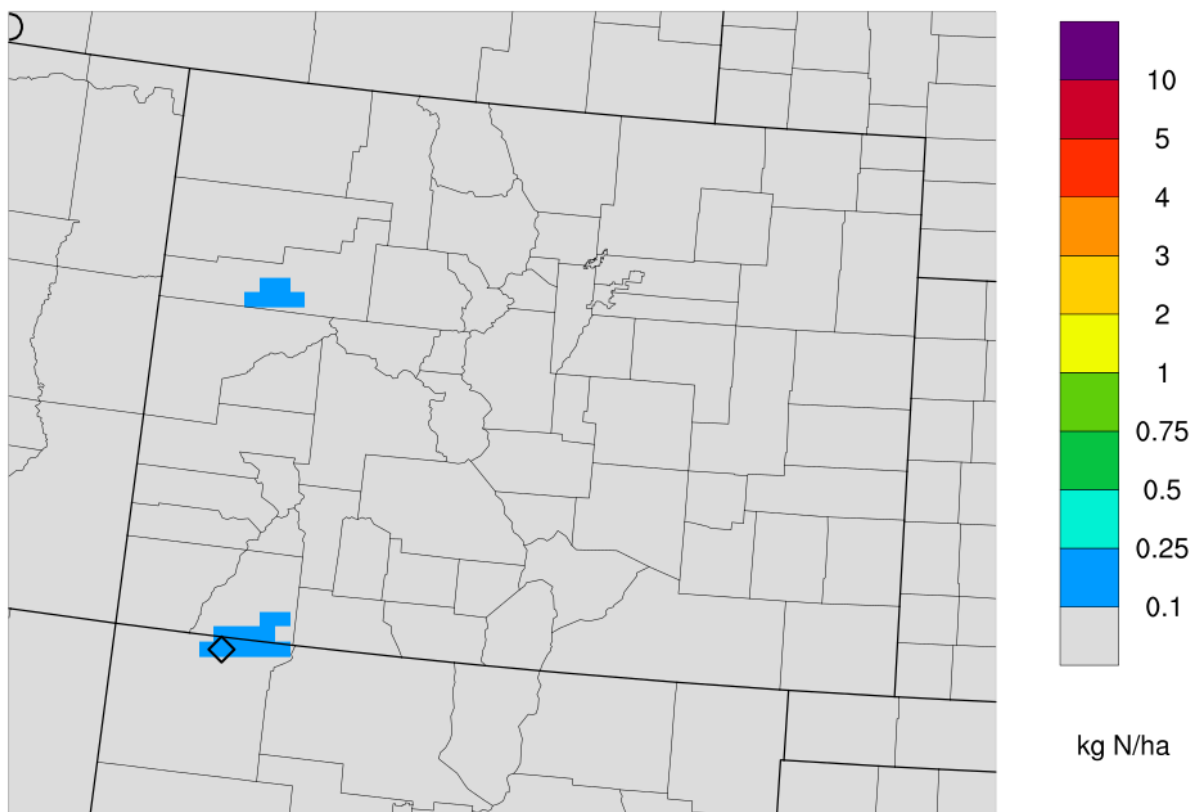
Appendix I describes that future air quality and related values (deposition and visibility) impacts from new federal oil and gas development in Colorado would vary across alternatives due to differences in air pollutant emissions levels (see previous sub-section for differences in emissions levels among alternatives). As described in the previous sub-section, new federal oil and gas development and operations related air pollutant emission levels under the no-action Alternative A would be lower than the new federal oil and gas development/operations related emissions levels modeled for the BLM Regional Modeling Study 2032 scenario meaning that air quality and related value impacts associated with new federal oil and gas for no-action Alternative A would likely be lower than those described (and shown in the figure) above. Air quality and related value impacts for the BLM Regional Modeling Study 2032 scenario are projected to be minimal with respect to NAAQS (cumulative impact thresholds) levels for new federal oil and gas development and operations. Since the new federal oil and gas emissions for Alternatives B and C are lower than the no-action Alternative A, the impacts would correspondingly be lower as well. Emissions for Alternative D are lower than the no-action Alternative A and action alternatives B and C, therefore, it would have the lowest air quality and related value impacts among the alternatives. The White River FO would likely experience the largest reduction in future air quality concentrations since it had the highest percent decline in oil and gas production and criteria air pollutant (CAP) and HAP emissions when considering additional restrictions/stipulations associated with the action alternatives (see tables in previous sub-section). Based on the discussion and figure shown above, it is possible that future cumulative O₃ 8-hour and NO₂ 1-hour concentrations in the White River FO/Colorado River Valley FO area could be up to 0.8 and 10.6 ppb lower under the action alternatives, respectively. In summary, the lower emissions levels associated with the action alternatives of NO_x, PM₁₀, SO₂, and CO would lead to lower concentrations of NO₂, PM₁₀, SO₂, and CO. Since O₃ and PM_{2.5} are secondary pollutants (formed through reactions), there is a more complex relationship between emissions and concentrations. Generally, the lower NO_x, VOC, and PM_{2.5} emission levels associated with the action alternatives would likely lead to lower O₃ and PM_{2.5} concentrations. HAP impacts associated with new federal oil and gas would be lower as well under the action alternatives due to lower emissions levels.

The dependence of air quality and air quality related value (AQRV) impacts on CAP emissions are discussed in **Appendix I**. Nitrogen and sulfur deposition due to new Colorado-based federal oil and gas emissions sources is predicted to be minimal for the projected 2032 modeling (~ no-action scenario) and would likely be reduced to almost negligible levels for the action alternatives due to the lower NO_x and SO₂ emissions. Lower NO_x, SO₂, PM, and VOC emissions under the action alternatives will also likely lead to less light extinction (i.e., less visibility impairment) contribution from new federal oil and gas sources. The following figure shows maximum predicted annual nitrogen deposition due to air pollutant emissions from new federal oil and gas sources in western Colorado FOs for the BLM Regional Modeling Study 2032 scenario. Under the action alternatives, it is possible that cumulative annual nitrogen deposition could be up to 0.2 kg/ha-yr lower in western Colorado big game habitat/corridor areas.

Section 2.2.5 of **Appendix I** provides details regarding cumulative impacts for the air quality modeling study. As described for projected 2032 air pollutant emissions levels, the highest NO_x emissions are from existing oil and gas developments on non-federal lands, followed by new oil and gas developments on non-federal lands. The highest VOC emissions are also from existing oil and gas developments on non-federal lands, followed by existing oil and gas developments on federal lands.

Figure 4. Maximum Predicted Annual Nitrogen Deposition due to Air Pollutant Emissions from New Federal Oil and Gas Sources in Colorado for the BLM Regional Modeling Study 2032 Scenario

**Figure CO.NDEP.6
Annual Total Nitrogen Deposition
OilGas_NewFed_WesternCO**



◇ $\max(15,12) = 0.2 \text{ kg N/ha}$
○ $\min(1,53) = 0.0 \text{ kg N/ha}$

Overall, cumulatively for the projected 2032 modeling, NO₂, O₃, and SO₂ did not show any NAAQS exceedances throughout Colorado. Exceedances were predicted in limited areas in Jackson, Rio Blanco, Fremont, and Custer Counties due to wildfires for maximum 2nd highest daily PM₁₀, maximum 8th highest daily PM_{2.5}, maximum annual PM_{2.5}, 1-hour daily maximum CO, and 8-hour daily maximum CO. When wildfire contributions are excluded, no cumulative NAAQS exceedances are predicted for all pollutants and averaging times. In general, non-federal oil and gas development sources are predicted to be the largest contributors to cumulative 1-hour NO₂ concentrations, while other anthropogenic sources (other than direct / field-level [upstream] oil, gas, and coal sources) including indirect (downstream) mobile, residential and industrial sources were the largest contributors to cumulative 8-hour O₃ concentrations, and wildfires were the largest contributors to cumulative 24-hour PM₁₀, 24-hour PM_{2.5}, annual PM_{2.5}, 1-hour CO, 8-hour CO, 1-hour SO₂, and 3-hour SO₂ concentrations.

Cumulative annual nitrogen deposition values over Colorado vary between 1 and 6 kg N/ha and values within the Class I areas do not exceed the applicable nitrogen deposition critical loads. In general, the largest contributors to nitrogen deposition are anthropogenic sources other than oil and gas. Cumulative annual sulfur deposition values over most of Colorado vary between 0.1 and 1 kg S/ha. Like for nitrogen deposition, the largest contributors to sulfur deposition are anthropogenic sources other than oil and gas.

Modeled cumulative visibility design values in Colorado for the most impaired days are projected to be below the uniform rate of progress toward the 2064 visibility goals. Design value contributions from the oil and gas sector are modeled to be less than 2 percent of the total visibility impacts.

New Colorado-based federal oil and gas development/operations through 2032 are not projected to cause a significant impact to cumulative air quality in year 2032 for the no-action scenario. Any reductions in new federal oil and gas emissions from future baseline no-action alternative levels that would be associated with the action alternatives restrictions / stipulations would likely result in overall year 2032 cumulative air quality concentrations and related values being lower than the those described for the BLM Regional Modeling Study 2032 scenario and no-action alternative.

GHGs and Potential Climate Change Impacts

Section 3.0 of **Appendix I** provides details and information (including references) regarding GHGs and climate change. Emissions for GHGs including CO₂, CH₄ and N₂O from the production, processing, transport, and downstream combustion of new (development year 2025 through RMPs end-years [end-years vary by Field Office]) federal oil and natural gas from the planning area under each alternative are estimated for years 2025 through 2050. CO₂e emissions are presented for each year using the 20-year and 100-year time horizon GWPs from Sixth Assessment Report (AR6) of the International Panel on Climate Change (IPCC).

As described in **Appendix I**, under the Paris Agreement, the United States has established an economy-wide target of reducing its net GHG emissions by 50 percent to 52 percent below 2005 level by 2030. The 2005 U.S. net emissions (including sinks) were 6,635 MMT CO₂e. Therefore, the 2030 U.S. net emissions target is estimated to be between 3,185 and 3,318 MMT CO₂e. The total GHG emissions from new federal oil and gas production, transportation, processing, and downstream combustion under no-action alternative A in 2030 are approximately 11.32 MMT CO₂e, which comprise roughly 0.34 percent to 0.36 percent of the U.S. 2030 net GHG emissions target.

Appendix I describes GHG emissions equivalencies using EPA's calculator. The results indicate that the annual average new Colorado-based federal oil and gas GHG emissions level from 2025 to 2050 of approximately 8.29 MMT CO₂e (calculated using the 100-year GWPs) under no-action Alternative A, is equivalent to:

- GHG emissions from 1,029,181 homes' energy use for one year;
- GHG emission from 2.2 coal-fired powerplants for one year;
- GHG emissions from 45,020 railcars' worth of coal burned;
- GHG emissions from 918,861,382 gallons of gasoline consumed; and
- GHG emissions avoided by 2,271 wind turbines operating for one year.

These no-action alternative GHG emissions equivalency values can be used in conjunction with projected GHG emissions comparisons among the alternatives to describe equivalencies that could be associated with the action alternatives. Total GHG emissions from new federal production, transportation, processing, and

downstream combustion under Alternatives B and C in 2030 would be approximately 8 percent lower than for no-action Alternative A. For Alternative D, new Colorado-based oil and gas related emissions would be roughly 8.3 percent lower than the no-action alternative levels. In addition, these percent reduction levels associated with the action alternatives can be applied to the no-action Alternative A percentage of the U.S. 2030 net GHG emissions target shown above to describe approximate percentages of the U.S. 2030 GHG target level for the action alternatives; new federal oil and gas emissions for Alternatives B and C and Alternative D would comprise approximately 92 and 91.7 percent of ~ 0.35 percent (Alternative A percentage) of the U.S. 2030 GHG target level respectively.

Social costs of GHGs (SC-GHGs) were calculated based on Interagency Working Group (IWG) estimates of social cost per metric ton of emissions for a given future year using new federal oil and gas GHG emissions associated with the no-action Alternative A and action alternatives B, C and D (IWG 2021). See Section 3.3 in **Appendix I** for annual GHG emissions levels for each year 2025-2050 used for calculating SC-GHGs. The following table shows potential SC-GHGs that could be associated with the no-action Alternative A for all new Colorado-based federal oil and gas development/operations year 2025 through RMPs end-years (varies by field office) production, transportation, processing, and downstream combustion GHG emissions. The projected GHG emissions and corresponding SC-GHGs reduction percentages for the action alternatives when compared to the no-action alternative baseline levels shown below are described in the previous paragraph; SC-GHGs for Alternatives B and C, and Alternative D would be approximately 8 percent and 8.3 percent lower than the no-action Alternative A values shown in the table below, respectively.

Table 3-18. Total SC-GHGs for New Colorado Federal Oil and Gas GHG Emissions (2025-2050) – Alternative A

GHG	Average, 5%	Average, 3%	Average 2.5%	95th Percentile, 3%
CO2	\$2,510,928,395	\$9,407,630,992	\$14,177,928,942	\$28,636,803,106
CH4	\$433,238,886	\$1,100,621,108	\$1,480,134,229	\$2,936,051,541
N2O	\$6,834,788	\$23,777,353	\$35,640,192	\$63,219,633
Total	\$2,951,002,068	\$10,532,029,454	\$15,693,703,363	\$31,636,074,280

Source: IWG 2021

Cumulative GHG emissions for existing federal oil and gas as well as Tribal and non-federal oil and gas are described in Section 3.3.4 of **Appendix I**.

Colorado released its Greenhouse Gas Pollution Reduction Roadmap in January 2021. This Roadmap laid out an achievable pathway to meet the state’s science-based climate targets of GHG emission reductions of 26 percent by 2025, 50 percent by 2030 and 90 percent by 2050 from 2005 levels. Thus, cumulative GHG emissions in Colorado are expected to be significantly lower by 2030 compared to current levels.

The BLM 2021 Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends provides an estimate of the total GHG emissions from the extraction, processing, transportation, and end use of fossil fuels from federal onshore mineral estate across the U.S. along with a summary of projected climate change impacts. It estimates that the total GHG emissions from federal fossil fuels in fiscal year 2021 were approximately 913.9 MMT CO₂e. The report also provides an estimate of the long-term cumulative GHG emissions from onshore federal oil, gas, and coal production from 2022 to 2050 of approximately 24,299 MMT CO₂e. Global climate change impact modeling was completed for the BLM Report and it was estimated that all projected US federal oil- and gas-related emissions through year 2050 following U.S. Energy

Information Administration projections would constitute approximately one percent of the lower carbon budget temperature target of 1.5-degree Celsius change (net zero by 2050 scenario). See **Appendix I** for more information and references to the BLM Specialist Report and other information sources used for this analysis.

3.2.3 Climate

Issue 1: How do the alternatives potentially impact GHGs / climate change (see Air Quality)? What are the impacts to natural resources in the planning area already or predicted to be vulnerable and exacerbated by climate change, especially those resources critical for big game?

Issue 2: How do the alternatives contribute to landscape resiliency, given prolonged and intensifying drought conditions and scarce riparian resources?

Issue 3: How might alternatives affect project level planning, which may interplay with natural events such as wildfire and flooding? Specifically, how can climate change, drought, and novel weather patterns be accounted for within implementation-level oil and gas management?

Issue 4: How will climate variability impact big game populations in the planning area, taking into account foreseeable trends and planned actions in the area?

Issue 5: What are the impacts across alternatives to big game habitat effectiveness when combined with forecasted impacts from climate change in 20 years?

Issue 6: How do the alternatives differ with respect to the cumulative effects of climate change when considered with non-BLM land use activities in the planning area. How does the implementation of conservation actions contribute to cumulative effects on big game and their habitats associated with climate change?

Affected Environment

Colorado's high elevation, midlatitude, and continental interior geography results in a cool, dry climate. The average annual temperature for the state is 43.5 degrees Fahrenheit (°F) and the average statewide precipitation is 17 inches. The climate of local areas are affected by differences in elevation, and to a lesser degree, by the orientation of mountain ranges and valleys. While temperature decreases and precipitation generally increases with altitude, these patterns are affected by the orientation of mountain slopes, which affect prevailing winds, and topographical features, which create local air movement patterns.

The climate of the eastern plains of Colorado is comparatively uniform, with low relative humidity, abundant sunshine, light rainfall, moderate to high wind movement, and a large daily range in temperature. Summer daily maximum temperatures are often 95°F or above, and 100°F temperatures have been observed. In contrast, the topography of western Colorado causes large variations in climate within short distances. At the summits of mountains, temperatures are low, averaging less than 32°F over the year. Average summer temperatures in western Colorado are around 60°F, with highs usually in the range of 70 to 80°F but occasionally exceeding 90°F (WRCC 2022).

Precipitation in the state is low, though highly variable depending on location. The western portion of the state sees most of its precipitation in winter months, while southern portions of the state receive mid to late-summer precipitation. Heavy precipitation can be produced on the eastern slope of the divide, particularly during the spring and summer, while the plains see most of their precipitation during the growing season (CNHP 2015).

Changes in temperature, precipitation, long-term climate patterns, and other measured climate variables that persist for decades or longer are referred to as climate change (IPCC 2014). The IPCC has concluded that it is unequivocal that human influence has warmed the atmosphere, ocean, and land and that human

activities have caused GHG concentrations to increase since the mid-eighteenth century (IPCC 2021). The increase in well-mixed GHG concentrations has caused widespread changes in the Earth's climate systems. These include, but are not limited to, successively warmer global surface temperature and increasing global average precipitation.

Evidence of observed changes in extremes, such as heat waves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since the IPCC Fifth Assessment Report (IPCC 2014). The IPCC in its Sixth Assessment Report (IPCC 2021) estimates that the likely range of the human-caused increase in global surface temperature between 1850-1900 and 2010-2019 was 1.4 to 2.3°F (0.8 to 1.3 degrees Celsius [°C]). The increase in well-mixed GHG concentrations was likely accountable for 1.8 to 3.6°F (1.0 to 2.0°C) of the increase in global surface temperature, while other human drivers contributed a cooling of 0.0 to 1.4°F (0.0 to 0.8°C) (IPCC 2021). Natural drivers and internal variability changed the global surface temperature by -0.2 to 0.2°F (-0.1 to +0.1°C) and -0.4 to +0.4°F (-0.2 to +0.2°C), respectively (IPCC 2021). Human-induced climate change has also increased the global average precipitation over the land area since the mid-twentieth century and has shifted the mid-latitude storm tracks poleward in both hemispheres. Under scenarios with increasing carbon dioxide (CO₂) emissions, the ocean and land carbon sinks are projected to be less effective at slowing the accumulation of CO₂ in the atmosphere (IPCC 2021).

Climate data show that Colorado has begun experiencing the effects of climate change, and studies indicate that climate change will continue influencing the natural resources, open spaces, built environment, economy, and recreation opportunities in the state. Temperatures in Colorado have increased by 2.5°F since the start of the 20th century and have stayed consistently higher than the long-term average since 1998 (NOAA 2022a); a Colorado Climate Vulnerability Study (Childress et al. 2015) reports that 2°F of warming has occurred over the past 30 years alone. Six of the eight hottest years in the state's recorded history have occurred since 2012, and the most recent 10-year period (2011-2020) was the hottest yet observed (BLM 2021). Average annual temperatures in the more recent past are higher than the long-term average (1895 to present) and are expected to continue to increase (Colorado State 2022, EPA 2016, NOAA 2022a).

In addition to the overall trend of higher average temperatures, the state has experienced an above average number of very hot days (days with a maximum temperature exceeding 95°F) and a decrease in the number of very cold nights (days with a minimum temperature below 0°F) since 1990. Warming has occurred in all seasons and has been observed throughout the state. Daily minimum temperatures increased more than daily maximum temperatures. The growing season (that is, frost-free days) has increased by nearly 3 weeks since 1991 relative to the 1901 to 1960 average (BLM 2021). The Palmer Drought Severity Index has shown a trend towards more frequent soil moisture drought conditions in Colorado over the past 30 years, reflecting the combination of the warming trend and below-average precipitation since 2000 (Childress et al. 2015). Drought reconstructions from tree rings indicate that prior to 1900, the state experienced droughts that were more severe and sustained than any modern droughts (Childress et al. 2015).

Long-term average annual precipitation has been variable in Colorado over the period of record, though the state has generally experienced above average fall precipitation since 1980 and below average spring precipitation since 2000 (BLM 2021, NOAA 2022a). There is considerable site-specific variability among Colorado snow monitoring sites, with some indicating no long-term trend while others show a significant decrease in April 1 snowpack (BLM 2021). Generally, there have been slight declines in snowpack in northern Colorado and larger declines in southern Colorado (NOAA 2022a). The US Environmental Protection Agency estimated that snowpack measured in April declined by 20 to 60 percent at most monitoring sites

in Colorado since the 1950s (EPA 2016). Increased temperatures and enhanced solar absorption from dust-on-snow have contributed to earlier snowmelt and peak runoff timing during spring by 1 to 4 weeks over the past 30 years (Childress et al. 2015).

Climate model projections indicate future warming in Colorado. Statewide average annual temperatures are projected to warm by 2.5°F to 5°F by 2050 relative to a 1971–2000 baseline under a low GHG emissions scenario. Under a high GHG emissions scenario, the projected warming is 3.5°F to 6.5°F and would occur later in the century (Childress et al. 2015). Summer temperatures are projected to warm slightly more than winter temperatures, where average temperatures would be similar to the hottest summers that have occurred in the past 100 years. Increases in heat wave intensity are projected, but the intensity of cold waves are projected to continue to decrease (BLM 2021). Higher temperatures will contribute to increased evaporation rates, potentially contributing to drier overall conditions. Projected hotter temperatures increase probabilities of decadal to multidecadal megadroughts, which are persistent droughts lasting longer than a decade, even when precipitation increases. Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, will continue to increase wildfire risks and impacts to people and ecosystems (BLM 2021).

Individual climate models show a range of potential precipitation changes by 2050 of -5 percent to +6 percent under a low emissions scenario, and -3 percent to +8 percent under a high scenario (Childress et al. 2015). Some models indicate that winter precipitation will increase in the coming decades, but spring and summer precipitation will decrease (EPA 2016, NOAA 2022a). While Colorado has not experienced an upward trend in the frequency of extreme precipitation events to date, extreme precipitation events are projected to increase, primarily in winter (BLM 2021, Childress et al. 2015).

While models generally project an increase in winter precipitation by 2050, most projections of April 1 snowpack show declines by 2050 due to projected warming. Rising temperatures are projected to increase the average lowest elevation at which snow falls (the snow line). With a higher snow line, more precipitation would fall as rain instead of snow, reducing water storage in the snowpack, particularly at lower elevations that are now on the margins of reliable snowpack accumulation. Warmer temperatures would also result in earlier melting of the snowpack and increased evaporation of soil moisture, further decreasing water availability during the already dry summer months (BLM 2021). Reduced snowpack, coupled with increased evaporation rates from increased temperatures, would result in more variable water levels and reduced availability of water to be released. Late-summer river flows are projected to continue to decrease as peak runoff shifts earlier in the season, although the changes in the timing of runoff are more certain than changes in the amount of runoff (Childress et al. 2015). In general, most published research indicates a tendency toward future decreases in annual streamflow for all of Colorado's river basins (BLM 2021).

The major sources of GHGs in Colorado are transportation, electrical generation, oil and gas production, and fuel use in residential, commercial, and industrial spaces (State of Colorado 2021). In 2019, CO₂ emissions in Colorado from fossil fuel consumption were 91.7 million metric tons, or approximately 1.8 percent of the total US energy-related CO₂ emissions (EIA 2022). Estimated 2020 federal GHG emissions in Colorado were 77.27 million metric tons of CO₂ equivalents, including extraction, processing, transportation, and combustion of oil, gas, and coal produced from the BLM-administered federal mineral estate (BLM 2021).

Environmental Consequences

Impacts on climate change are analyzed under **Section 3.2.2** above. The impacts and trends associated with climate change on resources and resource uses are discussed in the relevant resource sections in this chapter.

3.2.4 Noise and Acoustic Environment

Issue 1: How does the closure of lands to fluid mineral leasing in and outside of big game HPH impact noise associated with drilling and operating wells or transfer stations?

Analytical Methods and Assumptions

- BLM has no regulatory control over state and federal highway noise. Any noise generated from highways and interstates is not considered in the analysis of direct and indirect effects but is accounted for in cumulative effects.
- Other noise generators, such as humans, industry operation (noise generated from oil and gas activities is included), and other ambient noises are not considered in the analysis of direct and indirect effects but is accounted for in cumulative effects.
- Specific noise impacts in open fluid mineral leasing areas may vary because stipulations are different at the field office level. Some noise impacts may be more localized, depending on the stipulations implemented.

Closing areas to oil and gas leasing in areas that do not have current oil and gas development would not increase or decrease noise levels. Noise generated from oil and gas activities would stay the same as they are presently and in the future.

Scope of the Analysis

- Scope of the noise analysis is limited to noise pollution generated from oil and gas activities on open/closed fluid mineral leasing areas, and open/closed fluid mineral leasing areas in HPH.

Affected Environment

Acoustic Environment Background (General)

The acoustic environment, or soundscape, is the combination of all sounds in a given area. These include natural sounds, such as wind, water, and sounds caused by insects, birds, and other wildlife. These also include human-caused sounds, which are considered noise because they have the potential to affect the natural acoustic environment and the noise-sensitive resources in that environment. **Table 3-19** provides examples of noise levels and human responses to give context to how oil and gas development may be perceived by human receptors.

Table 3-19. Typical Noise Levels and the Associated Human Perception or Response

Noise Source	Noise Level (dBA)	Human Perception or Response
Air raid siren	140	Painfully loud
Thunderclap	130	Painfully loud
Jet takeoff (200 feet)	120	Maximum vocal effort
Pile driver; rock concert	110	Extremely loud
Firecrackers	100	Very loud
Heavy truck (50 feet)	90	Very annoying
Hair dryer	80	Annoying
Noisy restaurant; freeway traffic	70	Telephone use difficult
Conversation	60	Intrusive

Noise Source	Noise Level (dBA)	Human Perception or Response
Light automobile traffic (100 feet)	50	Quiet
Living room; bedroom	40	Quiet
Library; whisper (15 feet)	30	Very quiet
Broadcasting studio	20	Extremely quiet

Source: Olivera et al. 2011

As noted in **Table 3-19**, sound levels of 80 to 90 A-weighted decibels (dBA) typically elicit annoyance. Annoyance describes a reaction to sound, based on its physical nature and its emotional effect. Though subjective, annoyance is routinely used as a basis for evaluating environmental noise impacts. The level of annoyance is affected by the sound’s persistence, frequency, and the magnitude of its fluctuation (whether it is impulsive versus steady), and whether the receiver finds the sound to be pleasant or unpleasant. In general, annoyance increases with the persistence of the sound, its impulsivity, more frequent and greater fluctuations, and a receptor’s perceived inability to exert control over the noise source.

Similarly, the degree to which noise may disturb wildlife receptors depends on many factors. Wildlife responses to noise are known to vary by species; the acoustical factors, such as frequency, intensity, and duration of noise; and the non-acoustical factors, such as the life history stage, environmental or behavioral context, and degree of past exposure (Francis and Barber 2013). Noise that is abrupt and unpredictable may be perceived as a threat, potentially triggering a startle response or antipredator behavior (Frid and Dill 2002; Francis and Barber 2013). Chronic noise may affect sensory capabilities via the masking of biologically important natural sounds, such as those used for communication or detection of predators or prey (Francis and Barber 2013).

Oil and Gas Noise Impacts

Oil and gas sites produce a variety of noise sources during the exploration, construction, development, and operation stages of the drilling process. The four phases of oil and gas development typically include drilling, hydraulic fracturing, completion, and production (Radtko et al. 2017). The noise produced during the construction and drilling phases of oil and gas development is typically louder than in other phases of operations; however, low-frequency noise generated from daytime and nighttime operations (particularly in the range of 50 to 60 dBA) may cause annoyance and detrimental health impacts (Almzazam and Alfaghi 2021; Blair et al. 2018).

Noise sources from oil and gas typically come from rig engines (engine, exhaust, and cooling fans), mud pumps, shale shakers (low-frequency noise potential), rig top drives, and ancillary equipment (light tower generators, blowers, and other facility-related infrastructure; Noise Monitoring Services 2018). The process of hydraulic fracturing contributes the largest amount of noise pollution due to the use of low-frequency drilling trucks (Noise Monitoring Services 2018). In Colorado, specific noise control regulations must be followed when an operator is developing a well site (**Figure 3-4, Appendix D, Oil and Gas Wells in Relation to Big Game High Priority Habitat**). Between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted (see **Table 3-20**, below) may be increased 10 dBA for a period not to exceed 15 minutes in any 1-hour period. The allowable noise level for periodic, impulsive, or shrill noises is reduced by 5 dBA from the levels shown in **Table 3-20** (ECMC 2008). As described in the ECMC Aesthetic and Noise Control Regulations (ECMC 2008), oil and gas pipeline or gas facility installation or maintenance or use of drilling, completion, or workover rigs or stimulations must comply with the maximum noise level for industrial zones. However, if the operation is located on the same property as an occupied building unit, the operator

must comply with the noise levels for residential zones. Other requirements apply for different instances when the noise source is located on a separate property but sensitive receptors are nearby.

Highways create the necessary infrastructure required for oil and gas exploration, development, and maintenance. In Colorado, the oil and gas industry uses the existing highway infrastructure, which contributes to the overall region's soundscape (**Figure 3-5, Appendix D, Roads in Big Game High Priority Habitat**). Oil and gas operators may also use their own routes or existing BLM routes with a permit to access, construct, and maintain facilities. Using existing travel routes for oil and gas purposes contributes to the region's short- or long-term soundscape based on the time of day and the scale of operations.

Table 3-20. Permitted Noise Levels

Zone	7:00 a.m. to next 7:00 p.m. Noise Level (dBA)	7:00 p.m. to next 7:00 a.m. Noise Level (dBA)	Human Perception or Response
Residential, agricultural, and rural	55	50	Quiet
Commercial	60	55	Quiet to painfully loud
Light industry	70	65	Intrusive to telephone use difficult
Industrial	80	75	Telephone use is difficult to annoying

Sources: ECMC 2008; Olivera et al. 2011

Acoustic Environment (Specific to the Planning Area)

The planning area encompasses approximately 8.3 million acres of BLM-administered land and approximately 27 million acres of federal mineral estate. The planning area includes areas that are highly developed and areas that are largely undeveloped. **Figure 3-3, Appendix D, Oil and Gas Wells and Leasing Areas**, displays existing oil and gas leases in the decision area that contribute to the overall soundscape of the planning area. The decision area is scattered throughout the BLM's administrative boundaries and includes a wide range of human-caused noise sources, such as vehicles, including off-highway vehicles (OHVs); equipment and operations associated with oil and gas development; target shooting; motorized craft on reservoirs and lakes; and those associated with the communities next to and within the BLM's administrative boundaries. Additional sources of noise generation include grazing; ROW travel access and maintenance; adjacent private lands operations, maintenance, and use; human caused noises, such as noise from residential, commercial, or industrial areas; industrial noise from coal, sand and gravel operations, and mining activities; and airplanes. The BLM does not have the authority to regulate noise impacts from activities that are unrelated to its authorizations. However, BLM can apply stipulations or close fluid mineral leasing areas to mitigate acoustic impacts.

Noise impacts on the area's soundscapes are managed separately under each RMP based on the different resources that influence the local and regional soundscape. Some of these resources include minerals, transportation, travel, recreation, oil and gas development, and other permitted activities. All the soundscapes differ between Colorado field offices due to the separate resource uses and permitted activities. Some areas that permit more oil and gas development have louder landscapes, particularly during nighttime operations. Areas with less development have more quiet landscapes; however, if additional road infrastructure is near, soundscapes are negatively impacted. It is important to note that noise impacts can occur outside the BLM decision area and carry cumulative impacts to other surrounding areas.

Reasonably Foreseeable Trends

Colorado has seen a dramatic rise in population in recent years and continues to expect substantial future growth. As Colorado continues to grow, additional human development, urban sprawl, and the influx of new cars will continue to contribute to the region's soundscape. Noise levels will increase as more people migrate to Colorado, and the potential for overlap between big game priority habitat and road networks will increase. Multiple BLM field offices have indicated that outdoor recreation, particularly nonmechanized recreation that includes mountain biking, will continue to increase for the foreseeable future. The continuing increase in OHV recreation opportunities will continue to contribute to the region's soundscape. However, the implementation of ECMC's Aesthetic and Noise Control Regulations (ECMC 2008) will continue to alleviate noise emissions from oil and gas activities.

Environmental Consequences

Impacts Common to all Alternatives

NSO, CSU, and TL stipulations implemented under all the alternatives would reduce noise pollution from oil and gas activities while increasing the overall quality of the soundscape. Stipulations would help mitigate potential noise disturbances to big game species from drilling activities, however, stipulations differ by alternative, as described in **Chapter 2**.

Alternative A

Fluid mineral leasing stipulation acres in the decision area

Approximately 86.2 percent of the decision area would be open to fluid mineral leasing that is subject to standard terms and conditions or subject to unmapped stipulations (**Figure 2-1, Appendix D**, Alternatives A, B, and C: Closed to Fluid Mineral Leasing). Noise generated from oil and gas activities would continue to occur in areas of current and future development since new areas would not be closed to fluid mineral leasing. Transportation-related noise pollution resulting from oil and gas activities would continue to occur and may expand. Existing routes would continue to be utilized and new routes could be authorized with new oil and gas developments. Specific timing limitations or site-specific operation hours would continue and help mitigate noise generated from oil and gas activities where they are applied. A much smaller portion of the decision area (13.8 percent) would continue to be closed to fluid mineral leasing. Areas that are closed to oil and gas leasing would not see an increase in noise generated from oil and gas activities because these activities would continue to be prohibited. Around 53.2 percent of open fluid mineral leasing areas would contain some form of timing limitations, while the other 20.8 and 26.2 percent would continue to apply NSO and CSU stipulations for fluid minerals. These stipulations in areas open to fluid mineral leasing would continue to help mitigate sound pollution from oil and gas activities in the decision area.

Fluid mineral leasing stipulation acres in HPH

Under Alternative A, approximately 85.7 percent of fluid mineral leasing that occurs in HPH would be open to fluid mineral leasing subject to stipulations. Noise pollution can cause stress responses in animals with variable responses among species and individuals (Radle 2007; Barber et al. 2009). Timing limitations could help to mitigate potential noise pollution to big game species on 67.5 percent of open fluid mineral leasing areas that occur in HPHs. Timing limitations can help reduce noise pollution by limiting disturbances to certain hours of the day; prevent development over a period, seasonal restrictions, or reproductive seasons. The addition of new stipulations would help mitigate and improve overall noise conditions in big game habitat HPH.

Alternative B

Fluid mineral leasing stipulation acres in the decision area

Alternative B would open and close the same amount of fluid mineral leasing areas in the decision area as Alternative A, however, the differences in open fluid mineral leasing areas with terms and conditions or stipulations would differ. Approximately 62.9 percent and 63.5 percent of open fluid mineral leasing areas would contain a CSU or timing limitation respectively; representing a 140.2 percent and 19.3 percent increase in CSU or timing limitations compared with Alternative A. The acres where CSU and TL stipulations would be applied Alternative B would help mitigate noise pollution generated from oil and gas industry and associated transportation activities. These additional stipulations would reduce noise impacts on human and nonhuman populations compared with Alternative A. In areas where development may be in proximity to human dwellings, additional stipulations would help reduce noise levels of the overall soundscape compared with Alternative A. Alternative B would apply NSO stipulations to a similar number of acres found under Alternative A.

Fluid mineral leasing stipulation acres in HPH

Alternative B would have a similar number of acres in open fluid mineral leasing areas in big game HPH as Alternative A, however, additional stipulations would be applied. Approximately 85.7 percent and 83.0 percent of open fluid mineral leasing areas would contain a CSU or TL, respectively; representing a 181.4 percent and 22.9 percent increase in CSU or TLs compared with Alternative A. Under Alternative B, noise pollution in big game HPH areas would decrease compared with Alternative A because overlapping CSU and TLs would mitigate noise impacts on wildlife in big game HPH. NSO stipulations would slightly increase, which would decrease noise in big game HPH where NSO stipulations are applied.

Alternative C

Fluid mineral leasing stipulation acres in the decision area

Impacts under Alternative C would be similar to those as described under Alternative B.

Fluid mineral leasing stipulation acres in HPH

Impacts under Alternative C would be similar to those as described under Alternative B.

Alternative D

Fluid mineral leasing stipulation acres in the decision area

Under Alternative D, 55.2 percent of the decision area would be open to fluid mineral leasing while 44.8 percent would be closed to fluid mineral leasing (**Figure 2-2, Appendix D, Alternative D: Closed to Fluid Mineral Leasing**). The total amount of closed acres would increase by over two-fold, which would reduce noise pollution generated from oil and gas activities compared with Alternative A. Closed fluid mineral leasing areas would see an overall quieter soundscape in the short and long term compared with Alternative A. However, these reductions may not occur in areas with existing leases.

Fluid mineral leasing stipulation acres in HPH

Under Alternative D, 60.9 percent of acres in big game HPH would be closed to fluid mineral leasing; over a three-fold increase in closed fluid mineral leasing areas in big game HPH compared with Alternative A. There would be a decrease in noise pollution in big game HPH from drilling infrastructure because more acres would be closed to the development of fluid minerals. Big game species would have a larger area to travel without the interference of noise pollution from oil and gas activities, resulting in an overall quieter soundscape compared with Alternative A. Approximately 39.1 percent of acres in big game HPH would be open to fluid mineral leasing, a 54.4 percent decrease compared with Alternative A. While there might be a

decrease in areas open to fluid mineral leasing with stipulations applied, overall noise would not increase because fewer areas would be open for oil and gas development compared with Alternative A.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions, such as oil and gas drilling and development, mineral development, land use authorizations and access, livestock grazing, travel and transportation and recreation, and road construction, have affected, and are likely to continue to affect noise resources throughout the cumulative effects analysis area. These affect noise resources by increasing the amount of noise generated in the soundscape, which can lead to higher ambient noise levels. The increase in population for example, will strain existing transportation infrastructure and lead to higher levels of congestion and noise generated from motorized vehicles. Larger populations require more energy, which will result in more energy development and ROWs in the planning area over time. Additional mineral development could have future impacts on the soundscape of the planning area. Other sources of noise in the planning area that would have cumulative impacts include air traffic, agricultural activities, and construction and industrial development. The sounds produced from the landing and take-off cycle at regional airports within the planning area, as well as those from the engines of aircraft flying overhead, can contribute to high levels of noise pollution. Similarly, noises caused by tractors or other agricultural machines and the equipment, machinery, and vehicles used for construction and industrial activities would increase the levels of noise pollution in the soundscape, having cumulative impacts on the acoustic environment.

The no action alternative would contribute to cumulative effects by allowing for more oil and gas development within wildlife migration and movement corridors, thus causing more human caused disturbances from development and transportation. The increase in disturbances from development and transportation would increase overall ambient noise levels in certain areas because there would be more potential noise generation sources.

Alternatives B and C would reduce the cumulative impacts within the planning area by limiting the oil and gas development in big game HPH. By doing so, the BLM would also be limiting ground disturbance and other disturbances, which would help reduce overall noise levels in certain areas during specific times of the year or due to other stipulations. However, the other disturbances listed above would remain the same.

Alternative D would reduce cumulative impacts more than any of the other alternatives by having more areas closed to oil and gas leasing and limiting the effects further. The other disturbances such as mineral development, livestock grazing, and recreation would remain the same as the no action alternative. However, because larger areas would be closed to fluid mineral development on BLM-administered lands, certain area's soundscapes would improve due to the absence of noise generated from mineral development.

The direct and indirect impacts under all action alternatives would further minimize the cumulative impacts on noise in the planning area by decreasing surface disturbing activities related to oil and gas development. As such, noise generated from drilling, construction of facilities, and construction-related traffic would be reduced, having long-term impacts on the acoustic environment.

3.2.5 Soil Resources

Issue 1: What are the impacts of big game on soil quality?

Issue 2: What are the effects to soil quality from the no action and action alternatives?

Analytical Methods and Assumptions

The following analysis reviews impacts each proposed alternative would have on soil resources. For each alternative, the BLM estimated soil disturbance and impacts on soil quality to present a quantitative analysis.

The BLM discussed impacts qualitatively where quantitative data were not available. The BLM identified the potential impacts discussed below by reviewing the best available science and data. Impacts were determined by assessing the number of acres planned for modification under each alternative.

Quantitative assessment included the following analyses:

- Comparison of acres of existing oil and gas wells and authorized and pending lease acreages that intersect fragile soils as indicated erosion hazard rating, percent slope, hydrologic soil group, and depth to bedrock.
- Comparison of acres open, closed, and subject to NSO, CSU, and TL stipulations to oil and gas leasing by alternative that intersect fragile soils as indicated by erosion hazard rating, percent slope, hydrologic soil group, and depth to bedrock.
- Comparison of acres closed to oil and gas development by designation of recreation area, wilderness areas, wilderness study areas, wild and scenic rivers, national conservation areas, and national monuments by alternative that intersect fragile soils as indicated by erosion hazard rating, percent slope, hydrologic soil group, and depth to bedrock.
- Comparison of acres by oil and gas leasing stipulations that intersect fragile soils as indicated by erosion hazard rating, percent slope, hydrologic soil group, and depth to bedrock.

Assumptions used in the analyses include:

- Soils, especially in fragile soil areas, are susceptible to impacts from surface disturbance, which can lead to compaction, accelerated erosion, and soil loss.
- As slope increases, the potential for erosion increases, and the risk of soil instability following disturbance increases, particularly if cover, structure, or permeability has been altered.
- Surface-disturbing activities have greater impacts where soils have higher erodibility or fragility.
- Surface disturbance that results in loss of vegetation cover would cause soils to be more vulnerable to erosion and less resistant to degradation.
- Areas with NSO and CSU stipulations for more fragile and erosive soils would provide more protection for these soils than areas without stipulations.

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area includes all BLM-administered lands and approximately 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Soils are a living system that is linked to nutrient and hydrologic cycles and other ecological processes. The distribution and occurrence of soils depend on several factors, including the interaction of topographic relief (slope and slope length), soil parent material (geology), living organisms, climate, and time. These variables influence the creation of complex and diverse soils. Detailed soils information is available from the Natural Resources Conservation Service's (NRCS) Soil Survey Geographic database (NRCS 2022a) for the individual soil surveys in the decision area (**Figure 3-6, Appendix D, Soil Orders**).

Major land resource areas are geographically associated land resource units. **Table 3-21**, below, shows the major land resource areas in Colorado and their dominant soil orders along with the acreage each occupies in the decision area. The dominant physical characteristics (including the physical geography, geology, climate, water, soils, and biological resources) of the major land resource areas are described in Agriculture Handbook 296 (NRCS 2022a) and are incorporated by reference.

Table 3-21. Major Land Resource Areas for the Decision Area

Major Land Resource Area*	Dominant Soil Orders	Acres in the Decision Area
34A (Cool Central Desertic Basins and Plateaus)	Aridisols, entisols	1,249,000
34B (Warm Central Desertic Basins and Plateaus)	Aridisols, entisols, mollisols	2,042,000
35 (Colorado Plateau)	Aridisols, entisols, alfisols, mollisols	55,000
36 (Southwestern Plateaus, Mesas, and Foothills)	Alfisols, aridisols, entisols, inceptisols, mollisols	2,221,000
46 (Northern and Central Rocky Mountain Foothills)	Entisols, inceptisols, mollisols	70,000
47 (Wasatch and Uinta Mountains)	Aridisols, entisols, inceptisols, mollisols	262,000
48A (Southern Rocky Mountains)	Alfisols, inceptisols, mollisols	4,411,000
48B (Southern Rocky Mountain Parks and Valleys)	Mollisols, alfisols	692,000
49 (Southern Rocky Mountain Foothills)	Alfisols, entisols, inceptisols, mollisols	95,000
51 (High Intermountain Valleys)	Aridisols, entisols	379,000
67A (Central High Plains, Northern Part)	Mollisols, entisols	6,000
67B (Central High Plains, Southern Part)	Mollisols, alfisols, aridisols, entisols	227,000
69 (Upper Arkansas Valley Rollings Plains)	Aridisols, entisols	980,000
70A (High Plateaus of the Southwestern Great Plains)	Mollisols, entisols, alfisols, inceptisols	167,000
72 (Central High Tableland)	Entisols, mollisols	97,000
77A (Southern High Plains, Northern Part)	Alfisols, mollisols	7,000

Source: NRCS 2022a

*Major land resource areas are generally designated by Arabic numbers and identified by a descriptive geographic name. Some are designated by an Arabic number and a letter because previously established major land resource areas have been divided into smaller, more homogenous areas.

The dominant soils in the decision area are alfisols, aridisols, entisols, inceptisols, and mollisols (NRCS 2022a). Alfisols result from weathering processes that leach clay, minerals, and other constituents out of the surface layer and into the subsoil, where they can hold and supply moisture and nutrients to plants. They form primarily under forest or mixed vegetation cover. Aridisols are soils that are too dry for the growth of mesophytic plants.¹ The lack of moisture restricts the intensity of weathering processes and limits most soil development processes to the upper portion of the soils. Entisols are soils that show little or no evidence of soil horizon development. They occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development, such as dunes, steep slopes, and floodplains. Inceptisols are found in semiarid to humid environments, and generally exhibit only moderate degrees of soil weathering and development. Mollisols are quite fertile and have a moderate to pronounced seasonal moisture deficit (NRCS 2022b).

Of these, alfisols, entisols, inceptisols, and mollisols are generally in the areas the most utilized by big game species; this is because these soil types support habitat and forage. While soil fertility is not the only factor

¹ Plants that grow under moderate moisture conditions

that affects the nutritive value of plants, in general, fertile soils have a greater potential to support big game species (Murphy and Porath 1969).

Fragile soils in the decision area consist of soils with a high wind and water erosion potential, soils prone to impacts from drought conditions, and soils located on steep slopes or on eolian² dune deposits on valley floors. The BLM estimated the distribution and abundance of fragile soils in the decision area using NRCS Soil Survey Geographic Database data. Soils of management concern include soils with high water erosion potential, high wind erosion potential, low drought tolerance, poor upland soil health, and prime or unique farmlands (BLM 2022c). In general, fragile soils are most vulnerable to impacts from surface-disturbing activities due to their higher susceptibility to erosion and their limited reclamation potential.

Soils can be naturally susceptible to erosion because of factors such as topography, vegetation type and density, ground cover, and soil moisture regimes. The slope also influences runoff generation and soil erosion. The slope's gradient, length, and shape are general slope parameters that influence runoff generation and soil erosion. In general, runoff generation and soil erosion typically increase as the percent slope increases. The NRCS categorizes slopes into five groups, ranging from gently sloping (1-10 percent slopes) to very steep (greater than 40 percent slopes). Soils on steep and very steep slopes are generally subjected to high drainage densities, high relief, and high ruggedness that results in increased erosion rates. Therefore, soils with slopes greater than 30 percent can generally be considered fragile, as shown in **Table 3-22**, approximately 2,449,000 acres within the Decision Area (18.8 percent) have a slope rating of greater than 30 percent.

Table 3-22. Acres of Percent Slope in the Decision Area

Percent Slope Range	Acres in the Decision Area	Percentage of the Decision Area
Gently sloping, 0-10 percent	3,173,000	24.4 percent
Strongly sloping, 11-20 percent	1,763,000	13.6 percent
Moderately steep, 21-30 percent	1,355,000	10.4 percent
Steep, 31-40 percent	986,000	7.6 percent
Very steep, >40 percent	1,463,000	11.2 percent
No Rating	4,270,000	32.8 percent
Grand Total	13,010,000	

Source: NRCS 2022b

Soils with similar properties have similar susceptibility to erosion by wind and water. The erosion hazard ratings for roads and trail are soil interpretations from the NRCS web soil survey; they incorporate erosion by wind and water and are based on slope, soil erosion factor K, and content of rock fragments (**Table 3-23**). A rating of slight (1,140,00 acres in the decision area) indicates that that little or no erosion is likely. A rating of moderate (3,626,000 acres in the decision area) indicates that some erosion is likely, and that simple erosion-control measures are needed. A rating of severe (7,279,000 acres in the decision area) indicates that significant erosion is expected.

² Deposited, produced, or eroded by the wind

Table 3-23. Acres of Erosion Hazard Ratings in the Decision Area

Erosion Hazard Rating	Acres	Percentage of the Decision Area
Slight	1,140,000	8.8 percent
Moderate	3,626,000	27.9 percent
Severe	7,279,000	55.9 percent
Not rated	964,000	7.4 percent
Grand Total	13,010,000	

Source: NRCS 2022b

There are 964,000 acres in the decision area that are not rated for an erosion hazard. Soils classified by the NRCS as having moderate or severe erosion hazard ratings are generally considered fragile, which includes the majority of the decision area (10,905,000 acres, 83.8 percent).

Runoff and soil depth also contribute to soil fragility in greater susceptibility to wind and water erosion, and drought tolerance. Runoff potential estimates are categorized by the NRCS in Hydrologic Soil Groups based on rates of water infiltration and water transmission (**Table 3-24**). Hydrologic Soil Group A soils (488,000 acres in the decision area) have lowest runoff potential include mainly deep, well-drained to excessively drained sands and gravelly sands. Hydrologic Soil Group B soils (1,541,000 acres in the decision area) have moderate runoff potential and include mainly moderately deep, moderately well-drained soils with moderately fine to moderately coarse textures. Hydrologic Soil Group C soils (2,689,000 acres in the decision area) have higher runoff potential and typically include soils with a layer that impedes the downward movement of water or soils with moderately fine to fine texture. Hydrologic Soil Group D soils (2,868,000 acres in the decision area) have the highest runoff potential mainly include clays with high shrink-swell potential, a high water table, or shallow soils over layers that impede or are impervious to the downward movement of water. For soils with dual hydrologic groups (A/D, B/D, or C/D), the first letter corresponds to the rating for drained areas, and second for undrained areas, and only soils in the D group in their natural conditions can have dual classes (64,000 acres in the decision area).

Table 3-24. Acres of Hydrologic Soil Groups in the Decision Area

Hydrologic Soil Group	Acres	Percentage
A	488,000	3.8 percent
B	1,541,000	11.8 percent
C	2,689,000	20.7 percent
D	2,868,000	22.0 percent
A/D	14,000	0.1 percent
B/D	13,000	0.1 percent
C/D	36,000	0.3 percent
No Rating	5,360,000	41.2 percent
Grand Total	13,010,000	

Source: NRCS 2022b

Depth to bedrock (**Table 3-25**) is recorded as a representative value indicating the expected depth of soil to lithic, paralithic, and/or densic bedrock (NRCS 2022b). Depths of less than 50 centimeters (cm) to bedrock are considered shallow (6,467,000 acres in the decision area) and can contribute to erosion susceptibility and fragility. Soils with depths ranging from 50 to 100 cm to bedrock are moderately deep (1,347,000 acres in the decision area) and have less susceptibility to erosion. Soils with depths ranging from 100 to 150 cm to bedrock are considered deep (391,000 acres in the decision area) and soils with depths

Table 3-25. Acres of Depth to Bedrock Ranges in the Decision Area

Depth to Bedrock Ranges	Acres	Percentage
0-50 cm	6,467,000	49.7 percent
50 - 100 cm	1,347,000	10.4 percent
100 - 150 cm	391,000	3.0 percent
150 - 200 cm	18,000	0.1 percent
>200 cm	6,000	0.0 percent
No Rating	4,780,000	36.7 percent
Grand Total	13,010,000	

Source: NRCS 2022b

over 150 cm to bedrock are very deep (24,000 acres in the decision area) and are least susceptible to erosion.

Reasonably Foreseeable Trends and Planned Actions

Soil erodibility and low soil strength, combined with steep slopes and variable rates of runoff, can lead to undesirable effects. Erosion is a natural process, but human activities can speed up or increase the potential magnitude of these effects. Erosion rates may increase significantly when soil is disturbed. Human activities that contribute to soil erosion include, but are not limited to, logging, mining, agriculture, urbanization, and industrialization.

Oil and gas exploration and development activities can create surface disturbances that can lead to an increased rate of runoff and erosion of soils. In 2021, Colorado produced approximately four times more crude oil than in 2010, primarily from the increased use of horizontal drilling and hydraulic fracturing technologies (EIA 2022). These activities are expected to continue. Mineral and energy exploration and development activities have best management practices in place to minimize soil surface disturbance, but continued oil and gas exploration and development create the potential for additional soil disturbance and accelerated rates of erosion. A total of 2,123 wells and 355,000 acres of authorized and pending leases are currently located on steep and very steep slopes (**Table 3-26**). A total of 12,778 wells and 1,876,000 acres of authorized and pending leases are currently located on soils with moderate or severe erosion hazard ratings (**Table 3-27**). A total of 5,595 wells and 904,000 acres of authorized and pending leases are currently located on soils hydrologic soil groups C, D, A/D, B/D, or C/D with higher runoff potential (**Table 3-28**). A total of 7,171 wells and 1,244,000 acres of authorized and pending leases are currently located on soils with shallow depth to bedrock (**Table 3-29**).

Table 3-26. Existing Oil and Gas Wells and Leasing in the Decision Area by Slope

Percent Slope Range	No. of Wells	Oil and Gas Leasing Acres	
		Authorized	Pending
Gently sloping, 0-10 percent	4,092	564,000	73,000
Strongly sloping, 11-20 percent	1,760	174,000	18,000
Moderately steep, 21-30 percent	1,649	287,000	3,000
Steep, 31-40 percent	415	85,000	8,000
Very steep, >40 percent	1,708	232,000	28,000
No Rating	4,843	608,000	18,000
Grand Total	14,467	1,950,000	148,000

Source: NRCS 2022b

Table 3-27. Existing Oil and Gas Wells and Leasing in the Decision Area by Erosion Hazard Rating

Erosion Hazard Rating	No. of Wells	Oil and Gas Leasing Acres	
		Authorized	Pending
Slight	1,009	113,000	15,000
Moderate	4,526	429,000	78,000
Severe	8,522	1,313,000	56,000
No Rating	5	97,000	0
Grand Total	14,467	1,950,000	148,000

Source: NRCS 2022b

Table 3-28. Existing Oil and Gas Wells and Leasing in the Decision Area by Hydrologic Soil Group

Hydrologic Soil Group	No. of Wells	Oil and Gas Leasing Acres	
		Authorized	Pending
A	1,379	70,000	2,000
B	1,154	203,000	30,000
C	2,945	330,000	45,000
D	2,561	488,000	23,000
C/D	86	15,000	-
A/D	1	2,000	-
B/D	2	1,000	-
No Rating	6,339	865,000	49,000
Grand Total	14,467	1,952,000	149,000

Source: NRCS 2022b

Table 3-29. Existing Oil and Gas Wells and Leasing in the Decision Area by Depth to Bedrock

Depth to Bedrock	No. of Wells	Oil and Gas Leasing Acres	
		Authorized	Pending
0-50 cm	7,171	1,167,000	77,000
50 - 100 cm	891	152,000	28,000
100 - 150 cm	246	68,000	2,000
150 - 200 cm	31	8,000	-
>200 cm	-	-	-
No Rating	6,128	556,000	42,000
Grand Total	14,467	1,951,000	149,000

Source: NRCS 2022b

Big game influence a variety of soil properties, including nutrient availability, mineralization rates, bulk density, infiltration rates, moisture levels, salinity, temperature, erosion, and microbial communities (Dodge et al. 2020). Some studies document big game accelerating nutrient cycling by depositing nutrients in the form of excrement and by aiding fast-growing plant species with high-quality regrowth, which promotes leaf litter returned to the soil. However, big game can decelerate nutrient cycling in nutrient poor soils by selectively foraging nutrient-rich plants, which shifts the plant community toward species that produce lower-quality leaf litter (Dodge et al. 2020).

Herbivory by large ungulates can cause a moderate to severe reduction of shrubs in forest communities, which can eventually result in reduced soil fertility (Irwin et al. 1994). At low and high soil moisture contents, studies suggest that big game-induced soil compaction can negatively affect nitrogen cycling, particularly on

fine-textured soils (Dodge et al. 2020). In turn, these effects that big game have on soils affect numerous ecosystem processes, including the ability of an area to continually support big game populations.

Environmental Consequences

Alternative A

The amount of authorized and pending oil and gas facilities open to fluid mineral leasing under Alternative A fall largely in fragile soils areas (**Table 3-30**) with severe erosion rating (343,000 acres), shallow depths (362,000 acres), hydrologic soils groups with the highest runoff potential (138,000 acres), and to a lesser extent, steep slopes (49,000 acres). Moderate lease stipulations (CSU and TL) that would limit, but not prevent impacts to fragile soils are present and tend occupy the most acres of fragile soils in terms of severe erosion hazard (453,000 acres), steep slopes (65,000 acres), shallow soils (469,000 acres), and those with highest runoff potential (179,000 acres). Areas that are closed to leasing or have the most restrictive NSO stipulations that would prevent surface disturbance to potentially fragile soils cover the fewest acres under Alternative A, both in total and for those with severe erosion hazard (104,000 acres), steep slopes (16,000 acres), shallow soils (100,000 acres), and the highest runoff potential (40,000 acres).

Table 3-30. Acreages of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternative A

Soil Characteristic	Closed	Open					Total
		NSO	CSU	TL	CSU-TL	Standard	
Erosion Hazard							
Slight	1,000	7,000	53,000	30,000	1,000	63,000	155,000
Moderate	6,000	43,000	63,000	108,000	22,000	128,000	370,000
Severe	8,000	96,000	131,000	308,000	14,000	343,000	900,000
Not rated	1,000	9,000	16,000	21,000	0	29,000	76,000
<i>Subtotal</i>	<i>16,000</i>	<i>155,000</i>	<i>263,000</i>	<i>467,000</i>	<i>37,000</i>	<i>563,000</i>	<i>1,501,000</i>
Percent Slope							
0-10 percent	4,000	22,000	55,000	99,000	6,000	121,000	307,000
11-20 percent	1,000	7,000	29,000	26,000	1,000	41,000	105,000
21-30 percent	1,000	22,000	23,000	61,000	3,000	65,000	175,000
31-40 percent	1,000	4,000	8,000	11,000	1,000	12,000	37,000
> 40 percent	1,000	10,000	20,000	25,000	0	37,000	93,000
No Rating	6,000	55,000	77,000	150,000	15,000	175,000	478,000
<i>Subtotal</i>	<i>14,000</i>	<i>120,000</i>	<i>212,000</i>	<i>372,000</i>	<i>26,000</i>	<i>451,000</i>	<i>1,195,000</i>
Depth to Bedrock							
0-50 cm	8,000	92,000	150,000	301,000	18,000	362,000	931,000
50-100 cm	2,000	12,000	13,000	29,000	4,000	33,000	93,000
100-150 cm	0	3,000	4,000	10,000	0	13,000	30,000
150-200 cm	0	0	0	0	0	0	0
>200 cm	0	0	0	0	0	0	0
No Rating	6,000	47,000	96,000	127,000	14,000	155,000	445,000
<i>Subtotal</i>	<i>16,000</i>	<i>154,000</i>	<i>263,000</i>	<i>467,000</i>	<i>36,000</i>	<i>563,000</i>	<i>1,499,000</i>

Soil Characteristic	Closed	Open				Standard	Total
		NSO	CSU	TL	CSU-TL		
Hydrologic Soil Groups							
A	1,000	4,000	13,000	18,000	0	20,000	56,000
B	2,000	14,000	21,000	30,000	4,000	40,000	111,000
C	1,000	17,000	47,000	45,000	4,000	65,000	179,000
A/D	0	0	0	0	0	0	0
B/D	0	0	0	0	0	0	0
C/D	0	0	0	0	0	1,000	1,000
D	4,000	36,000	65,000	108,000	6,000	138,000	357,000
No Rating	8,000	84,000	118,000	265,000	22,000	299,000	796,000
<i>Subtotal</i>	<i>16,000</i>	<i>155,000</i>	<i>264,000</i>	<i>466,000</i>	<i>36,000</i>	<i>563,000</i>	<i>1,500,000</i>

Under Alternative A areas closed to oil and gas leasing would include recreation areas, wilderness areas, Wilderness Study Areas (WSAs), Wild and Scenic River (WSR) designations, and some National Conservation Areas (NCAs) and National Monuments (NMs) (Table 3-31). Recreation areas include campgrounds, day use areas, Extensive Recreation Management Areas (ERMAs), Natural Area/Endangered Area, OHV Designated Area, and Special Recreation Management Areas (SRMAs). Recreation areas under Alternative A would close to oil and gas development 340 acres of soils with severe erosion hazard, 166,000 acres of steep soils, 461,000 acres of shallow soils, and 225,000 acres of soils with the highest runoff potential. Wilderness areas in the decision area considered under Alternative A include Black Ridge Canyons, Dominguez Canyon, and Gunnison Gorge that together would protect 91,000 acres of severe erosion hazard soils, 33,000 acres of steep soils, 98,000 acres of shallow soils, and 53,000 acres of soils with the highest runoff potential. There is a total of 48 WSAs in the decision area considered under Alternative A, which together would close 284,000 acres of severe erosion hazard soils, 178,000 acres of steep soils, 357,000 acres of shallow soils, and 152,000 acres of soils with the highest runoff potential. Under Alternative A, the BLM would continue to close 218,000 acres of severe erosion hazard soils, 47,000 acres of steep soils, 299,000 acres of shallow soils, and 103,000 acres of soils with the highest runoff potential within National Monuments and NCAs. There are 55 segments of WSR decision area with 227 miles of those considered under Alternative A, which together would close 33 miles of severe erosion hazard soils, 23 miles of steep soils, 58 miles of shallow soils, and 46 miles of soils with the highest runoff potential.

Table 3-31. Acreages of Soil Fragility Characteristics Closed to Oil & Gas Facilities in Fluid Mineral by Other Designations for Alternatives A, B, and C

Soil Characteristic	Recreation Areas (acres)	Wilderness Areas (acres)	WSAs (acres)	NCAs & NMs (acres)	WSRs (miles)
Erosion Hazard Rating					
Slight	32,000	0	19,000	16,000	16
Moderate	177,000	21,000	63,000	121,000	13
Severe	340,000	91,000	284,000	218,000	33
Not rated	185,000	42,000	130,000	83,000	165
<i>Subtotal</i>	<i>734,000</i>	<i>154,000</i>	<i>496,000</i>	<i>438,000</i>	<i>227</i>
Percent Slope					
0-10 percent	96,000	12,000	50,000	85,000	28
11-20 percent	155,000	41,000	45,000	86,000	0
21-30 percent	16,000	10,000	40,000	20,000	2
31-40 percent	59,000	2,000	37,000	27,000	9
>40 percent	107,000	31,000	141,000	63,000	14
No Rating	301,000	59,000	184,000	157,000	173
<i>Subtotal</i>	<i>734,000</i>	<i>155,000</i>	<i>497,000</i>	<i>438,000</i>	<i>226</i>

Soil Characteristic	Recreation Areas (acres)	Wilderness Areas (acres)	WSAs (acres)	NCA & NMs (acres)	WSRs (miles)
Depth to Bedrock					
0-50 cm	461,000	98,000	357,000	299,000	58
50-100 cm	76,000	13,000	36,000	44,000	2
100-150 cm	3,000	0	16,000	0	0
150-200 cm	1,000	0	0	0	0
>200 cm	0	0	0	0	0
No Rating	193,000	43,000	87,000	95,000	167
<i>Subtotal</i>	<i>734,000</i>	<i>154,000</i>	<i>496,000</i>	<i>438,000</i>	<i>227</i>
Hydrologic Soil Groups					
A	19,000	1,000	10,000	7,000	0
B	36,000	0	42,000	12,000	1
C	120,000	20,000	69,000	107,000	30
A/D	1,000	0	1,000	0	0
B/D	0	0	0	0	0
C/D	0	0	0	0	0
D	225,000	53,000	152,000	103,000	46
No Rating	333,000	80,000	222,000	209,000	149
<i>Subtotal</i>	<i>734,000</i>	<i>154,000</i>	<i>496,000</i>	<i>438,000</i>	<i>227</i>

Alternative B

Without additional closures or NSO stipulations under Alternative B, impacts on fragile soils under this alternative would be similar to those under Alternative A. However, the inclusion of the “I in 640” surface disturbance density evaluation would greatly decrease impacts in HPH, and a greater amount of fragile soil resources would be protected from surface disturbance due to oil and gas development as compared to Alternative A. Under Alternative B, there would be more acres of fragile soils with CSU limitations as compared to Alternative A, including 300,000 acres of severe erosions hazard areas, 42,000 acres of steep soils, 307,000 acres of shallow soils, and 115,000 acres of soils with the highest runoff potential (**Table 3-32**).

Table 3-32. Acreages of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternatives B and C

Soil Characteristic	Closed	Open				Standard	Total
		NSO	CSU	TL	CSU-TL		
Erosion Hazard							
Slight	1,000	7,000	61,000	30,000	1,000	63,000	163,000
Moderate	6,000	43,000	98,000	116,000	22,000	128,000	413,000
Severe	8,000	96,000	300,000	316,000	14,000	343,000	1,077,000
Not rated	1,000	9,000	25,000	23,000	0	29,000	87,000
<i>Subtotal</i>	<i>16,000</i>	<i>155,000</i>	<i>484,000</i>	<i>485,000</i>	<i>37,000</i>	<i>563,000</i>	<i>1,740,000</i>
Percent Slope							
0-10 percent	4,000	22,000	109,000	106,000	6,000	121,000	368,000
11-20 percent	1,000	7,000	37,000	26,000	1,000	41,000	113,000
21-30 percent	1,000	22,000	54,000	61,000	3,000	65,000	206,000
31-40 percent	1,000	4,000	10,000	11,000	1,000	12,000	39,000
> 40 percent	1,000	10,000	32,000	28,000	0	37,000	108,000
No Rating	6,000	56,000	146,000	155,000	15,000	175,000	553,000
<i>Subtotal</i>	<i>14,000</i>	<i>121,000</i>	<i>388,000</i>	<i>387,000</i>	<i>26,000</i>	<i>451,000</i>	<i>1,387,000</i>

Soil Characteristic	Closed	Open				Standard	Total
		NSO	CSU	TL	CSU-TL		
Depth to Bedrock							
0-50 cm	8,000	92,000	307,000	312,000	18,000	362,000	1,099,000
50-100 cm	2,000	12,000	28,000	30,000	4,000	33,000	109,000
100-150 cm	0	3,000	11,000	11,000	0	13,000	38,000
150-200 cm	0	0	0	0	0	0	0
>200 cm	0	0	0	0	0	0	0
No Rating	6,000	47,000	138,000	132,000	14,000	155,000	492,000
<i>Subtotal</i>	<i>16,000</i>	<i>154,000</i>	<i>484,000</i>	<i>485,000</i>	<i>36,000</i>	<i>563,000</i>	<i>1,738,000</i>
Hydrologic Soil Groups							
A	1,000	4,000	18,000	19,000	0	20,000	62,000
B	2,000	14,000	35,000	34,000	4,000	40,000	129,000
C	1,000	17,000	58,000	49,000	4,000	65,000	194,000
A/D	0	0	0	0	0	0	0
B/D	0	0	0	0	0	0	0
C/D	0	0	1,000	1,000	0	1,000	3,000
D	4,000	36,000	115,000	110,000	6,000	138,000	409,000
No Rating	8,000	84,000	258,000	272,000	22,000	299,000	943,000
<i>Subtotal</i>	<i>16,000</i>	<i>155,000</i>	<i>485,000</i>	<i>485,000</i>	<i>36,000</i>	<i>563,000</i>	<i>1,740,000</i>

Under Alternative B, there would be no change in areas closed to oil and gas leasing from recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSR designations as compared to Alternative A (see **Table 3-31**).

Alternative C

The 3 percent disturbance threshold under Alternative C would limit impacts across a landscape scale, and the potential for disturbance would be dispersed across a larger area. While stipulations for HPH for alignment with ECMC rulemaking in Alternative B would also apply to Alternative C, these stipulations would contain more flexible waivers, exceptions, and modifications compared to Alternative B. Under Alternative C, impacts to soils are expected to be the same as Alternative B, as there are no changes to closures or major constraints (NSOs) or moderate stipulations (CSU and TL) acreages (see **Table 3-21**). Additionally, there would be no change in areas closed to oil and gas leasing from recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSR designations as compared to Alternative A (see **Table 3-20**).

Alternative D

Under Alternative D, the most acres of fragile soil would be protected from oil and gas development by closure and NSO including 116,000 acres of severe erosion hazard soils, 20,000 acres of steep soils, 119,000 acres of shallow soils, and 50,000 acres of soils with the highest potential runoff (**Table 3-33**). Moderate stipulations (CSU and TL) under Alternative D that would limit the degree of impacts to fragile soils cover more acres than Alternative A, though fewer than Alternatives B and C, including 600,000 acres of severe erosion hazard rating, 72,000 acres of steep soils, 590,000 acres of shallow soils, and 210,000 acres of soils with the highest runoff potential.

Alternative D would include the greatest number of areas closed to oil and gas leasing from designations such as recreation areas, wilderness areas, WSAs, NCAs, NMs, and WSRs (**Table 3-34**). Not only would the total areas and number of miles be greatest, but the number of acres of fragile soils closed to oil and gas development from these designations would also be greatest under Alternative D. This includes recreation areas with 749,000 acres of severe erosion hazards, 437,000 acres of steep soils, 919,000 acres of shallow

Table 3-33. Acreages of Soil Fragility Characteristics in Oil & Gas Facilities in Fluid Mineral Leasing Stipulations for Alternative D

Soil Characteristic	Closed	Open				Standard	Total
		NSO	CSU	TL	CSU-TL		
Erosion Hazard							
Slight	9,000	6,000	53,000	22,000	1,000	55,000	146,000
Moderate	20,000	40,000	84,000	102,000	21,000	114,000	381,000
Severe	24,000	92,000	285,000	301,000	14,000	327,000	1,043,000
Not rated	8,000	7,000	18,000	15,000	0	22,000	70,000
<i>Subtotal</i>	<i>61,000</i>	<i>145,000</i>	<i>440,000</i>	<i>440,000</i>	<i>36,000</i>	<i>518,000</i>	<i>1,640,000</i>
Percent Slope							
0-10 percent	13,000	19,000	99,000	97,000	5,000	111,000	344,000
11-20 percent	7,000	6,000	31,000	20,000	1,000	36,000	101,000
21-30 percent	4,000	22,000	51,000	58,000	3,000	62,000	200,000
31-40 percent	3,000	3,000	8,000	9,000	1,000	10,000	34,000
> 40 percent	4,000	10,000	29,000	25,000	0	33,000	101,000
No Rating	20,000	51,000	132,000	140,000	15,000	161,000	519,000
<i>Subtotal</i>	<i>51,000</i>	<i>111,000</i>	<i>350,000</i>	<i>349,000</i>	<i>25,000</i>	<i>413,000</i>	<i>1,299,000</i>
Depth to Bedrock							
0-50 cm	32,000	87,000	283,000	289,000	18,000	339,000	1,048,000
50-100 cm	5,000	12,000	25,000	27,000	4,000	30,000	103,000
100-150 cm	0	3,000	11,000	10,000	0	12,000	36,000
150-200 cm	0	0	0	0	0	0	0
>200 cm	0	0	0	0	0	0	0
No Rating	24,000	42,000	120,000	114,000	13,000	137,000	450,000
<i>Subtotal</i>	<i>61,000</i>	<i>144,000</i>	<i>439,000</i>	<i>440,000</i>	<i>35,000</i>	<i>518,000</i>	<i>1,637,000</i>
Hydrologic Soil Groups							
A	2,000	4,000	17,000	17,000	0	19,000	59,000
B	8,000	12,000	29,000	29,000	4,000	34,000	116,000
C	10,000	14,000	49,000	40,000	3,000	57,000	173,000
A/D	0	0	0	0	0	0	0
B/D	0	0	0	0	0	0	0
C/D	0	0	1,000	1,000	0	1,000	3,000
D	14,000	36,000	104,000	100,000	6,000	128,000	388,000
No Rating	26,000	79,000	239,000	253,000	22,000	281,000	900,000
<i>Subtotal</i>	<i>60,000</i>	<i>145,000</i>	<i>439,000</i>	<i>440,000</i>	<i>35,000</i>	<i>520,000</i>	<i>1,639,000</i>

Table 3-34. Acreages of Soil Fragility Characteristics Closed to Oil & Gas Facilities in Fluid Mineral by Other Designations for Alternative D

Soil Characteristic	Recreation Areas (acres)	Wilderness Areas (acres)	WSAs (acres)	NCA's & NMs (acres)	WSRs (miles)
Erosion Hazard Rating					
Slight	71,000	8,000	23,000	16,000	36
Moderate	280,000	23,000	65,000	122,000	21
Severe	749,000	126,000	310,000	218,000	74
Not rated	320,000	47,000	150,000	85,000	252
<i>Subtotal</i>	<i>1,420,000</i>	<i>204,000</i>	<i>548,000</i>	<i>441,000</i>	<i>383</i>

Soil Characteristic	Recreation Areas (acres)	Wilderness Areas (acres)	WSAs (acres)	NCA & NMs (acres)	WSRs (miles)
Percent Slope					
0-10 percent	157,000	13,000	50,000	85,000	43
11-20 percent	226,000	43,000	46,000	86,000	3
21-30 percent	101,000	38,000	41,000	20,000	10
31-40 percent	182,000	11,000	42,000	29,000	20
>40 percent	255,000	36,000	166,000	63,000	43
No Rating	500,000	64,000	203,000	158,000	265
<i>Subtotal</i>	<i>1,421,000</i>	<i>205,000</i>	<i>548,000</i>	<i>441,000</i>	<i>383</i>
Depth to Bedrock					
0-50 cm	919,000	110,000	389,000	301,000	118
50-100 cm	126,000	22,000	39,000	44,000	4
100-150 cm	17,000	0	16,000	0	1
150-200 cm	1,000	0	0	0	0
>200 cm	1,000	0	0	0	0
No Rating	356,000	73,000	103,000	96,000	260
<i>Subtotal</i>	<i>1,420,000</i>	<i>205,000</i>	<i>547,000</i>	<i>441,000</i>	<i>383</i>
Hydrologic Soil Groups					
A	36,000	1,000	14,000	7,000	8
B	93,000	14,000	49,000	12,000	2
C	234,000	45,000	77,000	107,000	49
A/D	1,000	0	1,000	0	4
B/D	1,000	0	0	0	0
C/D	0	0	0	0	0
D	512,000	61,000	168,000	104,000	78
No Rating	543,000	83,000	239,000	209,000	243
<i>Subtotal</i>	<i>1,420,000</i>	<i>204,000</i>	<i>548,000</i>	<i>439,000</i>	<i>383</i>

soils, and 512,000 acres of soils with the highest runoff potential. Wilderness areas closed to oil and gas development under Alternative D includes those of the other alternatives plus portions of the existing Powderhorn and Uncompahgre wilderness areas in northern Hinsdale County that would result in the protection of 126,000 acres of severe erosion hazard soils, 47,000 acres of steep soils, 110,000 acres of shallow soils, and 61,000 acres of soils with the highest runoff potential. A total of 53 WSAs would be closed to oil and gas development under Alternative D protecting 310,000 acres of severe erosion hazard soils, 208,000 acres of steep soils, 389,000 acres of shallow soils, and 168,000 acres of soils with the highest runoff potential. The number of acres of fragile soils closed to oil and gas development from NCAs and NMs would only be slightly higher under Alternative D, with the addition of 2,000 additional acres of fragile soils. A total of 383 miles of WSRs would be closed to oil and gas development under Alternative D, including 74 miles of severe erosion hazard soils, 63 miles of steep soils, 118 miles of shallow soils, and 78 miles of soils with the highest runoff rating.

Cumulative Impacts

The cumulative impact analysis for soil resources is the planning area. Combined with other past, present, and reasonably foreseeable future actions, activities and development on BLM-administered lands in the planning area would contribute to short- and long-term surface disturbances. This would affect general soil conditions as well as fragile soils. Activities affecting soils include past, present, and future energy and minerals development, livestock grazing, land use authorizations, recreation, travel, vegetation treatments, and Greater and Gunnison sage-grouse planning efforts, and fires and fuel management. Wild horses may also compact soils.

Energy and minerals development activities include past, present, and continued oil and gas leasing and development on BLM-administered lands as well as other federal and non-federal lands and the continued development of locatable minerals, coal, and nonenergy leasable and salable minerals. Development of fluid mineral resources places a major demand on soil resources in the planning area, including such surface-disturbing activities as mineral extraction and ROW development. Continued fluid mineral development generally requires both permanent and temporary roads, pits, drilled wells, and associated well pads, pipelines, and transmission lines and the necessary service roads for these facilities. Impacts from fluid mineral management on BLM-administered minerals may result in additional surface disturbance from exploration and development; however, the required stipulations to protect HPH would incidentally protect soil resources and reduce the potential for disturbance, soil compaction, and wind and water erosion.

Continued and increased use of roads and trails, both by motorized and nonmotorized users with increased populations in Colorado and interest in using public lands for recreation could lead to increased recreation pressure, which would continue to disturb vegetation that could result in a reduction of soil stability and a corresponding increase in erosion rates. Road construction has also occurred in association with timber harvesting, historic vegetation treatments, energy development, and mining on BLM-administered lands, private lands, State of Colorado lands, and National Forest System lands. The bulk of new road building is occurring for community expansion and energy development. Road construction is expected to continue and could also contribute to reductions in vegetation cover under all alternatives, particularly when combined with fluid mineral development.

Greater and Gunnison sage-grouse planning efforts, which would also constrain certain uses such as mineral development, ROW authorizations, and grazing, in certain habitats where these species occur. These habitats overlap to some extent with big game HPH. These would constrain certain uses such as mineral development, ROW authorizations, and grazing, and would also contribute to reduced cumulative impacts to soils from the ground-disturbing activities associated with them.

Continued risk for catastrophic wildfire can remove vegetation cover, and affected areas are more susceptible to soil erosion, though agencies have been working to reduce this risk through vegetation management that include past, present, and continued treatments to improve habitat, reduce hazardous fuels, and remove invasive weeds.

Under all of the alternatives, oil and gas closures and stipulations, including NSO, CSU, and TL, would reduce impacts on fragile soils by prohibiting or reducing surface-disturbing activities in certain areas. However, management under Alternative A would have a greater incremental contribution to cumulative impacts on fragile soils. In contrast, under Alternatives B, C, and D, the BLM would place more restrictions on development than under Alternative A. Therefore, all action alternatives would have a lower contribution to cumulative impacts on soils. Alternative D would include the fewest acres open and the most stringent restrictions for fluid mineral leasing. Therefore, Alternative D would provide the most protection and reduce impacts to soils to the greatest extent of all the alternatives.

3.2.6 Paleontological Resources

Issue 1: How would each alternative affect paleontological resources across the planning area? Where and how will potential oil and gas development limitations affect paleontological resources?

Issue 2: What impact do big game populations have on paleontological resources on BLM land in Colorado?

Paleontological resources are any fossilized remains or traces of organisms that are preserved in or on the earth's crust, that are of scientific interest, and that provide information about the history of life. Paleontological resources, whether invertebrate, plant, trace, or vertebrate fossils, constitute a fragile and nonrenewable record of the history of life. The BLM manages them for scientific, educational, and recreational values, such as casual collecting of common invertebrate and plant fossils, and to protect these resources from adverse impacts.

Analytical Methods and Assumptions

The analysis area for paleontological resources are the BLM-administered lands and resources in the decision area.

The analysis of impacts on paleontological resources from changes in the availability of lands for oil and gas leasing will:

- Describe—in general—the laws, regulations, and BLM policies and how the BLM considers the potential for impacting scientifically important paleontological resources for each phase of oil and gas leasing and development
- Describe the nature and types of potential impacts on paleontological resources that could result from the development of an oil and gas lease, including the subsequent exploration, development, production, abandonment, and reclamation phases of any permitted development
- Describe the potential impacts and protections for paleontological resources associated with the different types of constraints under consideration, including closures, NSO stipulations, CSU stipulations, and timing limitations
- Compare the alternatives in general terms regarding the potential for impacts on paleontological resources based on the level of constraints proposed under each alternative
- Discuss the potential for impacts on paleontological resources from changes in access, changes in travel routes, erosion, unauthorized collection, or vandalism

The analysis of impacts on paleontological resources is based on the following assumptions:

- The decision area includes fossil-bearing geological units and near-surface exposures or localities that may contain specimens of scientific interest.
- More fossil localities likely exist in the decision area than are currently known and mapped; fossil exposures represent only a very small subset of the decision area.
- The analysis focuses on general management over a large and varied decision area; it does not break out or quantify the details and locations of fossil localities but considers the broad geological units that may contain fossils.
- When surface soils contain fossils or provide a protective matrix around fossil deposits, surface disturbance can damage or destroy the fossil resources through direct impact or cause their displacement and accelerated weathering due to exposure.

- The BLM will continue to follow all existing regulatory procedures and guidance for the consideration of impacts for site-specific leasing, exploration, applications to drill, operations, production and reclamation.
- Inventories conducted before permitting surface disturbance or monitoring in high-probability areas may result in the identification and evaluation of previously undiscovered resources; however, not all fossil exposures would be considered scientifically significant.
- Paleontological resources are nonrenewable, but projects on BLM-administered land can lead to increased knowledge, additional research opportunities, and new discoveries.
- Oil and gas leasing allocations and stipulations considered in this planning process may cause direct impacts on paleontological resources by precluding access and use. Subsequent leasing decisions, exploration and development increase the risk of direct and indirect impact from surface disturbance
- Existing protections for paleontological resources specified in RMPs will continue.
- Development of existing leases would be required to conform to new objectives to the extent consistent with lease rights.
- Stipulations that protect certain big game animals, other wildlife, plants, or other resources may provide incidental protections for collocated paleontological resources. Conversely, these stipulations may result in impacts from surface disturbance on fossil exposures from redirecting uses and animal travel and congregation areas

Scope of the Analysis

The scope of the analysis is limited to the programmatic³ consideration of the effects of new or changed oil and gas management decisions—designed to maintain, conserve, and protect big game corridors and HPH—on recorded or undiscovered paleontological resources. The geographic scope of the analysis is the decision area of approximately 8.3 million acres of BLM-administered surface lands and 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

The BLM manages fossils to promote their use in research, education, and recreation in accordance with the Paleontological Resources Preservation Act (PRPA), Subtitle D of the Omnibus Public Land Management Act of 2009 (16 USC 470aaa through 470aaa-11), and the general guidance of FLPMA and NEPA. A final Department of the Interior regulation has recently been published at 43 CFR 49—Paleontological Resources Preservation to implement the PRPA. Together, the PRPA and the regulations at 43 CFR 49 require the BLM to:

- Manage paleontological resources using scientific principles and expertise
- Maintain a program of inventory and monitoring of paleontological resources
- Establish an education program to increase public awareness about paleontological resources
- Continue to require permitting for the collection of paleontological resources
- Continue to preserve paleontological objects for the public in approved museum collections
- Provide for casual collection of common invertebrate fossils by the public without a permit on BLM-administered lands

Fossils are found in nearly all sedimentary rock formations exposed on BLM-administered lands. The BLM's Potential Fossil Yield Classification (PFYC) system is used to broadly assess whether scientifically important

³ General and broad-based discussion of impact potential, not site or corridor specific.

paleontological resources may be present on the surface in mapped geological units. It is also used to assess possible resource impacts and mitigation needs for federal actions that involve surface disturbance and land use planning, or land tenure adjustments (BLM 2016). PFYC values range from Class 1 (very low) to Class 5 (very high). Geological units without enough information associated with them to assign a PFYC value may be assigned Class U (unknown potential) or Class W (for areas covered with surface water) (**Table 3-35**). The BLM considers PFYC assignments as only a first indication of the potential presence of paleontological resources; these assignments are used to focus further inventories, ground surveys, and planning.

Table 3-35. PFYC Classifications in the Decision Area by Acres

Potential Fossil Yield Classification of Rock Units	Acres in the Decision Area	Percentage in the Decision Area
Class 5 – Very High Potential	5,031,000	38.67%
Class 4 – High Potential	2,017,000	15.50%
Class 3 – Moderate Potential	2,080,000	15.99%
Class 2 - Low Potential	1,123,000	8.63%
Class 1 - Very Low Potential	1,285,000	9.88%
Class U - Unknown	1,438,000	11.05%
Class W – Open Water	23,000	0.18%
Total	12,997,00	99.90

It should be noted that over 54 percent of the decision area is in Class 4 or Class 5 high or very high potential areas for paleontological resources. The PFYC classification associated with existing oil and gas wells in the decision area is outlined in **Table 3-36**. Class 4 or Class 5 high or very high potential areas for paleontological resources are associated with over 70 percent of the existing wells.

Table 3-36. Existing Oil and Gas Wells in the Decision Area by PFYC Classifications

PFYC Classification	No. of Wells
Class 5 – Very High Potential	9,144
Class 4 – High Potential	1,047
Class 3 – Moderate Potential	1,957
Class 2 - Low Potential	1,618
Class 1 – Very Low Potential	31
Class U – Unknown	650
Total	14,448

The BLM and some museums and universities also maintain confidential databases and maps of known fossil exposures and localities. The BLM consults these databases on a project- and site-specific basis when evaluating project approvals. Locality data is also considered when developing and updating PFYC classifications but was not searched or accessed as part of the scope of this analysis. Accessing locality information or conducting ground surveys may be needed in the review of future lease sales and APDs to identify specific locations that should be monitored, avoided, or protected from oil and gas development or actions that may cause other surface disturbance.

Paleontological resources constitute a fragile and nonrenewable scientific record of the history of life. The resource condition is assessed by field observations by the BLM and paleontology researchers, paleontological reports, paleontology survey reports for proposed undertakings, and project review.

The BLM considers any vertebrate fossils or invertebrate and plant fossils that contribute to scientific information as significant. Many invertebrate and plant fossils are typically more abundant, and the BLM does

not ordinarily consider them to be of significance. Indicators for the condition of paleontological resources are as follows:

- Type of fossil resource present (vertebrate, invertebrate, or plant)
- Prevalence of the fossil resource in the area
- Geological formations in the planning area likely to contain fossils
- Physical condition of the fossil
- Scientific, educational, or recreational merit of the resource

The density of localities is an indicator of the richness of the paleontological resources for an area. A high density of localities may indicate a correspondingly high potential for more paleontological resources, suggesting that more active management of the paleontological resources in that area is warranted. A low density, however, may reflect either that fossils are rare or that the area has not received much exploration. A known locality in an area of rare occurrence, therefore, may prove to be even more significant due to its rarity.

The primary resource indicator is whether there is a loss of those characteristics that make the fossil locality or feature important or available for scientific use. Natural weathering, decay, erosion, improper collection, and vandalism can remove or damage those characteristics that make the paleontological resource scientifically important.

Reasonably Foreseeable Trends and Planned Actions

Ongoing trends of better access, recreational use, access to locality information on social media, erosion, and more human activity in areas where paleontological resources may be present could result in impacts from vandalism, unauthorized collection, and possible surface disturbance from development or intensive use. Paleontological surveys and mitigation efforts related to development could result in an increase of discoveries. This could result in new finds when mitigation work occurs in areas that have not been studied by researchers, who tend to return to areas that have proven fossils potential. The BLM anticipates that permitted research excavations would continue by museums and universities.

Environmental Consequences

Impacts Common to All Alternatives

The analysis area for paleontological resources are the BLM-administered lands and subsurface resources in the decision area. Under all alternatives existing protections for paleontological resources specified in RMPs will continue. The development of existing leases would be required to conform to the new objectives of this planning action to the extent consistent with lease rights.

The changing of availability or allocations of lands for oil and gas leasing would directly impact paleontological resources. Oil and gas leasing allocations and stipulations considered in this planning process may cause direct impacts on paleontological resources by precluding other access and uses. Subsequent leasing decisions, exploration and development increase the risk of direct and indirect impact from surface disturbance. Restrictions on surface-disturbing activities, such as closures and NSO, benefit paleontological resources by protecting them from damage, destruction, or illicit collection. Surface allocations and stipulations that protect certain big game animals, other wildlife, plants, or other resources may provide incidental protections for collocated paleontological resources. Conversely, these stipulations may result in impacts from surface disturbance on fossil exposures from redirecting uses and animal travel and congregation areas.

Surface and near-surface exposures can also be impacted by shallow ground-disturbing activities. Shallowly buried paleontological resources can be exposed by natural erosion, which can be exacerbated by surface-disturbing activities. Surface exposure can lead to discovery of paleontological resources, but fossils can be damaged or lost by the direct action of ground disturbance, subsequent erosion, and unauthorized collection.

Consideration of the potential for physical and other impacts on paleontological resources is assessed at the implementation level of oil and gas development in areas that may be identified as sensitive for paleontological resources based on PFYC classification, presence of localities or field studies.

For alternative comparison at this level of analysis, the acres of lands that are closed or open (with stipulations) to fluid mineral leasing for each alternative are assessed against the number of acres in the PFYC mapped geological units (**Table 3-37**). This comparison of management allocations focuses on PFYC Class 4 high and Class 5 very high potential locations. The presence of PFYC 4 or 5 units does not necessarily predict exposures of significant fossil localities that would be impacted or imply that known impacts would occur from oil and gas planning actions and actions proposed to protect and maintain big game corridors. Fossils may also occur in areas that may have less sensitive or unknown PFYC units. These data serve as a guide to evaluate the need for further investigation when authorizing future actions and to broadly compare the relative risk of impacts among alternatives.

Table 3-37. Acreages of PFYC Classification in Oil & Gas Facilities in Areas Subject to Fluid Mineral Leasing Stipulations

PFYC Class	Closed	Open				Standard
		NSO	CSU	TL	CSU-TL	
Alternative A						
Class 5 – Very High Potential	867,000	1,366,000	1,399,000	3,279,000	505,000	4,165,000
Class 4 – High Potential	263,000	378,000	745,000	833,000	54,000	1,754,000
Class 3 – Moderate Potential	345,000	418,000	661,000	963,000	157,000	1,736,000
Class 2 - Low Potential	113,000	290,000	344,000	523,000	41,000	1,010,000
Class 1 - Very Low Potential	136,000	119,000	90,000	589,000	7,000	1,149,000
Class U - Unknown	66,000	124,000	165,000	712,000	25,000	1,371,000
<i>Subtotal</i>	<i>1,790,000</i>	<i>2,704,000</i>	<i>25,022,000</i>	<i>6,919,000</i>	<i>790,000</i>	<i>11,207,000</i>
Alternatives B&C						
Class 5 – Very High Potential	867,000	1,393,000	3,267,000	3,518,000	505,000	4,165,000
Class 4 – High Potential	263,000	418,000	1,120,000	1,058,000	54,000	1,754,000
Class 3 – Moderate Potential	345,000	429,000	1,093,000	1,063,000	157,000	1,736,000
Class 2 - Low Potential	113,000	296,000	677,000	659,000	41,000	1,010,000
Class 1 - Very Low Potential	136,000	187,000	936,000	917,000	7,000	1,149,000
Class U - Unknown	66,000	144,000	1,071,000	1,019,000	25,000	1,371,000
<i>Subtotal</i>	<i>1,790,000</i>	<i>2,876,000</i>	<i>8,174,000</i>	<i>8,253,000</i>	<i>790,000</i>	<i>11,207,000</i>

PFYC Class	Closed	Open			Standard	
		NSO	CSU	TL CSU-TL		
Alternative D						
Class 5 – Very High Potential	1,788,000	1,111,000	2,346,000	2,614,000	417,000	3,244,000
Class 4 – High Potential	912,000	157,000	473,000	424,000	29,000	1,105,000
Class 3 – Moderate Potential	833,000	304,000	605,000	596,000	121,000	1,247,000
Class 2 - Low Potential	426,000	204,000	364,000	369,000	29,000	697,000
Class 1 - Very Low Potential	954,000	55,000	119,000	2,614,000	1,000	331,000
Class U - Unknown	806,000	64,000	332,000	370,000	19,000	632,000
<i>Subtotal</i>	<i>5,721,000</i>	<i>1,903,000</i>	<i>18,571,00</i>	<i>4,528,000</i>	<i>618,000</i>	<i>7,275,000</i>

Source: BLM GIS 2023

Alternative A

Under the No Action Alternative, the potential for impacts resulting from existing leases, and ongoing development would not change. Authorized and pending leases would continue in areas open to leasing, however the development of existing leases would be required to conform to the new objectives of this planning action to the extent consistent with lease rights. Acreage closed to leasing in Class 4 and 5 areas totals 263,000 and 867,000 acres respectively. Acreage open to leasing with NSO in Class 4 and 5 areas totals 378,000 and 867,000 acres respectively. These allocations are the most protective of paleontological resources from disturbance associated with oil and gas leasing and development. The nature and types of potential impacts on paleontological resources would be the same as described under *Impacts Common to all Alternatives*. Determining the presence and the extent and intensity of any potential impacts on paleontological resources can only be assessed on a site-specific basis.

Alternatives B and C

Alternatives B and C have the same acreage breakdown by stipulations and PFYC. Overall acres and acres in Class 4 and 5 areas closed to leasing would be the same as those under No Action Alternative. Areas open to leasing with NSO stipulations in Class 4 and 5 areas would increase slightly in proportion to Alternative A. These allocations are the most protective of paleontological resources from disturbance associated with oil and gas leasing and development. The potential for potential for impacts on paleontological resources in Class 4 and 5 areas would be similar to Alternative A for closed and NSO areas.

Class 4 and 5 areas open to leasing with CSU, and TL stipulations would increase over Alternative A, reducing the potential for future surface disturbance associated with oil and gas development in open areas. The 3 percent disturbance threshold under Alternative C would limit impacts across a landscape scale, and the potential for disturbance would be dispersed across a larger area. The surface disturbance density evaluation would limit the density of potential disturbances and facilitate avoidance paleontological resource locations. Overall, the nature and types of potential impacts on paleontological resources would be the same as described under *Impacts Common to all Alternatives*. Determining the presence of affected resources and the extent and intensity of any potential impacts on paleontological resources can only be assessed on a site-specific basis.

Alternative D

Under Alternative D, acreage closed to leasing in Class 4 and 5 areas total 912,000 and 1,788,000 acres respectively – a substantial increase in acres of high and very high potential areas for paleontological that would have increased protection from impacts from oil and gas development over Alternative A. Acreage

open to leasing with NSO in Class 4 and 5 areas would be reduced to 157,000 and 1,111,000 acres respectively, reflecting previously open areas that would then be closed.

Class 5 areas open to leasing with CSU, and TL stipulations would increase over Alternative A, reducing the potential for future surface disturbance associated with oil and gas development in open areas. The percentage of the decision area that would be closed to leasing would be increased from 13.8 percent to 44.8 percent, substantially decreasing the potential for future impacts from oil and gas development on paleontological resources. Overall, the nature and types of potential impacts on paleontological resources would be the same as described under *Impacts Common to all Alternatives*. Determining the presence of affected resources and the extent and intensity of any potential impacts on paleontological resources can only be assessed on a site-specific basis.

Cumulative Effects

The cumulative effects analysis area for paleontological resources is the planning area. Past and present actions that have likely affected paleontological resources are mining, commercial quarrying, oil and gas exploration, development, and production; increased recreation and tourism; infrastructure development; road construction, vandalism and unauthorized removal and the effects of climate change including erosion and exposure of buried resources. Activities on private land or privately financed are not subject to review and most regulations on uses. Future actions with the potential to affect paleontological resources are similar to past and present actions. However, actions on federal land or other government review would be conducted in the context of federal regulations or other review and impacts would be reduced.

The potential for cumulative effects on paleontological resources from oil and gas development in the decision area varies by alternative. Under all alternatives, oil and gas closures and stipulations like NSO, CSU, and TL would reduce impacts on paleontological resources by avoiding or reducing surface-disturbing activities in BLM-administered portions of the planning area. Management under Alternative A would produce the greatest potential for contributing to cumulative impacts on these resources. Under Alternatives B, C, and D, the BLM would place more restrictions on oil and gas development than under Alternative A. Due to this, all action alternatives would have less potential for contributing to cumulative impacts on paleontological resources than the no action alternative. Under Alternative D, the fewest acres would be open to oil and gas development and the most stringent restrictions for fluid mineral leasing among the alternatives would be adopted. Alternative D would have the least potential for impacts on paleontological resources, compared to the other alternatives.

3.3 BIOLOGICAL RESOURCES

3.3.1 Big Game Species and Habitat

Issue 1: What are the direct and indirect impacts to big game habitat and population trends from the alternatives related to oil and gas? What are the impacts from BLM and neighboring land use activities combined (cumulative disturbance) across alternatives and reasonably foreseeable future actions?

Issue 2: How would new stipulations, conservation measures, and development limitations affect big game species and high priority habitat?

Analytical Methods and Assumptions

The following analysis reviews the impacts each proposed alternative would have on big game HPH within the decision area. For each alternative, big game HPHs were overlaid with the proposed fluid mineral leasing stipulations. Where these data were not available, the impacts are discussed qualitatively. The potential impacts discussed below were identified by reviewing the best available science and data.

Indicators for big game and their HPH include the following:

- Disturbance and/or loss of plant communities, food supplies, cover, and other habitat components necessary for population maintenance used by big game species to a degree that would lead to substantial population declines.
- Disturbance and/or loss of seasonally important habitat (e.g., severe winter range or production areas) to a degree that would lead to substantial population declines.
- Interference with a species movement pattern that decreases the ability of a species to breed or overwinter successfully to a degree that would lead to substantial population declines.

Assumptions

- The actual locations of oil and gas well pads and associated infrastructure including pipelines and access roads are subject to change as a result of APDs.
- Short-term effects are defined as those that would occur over a time frame of 5 years or less, and long-term effects would occur over longer than 5 years.
- Impacts on big game from displacement depend on the location, extent, timing, or intensity of the disruptive activity. Furthermore, impacts from displacement will be greater for big game species that have limited habitat or a low tolerance for disturbance.
- Habitat will be managed in coordination with CPW herd objectives and species-specific plans.
- In the context of this analysis, the term “avoidance” means reduced use and does not imply a complete absence of use by big game.

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area includes all BLM-administered lands and approximately 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Big game species are an iconic part of the West and an important part of natural systems and local economies. Big game species in general are large, wide ranging, wild animals, and the list of species that are considered big game varies from state to state. For this RMPA, the big game species considered are mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus canadensis nelson*), pronghorn (*Antilocapra americana*), desert bighorn sheep (*Ovis canadensis nelsoni*), and Rocky Mountain bighorn sheep (*O. c. canadensis*). In Colorado there are about 303,000 Rocky Mountain elk, 392,000 mule deer, 73,000 pronghorn, and 7,500 desert and Rocky Mountain bighorn sheep. The scope of this RMPA/EIS proposes alternative management approaches for habitats important to these species. Big game in Colorado typically migrate from higher elevations in the summer to lower elevations in winter (**Figure 3-7**, Appendix D, Big Game Migration and Movement Corridors).

Big game seasonal habitats identified by CPW vary by big game species; however, they are generally defined by the area in which a majority of each species utilizes for summer, winter, migration, and reproduction, and by considering the proportion (density or percentage) of animals in an area relative to overall herd size, the geographic location of animals during the calendar year, and the weather conditions that describe those seasons. CPW wildlife biologists, district wildlife managers, and GIS staff delineate these areas based on current observed habitat use, including sources such as annual big game population counts (ground-based and aerial), GPS and VHF collar data, hunter harvest information, third party reporting, etc. to identify areas

of HPH. HPH areas for big game are identified in **Table 3-38**. These seasonal habitats have some overlap and are not geographically distinct (CPW has identified HPH for non-big game species that are not analyzed in this plan).

Table 3-38. High Priority Habitat for Big Game Species in Colorado

HPH Type	CPW Recommendation
<p>Elk Production Area: That part of the overall range of elk occupied by the females from May 15 to June 30 for calving.</p>	<p>TL - No permitted or authorized human activities from May 15 to June 30; CSU - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss.</p>
<p>Bighorn Sheep Production Area: That part of the overall range of bighorn sheep occupied by pregnant females during a specific period of spring. This period is April 15 to June 30 for Rocky Mountain bighorn sheep and February 1 to May 1 for desert bighorn sheep.</p>	<p>NSO (year-round) in CPW-identified bighorn sheep production areas; TL - No permitted or authorized human activities from April 15 to June 30 (Rocky Mountain Bighorn Sheep) or from February 1 to May 1 (Desert Bighorn Sheep).</p>
<p>Bighorn Sheep Winter Range: That part of the overall range where 90 percent of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up, or during a site-specific period of winter as defined for each data analysis unit.</p>	<p>TL - No permitted or authorized human activities (including overflights) from November 1 to April 30; CSU/ - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss.</p>
<p>Severe Winter Range: That part of the overall range where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.</p>	<p>TL - No permitted or authorized human activities from December 1 to April 30; CSU/ - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss.</p>
<p>Winter Concentration Area: That part of the winter range where densities are at least 200 percent greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten. Management and research have shown that winter range quality and quantity is one of the primary limiting factors for big game population performance. CPW has observed multiple severe winter events over the past several decades that have had significant impacts on big game populations. Human recreation and development, which are occurring at unprecedented levels in Colorado, increasingly overlap, fragment, and impact big game winter range habitats.</p>	<p>Elk and Mule deer: TL - No permitted or authorized human activities from December 1 to April 30; CSU/ - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss.</p> <p>Pronghorn: No permitted or authorized human activities from January 1 to April 30; CSU/ - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss.</p>

HPH Type	CPW Recommendation
Migration Corridor: A specific mappable site through which large numbers of animals migrate; its loss would change migration routes.	CSU/ - Surface density limitation of one pad per square mile and less than one linear mile of routes per square mile (640 acres). If pad or route density cannot be achieved or maintained, implement offsite mitigation to offset functional habitat loss

Definitions are from the CPW GIS species activity mapping definitions for “high-priority habitat” layers for elk, mule deer, and pronghorn (CPW 2022a).

Approximately 66 percent (8,645,000 acres) of the decision area contains big game HPH. **Table 3-39** shows the total acres of HPHs for elk, mule deer, pronghorn, and bighorn sheep in the decision area.

Table 3-39. Acres of Big Game HPHs in the Decision Area

	Severe Winter Range	Winter Concentration Area	Winter Range	Production Area	Migration Corridor
Elk	3,441,000	3,324,000	N/A	1,690,000	1,052,000
Mule deer	3,420,000	3,456,000	N/A	N/A	752,000
Pronghorn	N/A	625,000	N/A	N/A	48,000
Bighorn sheep	N/A	N/A	1,003,000	334,000	115,000

Source: BLM GIS 2022

*HPH layers overlap; acres are not additive.

*N/A = habitat types are not identified as HPH for that species

CPW has identified additional important migration and movement corridors for big game and expects to classify these areas as HPH in the future (**Figure 3-7**). This would potentially add approximately 63,000 acres of elk, 125,000 acres of mule deer, and 10,000 acres of pronghorn HPH migration and movement corridors to the decision area. The majority of these acres are located in the White River and Kremmling Field Offices (**Table 3-40**).

Table 3-40. Acres of Additional Big Game Migration and Movement Corridors by BLM Field Office

Field Office	Acres of CPW mapped migration corridors			
	Elk	Mule Deer	Pronghorn	Total
Colorado River Valley Field Office	0	0	0	0
Grand Junction Field Office	0	4,000	0	4,000
Gunnison Field Office	5,000	3,000	0	7,000
Kremmling Field Office	31,000	19,000	10,000	61,000
Little Snake Field Office	22,000	9,000	0	32,000
Royal Gorge Field Office	2,000	0	0	2,000
San Luis Valley Field Office	2,000	0	0	2,000
Tres Rios Field Office	0	0	0	0
Uncompahgre Field Office	1,000	10,000	0	11,000
White River Field Office	1,000	79,000	0	80,000
Total Acres	63,000	125,000	10,000	198,000

Source: BLM GIS 2023

Some of these new migration and movement corridors overlap areas that are already subject to BLM CSU stipulations. **Table 3-4I** shows the additional acres that would become subject to existing CSU stipulations should CPW add them to HPH. Most of these acres are in the Northwest District Office which would add 54,000 acres to the White River Field Office and 47,000 acres to the Kremmling Field Office that would become subject to CSU fluid mineral stipulations. For the purposes of this planning effort these areas will not be included as HPH in the decision area and thus BLM management would not change in these areas.

Table 3-4I: Acres of CPW Mapped Migration and Movement Corridors Not Currently subject to Open CSU/Open CSU/TL fluid mineral stipulations in the Decision Area

Field Office	Acres Not Currently Subject to Open CSU/Open CSU/TL fluid Mineral Stipulations in the Decision Area			
	Elk	Mule Deer	Pronghorn	Grand Total
Colorado River Valley Field Office	0	0	0	0
Grand Junction Field Office	0	3,000	0	3,000
Gunnison Field Office	5,000	3,000	0	7,000
Kremmling Field Office	27,000	14,000	6,000	47,000
Little Snake Field Office	12,000	5,000	0	18,000
Royal Gorge Field Office	1,000	0	0	1,000
San Luis Valley Field Office	2,000	0	0	2,000
Tres Rios Field Office	0	0	0	0
Uncompahgre Field Office	1,000	7,000	0	7,000
White River Field Office	0	53,000	0	54,000
Total Acres	48,000	85,000	6,000	139,000

Source: BLM GIS 2023

Management

The BLM is responsible for managing habitats for fish and wildlife communities; CPW and the US Fish and Wildlife Service (USFWS) have direct responsibility for population management. The BLM is indirectly responsible for the health and well-being of fish and wildlife populations that are supported by the habitats under its management, and it works cooperatively with the USFWS and CPW to manage wildlife habitats on BLM-administered lands. The BLM uses methods like land health assessments to measure Standards for Public Land Health, Guidelines for Livestock Grazing Management to maintain or achieve healthy public lands, and Proper Functioning Condition (PFC) to evaluate habitat of streams and water bodies.

The BLM recognizes the State’s authority to conserve and manage big game species. The BLM coordinates with the State to use best available science and quality information on big game species and their habitats. CPW’s mission is to perpetuate the wildlife resources of the state in accordance with the CPW’s strategic plan and direction from the Parks and Wildlife Commission and the Colorado legislature.

Big game populations are managed using CPW’s herd management plans (HMP), which establish population objective ranges and sex ratio objective ranges. The HMP for each herd incorporates the capability of the habitat to support big game populations, other social and biological limiting factors, and input from the public, organizations, and other agencies about their issues and concerns regarding hunting management and herd objectives. The purpose of a HMP is to integrate CPW’s management objectives with the concerns of other land management agencies and interested publics in determining how a big game herd in a specific geographic area should be managed. Population estimates of some big game species, in particular mule deer, are currently far below the HMP population objective ranges.

Populations, Trends, and Threats

Elk and Mule Deer

Colorado contains some of the best habitat for elk and mule deer in the western United States with western Colorado supporting the largest mule deer and elk herds in the state and across the western United States (CPW 2022b).

Rocky Mountain elk are one of the greatest conservation success stories in Colorado, given only 40,000 elk remained in all of North America in the early 1900s, and fewer than 1,000 in Colorado (Swift 1945). However, southwest Colorado has seen large declines in elk-calf ratios. CPW has research underway to determine causes of calf ratio declines for elk. Mule deer populations in western Colorado have been declining since the 1970s. Between 2006 and 2018, Colorado's estimated statewide deer populations declined from roughly 600,000 deer to approximately 433,000 deer (CPW 2020). Long-term mule deer population decline is due to many factors, including human population growth resulting in habitat loss and vehicle collisions, climate change, malnutrition, disease, and predation as well as increased competition with elk (CPW 2017a). Periodic extreme winter weather, such as that experienced in northwestern Colorado during winter 2022-2023, can result in high animal mortalities over a relatively short time period that limits long-term population size. Habitat quantity and quality are important factors in determining the number of mule deer that can exist in a herd over the long-term.

CPW has identified five landscape priority areas for elk and mule deer herds across the state. These areas include the Bear's Ears and White River herds in northwest Colorado, the San Juan Basin herds in southwest Colorado, the Uncompahgre Plateau in southwest, the Piney River and State Bridge herds in north-central Colorado, and the Book Cliffs herd in west-central Colorado (CPW 2022b).

In northwest Colorado, the Bear's Ears and White River mule deer and elk herds are among the most migratory of deer and elk herds in Colorado. Both shorter-distance, dispersed migration pathways and long-distance routes are used by migrants in the same herd. A significant proportion of each herd migrates 60 to 70 miles in spring and fall. The migratory pattern is primarily east-west, with summer ranges in the upper reaches of the Yampa and White River drainages near the Continental Divide and winter ranges west to within about 30 miles of the Colorado-Utah state line. The White River Herd, which was once the nation's largest mule deer herd, was reduced by two-thirds (from over 100,000 to roughly 32,000) between 2005 and 2021 (CPW 2022b). Threats to the herds in the area are energy development, increased recreation pressures, rural development and incompatible livestock management, drought, and highway mortality (CPW 2022b).

In southwest Colorado, the San Juan Basin herds are made up of approximately 23,000 deer, which is the second largest deer herd in Colorado, and 24,000 elk, which is the third largest elk herd in Colorado. This priority area is bordered by the New Mexico state line to the south, the Continental Divide to the east and north, and the Animas River to the west (CPW 2022b). Threats to the herds in the area are limited winter range at risk exurban development and a transition from agricultural to rural residential, energy development and the expansion of highway and transportation systems (CPW 2022c).

The Uncompahgre Plateau priority area is located in west-central Colorado, south of Grand Junction, west of Montrose, and north of the San Miguel River. Deer numbers in this area have been declining since 1980 from approximately 60,000 deer in 1980, to 11,000 in 2021. Elk numbers have also seen a decline from just over 14,000 in 2002 to around 12,500 in 2021 (CPW 2022b). These herds are experiencing habitat loss due

to housing development and recreation, impacting migration corridors, winter range, and production areas. Additional threats in the area include animal-vehicle collision and unmaintained fencing (CPW 2022c).

The Piney River and State Bridge landscape priority area is located in north-central Colorado in northern Eagle and southwestern Grand counties. It is bordered on the north by the Colorado River and on the south by the Eagle River and Interstate 70. The eastern boundary reaches alpine habitat along the Gore Range, which traverses south to Vail Pass. This area includes approximately 40 percent of the State Bridge deer herd (14,000 animals) and all of the Piney River elk herd (3,700 animals). Both herds are within CPW's long term population objectives, however, habitat carrying capacity is declining. The threats to deer and elk in this priority area are the "rapid expansion in the intensity and duration of year-around recreational activity and the associated increase in residential and commercial development" (CPW 2022c).

The Book Cliffs area is in west-central Colorado, along the Utah border, and supports about 8,600 mule deer and 5,000 elk. Both deer and elk migrate in elevation with the seasons. Portions of each herd migrate relatively long distances west, crossing state lines to spend the winter months in Utah. Recreation activities and suburban/exurban development are increasing threats, compounding long-term threats from effects of oil and gas development and production and livestock use of winter range (CPW 2022c).

The statewide post-hunt 2022 deer population estimate is 392,000, down from 416,000 last year. The sum of statewide population objective ranges is 431,000-521,000 for all 54 deer herds combined. In 2022, 15 of 54 (28 percent) deer DAUs are within their population objective ranges. The statewide deer population has averaged 418,000 over the last 10 years. The decade prior to that was marked by significant declines in some of the large westernmost herds in the state (CPW 2022b, 2022c).

The 2022 post-hunt estimate of 303,000 elk is slightly lower than the 309,000 elk estimated in 2021. The sum of Colorado's post-hunt HMP population objective ranges for elk statewide is 252,000-306,000 for all 42 elk herds combined. Antlerless licenses have been reduced for 19 years straight in order to maintain elk populations at population objectives (CPW 2022d).

Pronghorn

Pronghorns are endemic to North America and roam from west of the Mississippi River from southern Canada to central Mexico. In Colorado, approximately half of the state's pronghorn herds reside in the southeast region and the other half are found in the northwest with small populations in North Park, Middle Park, South Park and the San Luis Valley (Cooley et al. 2020; CPW 2014). Prior to European settlement, North American pronghorn population estimates were about 30-40 million. This number decreased to less than 40,000 by the 1920's due to overhunting. By the early 1960s there were approximately 15,000 pronghorn in Colorado which doubled to 30,000 in the 1970s, and stands at about 723,000 today (CPW 2014; 2022e).

The estimated statewide post-hunt pronghorn population is 73,000, down from 78,000 in 2021. The sum of statewide population objective ranges for hunted pronghorn herds is 69,000-81,000 combined. Six of 29 (21 percent) pronghorn DAUs are within HMP population objective ranges (CPW 2022e).

Bighorn Sheep

Prior to European settlement, Rocky Mountain bighorn sheep were prolific across Colorado's mountains and the Front Range. However, only a small number of bighorn sheep remained in Colorado by the early 1900s due to diseases introduced through European livestock and unregulated hunting (CDOW 2009). Populations started increasing after translocations began in the 1940s. From 1990 to 2007 the Rocky

Mountain bighorn sheep population in Colorado averaged 7,200 sheep. Herds are widely scattered throughout the mountains and foothills of the state.

There is no record of desert bighorn sheep occurring in Colorado prior to European settlement, however, it is likely that they were present in southwestern Colorado (CDOW 2009). Desert bighorn sheep were first reintroduced to Colorado in 1979. There are now three herds that are located across Colorado; the Black Ridge, Dominquez (Uncompahgre), and Dolores River herds which are located west and south of Grand Junction, west of Delta, and in the southwest corner of the state, respectively (Holland and Broderick 2013). From 1990 to 2001 the desert bighorn sheep population averaged 480 sheep (CDOW 2009).

The 2022 post-hunt population estimates were 500 for desert bighorn sheep and 7,500 for Rocky Mountain bighorn sheep (CPW 2022c).

Baseline Conditions and Existing Disturbances

Land use activities can have substantial effects on big game species' behavior and populations and can affect the functionality and permeability of big game HPHs, including on BLM-administered lands in Colorado. Studies show that animals may be forced to relocate from high-quality habitat areas to lower-quality areas, experience greater energy expenditures from frequent flight responses and increased vigilance, or shift their behaviors to avoid periods of high human activity (Taylor and Knight 2003; George and Crooks 2006). These alterations in behavior can reduce the amount of habitat that is available to wildlife, while leading to changes in animal physiology, reproduction, survival, and ultimately, population trends.

Existing Disturbance

The existing anthropogenic disturbance within HPH within the planning area (the state of Colorado) and the decision area (BLM surface and split-estate with federal mineral ownership; where BLM has authority to issue oil and gas leases and permits) was calculated for each DAU. The full methods, data, and maps are located in **Appendix L** and are summarized for each species below.

Elk: Anthropogenic disturbance has exceeded 3 percent within HPH in the planning area in 6 of the 42 elk DAUs and is rated as high in 10, moderate in 25, and low in the remaining 1 elk DAUs. Disturbance attributed to oil and gas is below 1 percent in the majority of elk DAUs (37 out of 42) (**Table L.E.1, Appendix L**).

In the decision area, anthropogenic disturbance has exceeded 3 percent within HPH in only one of the 42 elk DAUs and is rated as high in 9, moderate in 31, and low in the remaining one elk DAUs (**Table L.E.2, Appendix L**).

Mule deer: Anthropogenic disturbance within HPH in the planning area ranges from moderate to exceeding 3 percent for all 54 mule deer DAUs. Disturbance attributed to oil and gas is below 1 percent in all but 7 DAUs (**Table L.M.1, Appendix L**).

In the decision area, anthropogenic disturbance has exceeded 3 percent within HPH in four of the 54 deer DAUs and is rated as high in 12, moderate in 33, and low in the remaining 6 deer DAUs (**Table L.M.2, Appendix L**).

Pronghorn: Anthropogenic disturbance within HPH in the planning area has exceeded 3 percent in 3 out of 30 pronghorn DAUs, is rated as high in 10 DAUs, and moderate in 10, and low in the remaining 7 DAUs. Disturbance attributed to oil and gas is below 1 percent in all but two DAUs where disturbance from oil and gas makes up 1 percent of the anthropogenic disturbance in DAU ANT-3 and four percent in ANT-21 (**Table L.P.1, Appendix L**).

Anthropogenic disturbance within HPH in the decision area has exceeded 3 percent in 4 out of 30 pronghorn DAUs, is rated as high in 6 DAUs, and moderate in 8, and low in the remaining 12 DAUs (**Table L.P.2, Appendix L**).

Bighorn sheep: Anthropogenic disturbance within HPH in the planning area is below 3 percent for most bighorn sheep DAUs. However, there are three DAUs (RBS-03, RBS-14, and RBS-35) which exceed 3 percent disturbance. Disturbance attributed to oil and gas is below one percent in all bighorn sheep DAUs in Colorado (**Table L.B.1, Appendix L**).

In the decision area, anthropogenic disturbance within HPH has exceeded 3 percent in 5 of the bighorn sheep DAUs, is rated as high in 19 DAUs, and low in the remaining 18 DAUs (**Table L.B.2, Appendix L**).

Existing Density

The existing densities attributed to roads and oil and gas facilities within HPH within the planning area were calculated for each DAU. The full methods, data, and maps are located in **Appendix L** and are summarized for each species below.

Elk: Road densities are greater than 1 linear mile per square mile within 35 of the 42 elk DAUs within HPH in the planning area. Density of facilities attributed to oil and gas is rated at low in the majority of elk DAUs (38 out of 42) but are greater than 1 per 640 acres in DAU E-33. Road densities in E-33 are also greater than 1 linear mile per square mile (**Table L.E.5, Appendix L**).

Mule deer: Road density ranges from moderate to greater than 1 linear mile per square mile for all 54 mule deer DAUs within HPH in the planning area. Density of facilities attributed to oil and gas is rated as low in all but 7 of the mule deer DAUs. Within those 7 DAUs, five have oil and gas facilities greater than 1 per 640 acres and 2 are ranked as high density, and all 7 have road densities that are high or are greater than 1 linear mile per square mile (**Table L.M.5, Appendix L**).

Pronghorn: Road density within HPH in the planning area is greater than 1 linear mile per square mile in 18 out of 30 pronghorn DAUs. Density of facilities attributed to oil and gas is low in all but three DAUs. In those three DAUs, oil and gas facility density is moderate in ANT-3 and is greater than 1 per 640 acres in ANT-1 and ANT-2. Road density is greater than 1 linear mile per square mile in all three DAUs (**Table L.P.5, Appendix L**).

Bighorn sheep: Road densities within HPH in the planning area are low in seven of the bighorn sheep DAUs and range from moderate density to greater than 1 linear mile per square mile for the remaining 34 DAUs. Density of facilities attributed to oil and gas is rated as low in all bighorn sheep DAUs (**Table L.B.5, Appendix L**).

Within the BLM decision area, energy development (renewable and nonrenewable), high-density recreation, and travel and transportation are current sources of disturbance analyzed for big game.

Renewable and Nonrenewable Energy Development

Energy development across the Intermountain West has altered animal habitat use patterns and reduced populations, survival, and reproduction and declining recruitment rates are correlated with expanding residential and energy development, particularly within deer winter ranges (Johnson et al. 2017). For big game species, energy development has been associated with reduced survival in a population of elk within the Raton Basin in southern Colorado and northern New Mexico and declining recruitment rates for mule deer in western Colorado, particularly within winter ranges (Dzialak et al. 2011; Johnson et al. 2017).

Table 3-42 shows the number of oil and gas wells within big game HPH in the decision area (**Figure 3-4, Appendix D, Oil and Gas Wells in Relation to Big Game High Priority Habitat**). **Table 3-43** shows the acres open to surface and subsurface fluid mineral leasing that intersect big game HPH in the decision area. Within the areas open to fluid mineral leasing, **Table 3-44** shows the acres of authorized and pending BLM leases within big game HPH in the decision area. **Section 3.2.1, Geology and Fluid Minerals**, provides a description of these areas and classifications. The most acres and number of wells are within elk and mule deer severe winter range and winter concentration areas, compared with the other HPH types for mule deer, elk, pronghorn, and bighorn sheep. The greatest proportion of authorized and pending lease acres are located within elk production areas and mule deer severe winter range where total lease acres overlap 19 percent of the total acres of each of these habitat types in the Decision Area.

Table 3-42. Number of Oil and Gas Wells in HPHs in the Decision Area

	Severe Winter Range	Winter Concentration Area	Winter Range	Production Area	Migration and Movement Corridors
Elk	1,692	3,720	N/A	1,431	573
Mule deer	5,844	6,782	N/A	N/A	752
Pronghorn	N/A	782	N/A	N/A	165
Bighorn sheep	N/A	N/A	108	31	3

Source: BLM GIS 2022

*HPH layers overlap; acres are not additive

Table 3-43. Acres Open to Leasing in Big Game HPH in the Decision Area

Habitat	Open CSU	Open CSU-TLs	Open NSO	Open Other ¹	Open Standard	Open TLs
Elk						
Migration and movement corridors	270,000	105,000	260,000	7,000	99,000	460,000
Production area	526,000	121,000	581,000	53,000	113,000	1,277,000
Severe winter range	1,410,000	312,000	1,130,000	184,000	279,000	2,791,000
Winter concentration area	1,090,000	340,000	1,062,000	293,000	311,000	2,598,000
Mule Deer						
Migration and movement corridors	196,000	26,000	170,000	74,000	25,000	372,000
Severe winter range	1,265,000	215,000	1,029,000	331,000	196,000	2,946,000
Winter concentration area	1,150,000	265,000	1,024,000	457,000	238,000	2,678,000
Pronghorn						
Migration and movement corridors corridor	4,000	11,000	24,000	0	9,000	37,000
Winter concentration area	91,000	136,000	225,000	40,000	125,000	571,000

Habitat	Open CSU	Open CSU-TLs	Open NSO	Open Other ¹	Open Standard	Open TLs
Bighorn Sheep						
Migration and movement corridors	13,000	0	13,000	0	0	49,000
Production area	60,000	0	82,000	0	0	202,000
Winter range	240,000	0	215,000	0	0	582,000

Source: BLM GIS 2022

¹The 'Open Other' category includes areas where special conditions or requirements have been applied by lease notice in order to protect specific resources from impacts associated with development

*HPH layers overlap; acres are not additive

Table 3-44. Acres of Authorized and Pending BLM Oil and Gas Leases in Big Game HPH in the Decision Area

Habitat	BLM Oil and Gas Lease Areas (Acres)		
	Authorized	Pending	Total Acres
Elk			
Migration and movement corridors	61,000	1,000	62,000
Production area	291,000	23,000	314,000
Severe winter range	228,000	5,000	233,000
Winter concentration area	447,000	6,000	453,000
Mule Deer			
Migration and movement corridors	104,000	1,000	105,000
Severe winter range	497,000	1,000	498,000
Winter concentration area	648,000	1,000	649,000
Pronghorn			
Migration and movement corridors	6,000	0	6,000
Winter concentration area	59,000	2,000	61,000
Bighorn Sheep			
Migration and movement corridors	0	0	0
Production area	7,000	19,000	26,000
Winter range	35,000	19,000	54,000

Source: BLM GIS 2022

Travel, Transportation, and Right-of-Ways

Existing motorized routes impact big game species by decreasing effective use of adjacent habitat, disrupting migration routes and patterns, lowering wildlife densities, and increasing ambient noise to wildlife (Watson 2005). See **Section 3.4.6**, Travel and Transportation, for a description of travel and transportation management and route descriptions as well as a table that shows the miles of highways that intersect big game HPH in the decision area (**Table 3-45**).

Table 3-45 shows the miles of rights-of-way that intersect big game HPH in the decision area. Most of these are in elk and mule deer severe winter range and winter concentration areas. See **Section 3.4.8**, Lands, Realty, and Cadastral Survey, for more information.

Table 3-45. Miles of Rights-of-way in Big Game HPH in the Decision Area

	Severe Winter Range	Winter Concentration Area	Winter Range	Production Area	Migration and movement corridors
Elk	3,065	2,619	N/A	486	819
Mule deer	3,406	3,272	N/A	N/A	569
Pronghorn	N/A	723	N/A	N/A	68
Bighorn sheep	N/A	N/A	535	117	78

Source: BLM GIS 2022

High-density Recreation

Off-road recreation, including mountain biking, hiking, horseback riding, and all-terrain vehicle riding, has been shown to decrease big game resting and feeding times and increase daily travel times (Naylor et al. 2009). Studies suggest that the loss or fragmentation of habitat from trails and disturbance to species from even moderate levels of recreational use can degrade the value of habitat areas for big game species. Contrary to popular belief, non-motorized activities may have a greater negative effect on wildlife than motorized activities (Larson et al. 2016). Negative effects from both motorized and non-motorized recreation may include decreased species richness or diversity; decreased survival, reproduction, occurrence, or abundance; behaviors typically assumed to reflect negative responses to anthropogenic disturbance (for example, decreased foraging or increased vigilance); and physiological condition typically assumed to reflect disturbance effects (for example, decreased weight or increased stress) (Larson et al. 2016).

According to the trail density analysis of HPH in the planning area (see **Appendix L**), trail density is greater than 1 linear mile per square mile in 15 elk DAUs, 21 mule deer DAUs, five pronghorn DAUs, and 10 bighorn sheep DAUs (**Tables L.B.6, L.E.6, L.M.6, and L.P.6 in Appendix L**). Additionally, trail densities are rated as high in seven elk DAUs, eight mule deer DAUs, two pronghorn DAUs, and seven bighorn sheep DAUs.

The BLM manages various recreation areas across the state, including campgrounds, day-use areas, OHV designated areas, SRMAs, and ERMAs. **Section 3.4.5, Recreation**, provides a description of these areas. **Table 3-46** shows the acres of these areas that overlap big game HPH in the decision area. The greatest proportion of acres are in bighorn sheep winter range; recreation areas overlap 54 percent of the total bighorn sheep winter range on BLM managed lands within the Decision Area.

Table 3-46. Recreation Management Areas Within HPH in the Decision Area

Habitat	Recreation Management Areas (Acres)						Total Acres ¹
	Camp-ground	Day-use Area	ERMA	Natural Area/ Endangered Area	OHV Designated Area	SRMA	
Elk							
Migration and movement corridors	0	0	5,000	3,000	0	140,000	149,000
Production area	0	0	5,000	0	4,000	60,000	68,000
Severe winter range	0	1,000	164,000	5,000	4,000	431,000	605,000
Winter concentration area	0	1,000	67,000	2,000	4,000	200,000	273,000

Habitat	Recreation Management Areas (Acres)						Total Acres ¹
	Camp-ground	Day-use Area	ERMA	Natural Area/ Endangered Area	OHV Designated Area	SRMA	
Mule Deer							
Migration and movement corridors	0	3,000	12,000	0	10,000	101,000	125,000
Severe winter range	1,000	23,000	211,000	4,000	26,000	491,000	755,000
Winter concentration area	0	16,000	92,000	2,000	18,000	293,000	421,000
Pronghorn							
Migration and movement corridors	0	0	1,000	0	0	9,000	9,000
Winter concentration area	0	0	11,000	0	1,000	23,000	35,000
Bighorn Sheep							
Migration and movement corridors	0	0	4,000	0	1,000	78,000	83,000
Production area	0	2,000	9,000	1,000	4,000	160,000	176,000
Winter range	0	6,000	43,000	12,000	13,000	466,000	540,000

Source: BLM GIS 2022

¹Total acres may differ due to rounding

Table 3-47 shows the number of miles of OHV routes in HPH within the decision area. **Section 3.4.6, Travel and Transportation**, provides a description of these route designations. Most of these miles that overlap big game HPH are in mule deer and elk severe winter range and winter concentration areas.

Table 3-47. Miles of OHV Routes by Designation in HPH in the Decision Area

Habitat	OHV Route Designation (Miles) ¹				
	Closed	Limited	Open	Unknown	Total ²
Elk					
Migration and movement corridors	50	234	929	0	1,213
Production area	76	718	652	1	1,447
Severe winter range	417	1,175	4,123	17	5,732
Winter concentration area	50	1,472	2,655	23	4,200
Mule Deer					
Migration and movement corridors	73	326	737	1	1,134
Severe winter range	555	2,221	3,812	18	6,606
Winter concentration area	606	2,154	3,404	16	6,180
Pronghorn					
Migration and movement corridors	6	3	50	0	59
Winter concentration area	56	240	578	0	874
Bighorn Sheep					
Migration and movement corridors	27	3	54	0	84
Production area	28	50	90	1	169
Winter range	110	247	620	9	986

Source: BLM GIS 2022

¹These routes may or may not be available for travel during winter due to snow conditions.

²Total miles may differ due to rounding

Table 3-48 shows the miles of recreation trails by designation that overlap HPH in the decision area.

Table 3-48. Miles of Recreation Trails Within Big Game HPH in the Decision Area

Habitat	Recreation Trail Designation (Miles)					Total Miles ²
	Bicycle and Hike Only	Bicycle Only	Equestrian and Hike	Hike Only	Shared Non-motorized ¹	
Elk						
Migration and movement corridors	0	0	105	1	16	121
Production area	0	0	139	2	26	167
Severe winter range	11	1	353	18	321	704
Winter concentration area	1	1	290	15	246	552
Mule Deer						
Migration and movement corridors	0	0	45	1	70	116
Severe winter range	10	1	442	25	401	880
Winter concentration area	13	1	361	18	372	765
Pronghorn						
Migration and movement corridors	0	0	4	0	2	7
Winter concentration area	0	0	28	0	34	63
Bighorn Sheep						
Migration and movement corridors	0	0	29	5	12	46
Production area	0	0	67	2	10	79
Winter range	0	0	241	21	57	319

Source: BLM GIS 2022

¹ Hiking, bicycle, and equestrian use

² Total miles may differ due to rounding

Seasonal closures are implemented throughout the state and decision area to reduce disturbance to wildlife during the stressful periods of the year. There are 734,000 acres subject to some form of seasonal closure (closed to all uses, closed to motorized, closed to motorized and mechanized, limited to over-snow vehicle) in the decision area. Seasonal closures are implemented to reduce disturbance to wildlife habitats during the high-stress season and critically important periods of the year. Closures help protect wildlife during reproductive cycles and reduce overall disturbances in a specific area (BLM 2022p). The BLM seasonal closure map^[3] illustrates some of the seasonal closures found in Colorado. Guidance in existing RMPs and travel management plans includes some seasonal closures to all uses, motorized, and motorized and mechanized travel, within big game HPH.

Throughout the year, routes are open for administrative uses or emergencies despite the route designation. Mule deer winter concentration areas represent the largest seasonal closures to motorized and mechanized travel. Seasonal closures to motorized, motorized and mechanized travel, and closed to all uses differ between field offices based on the need to protect resources, promote visitor safety, or reduce use conflicts. Some field offices have routes that are seasonally closed, while others may not. These seasonal closures are existing regulations and do not include any potential big game amendment alternatives.

^[3] BLM Colorado Seasonal Closure Web Application: [BLM CO Seasonal Closures Web Experience \(arcgis.com\)](https://arcgis.com)

Environmental Consequences

Nature and Type of Effects

Big game species and habitats within the decision area would be affected under all alternatives. Impacts would be primarily caused by disruption and disturbance from permitted activities and changes to habitat condition, which are directly linked to vegetation conditions (**Section 3.3.3**). Potential short-term impacts include mortality, injury, displacement, and noise or human disturbance caused by increased vehicle traffic and heavy machinery use. Potential long-term impacts include removal, fragmentation, and degradation of habitats due to construction of roads and facilities and long-term avoidance of developed areas. Direct and indirect habitat losses and fragmentation are most significant when the operations occur in specialized or sensitive habitats, or the oil and gas development is widespread, as was common in previous decades, in fields where single, horizontal-well pads are densely spaced.

Big game responses to increasing human disturbance include increased movement rates and probabilities of flight response that increased daily movements and reduced use in home ranges (Wisdom et al. 2004; Rowland et al. 2004, 2014; Montgomery et al. 2013). These responses cause individuals to expend more energy, which could impact reproductive success or susceptibility to mortality, predation, or disease. Species have also been shown to avoid habitat adjacent to disturbance extending to distances of over a mile (Wyoming Game and Fish Department 2010). Mule deer are less likely to occupy areas in close proximity to well pads than those farther away (Sawyer et al. 2006). Mule deer were less likely to use habitat within 1.7 to 2.3 miles of well pads, suggesting that indirect habitat loss may be substantially greater than direct habitat losses (Sawyer et al. 2006). A multi-year study on the Pinedale Anticline suggests that not only do mule deer avoid mineral activities, but the deer have not become accustomed to the disturbance after three years of drilling activity (Madson 2005). Other studies have found the average distances from well pads and roads to areas of high winter use by mule deer were 0.44 to 2.3 miles and 0.27 to 0.6 mile, respectively (Sawyer et al. 2006). Hebblewhite (2008) conducted a meta-analysis of over 160 studies and found an average 0.6-mile avoidance response from human disturbance, with the greatest avoidance in summer. Powell (2003) found that elk avoided areas less than 0.3-mile from human development in the fall, winter, and spring. Big game animals are expected to return to disturbance areas following construction; however, populations would likely be lower than prior to project implementation as the human activities associated with operation and maintenance continue to displace big game. Mule deer are more sensitive to operation and maintenance activities than pronghorn and elk, and, as the Pinedale Anticline study suggests, mule deer do not readily habituate (Madson 2005) and avoidance of roads and facilities may be long term and chronic (Lustig 2003; Sawyer et al. 2017).

It is important to note that average avoidance distances do not correspond to total habitat loss, as some deer and elk will use habitats closer to disturbances depending on individual responses and cover type. Impacts are greater in open landscapes and in areas with high densities of well pads, roads, and facilities and areas of high traffic (Sawyer et al. 2020; Wyoming Game and Fish Department 2010). For example, mule deer migratory use has been shown to significantly decline when surface disturbance from energy development exceeds 3 percent (Sawyer et al. 2020). Gigliotti, et al (2023) found elk exhibited stronger responses (either selection or avoidance) when selecting home range locations than when selecting areas within home ranges or selecting movement paths and across all levels of selection elk exhibited neutral selection for human development at low levels of availability (<1.1 percent–2.2 percent developed) but avoided areas that were >1.1 percent–2.2 percent developed. Another study used surface disturbance caused by well pads and roads as an index of human-induced rapid environmental change (HIREC) and evaluated behavioral responses across three spatial scales during winter and migration seasons. During

migration, both species tolerated low levels of disturbance. Once a disturbance threshold was surpassed, however, they avoided HIREC. For mule deer, thresholds were consistently ~3 percent, whereas thresholds for pronghorn ranged from 1 percent to 9.25 percent surface disturbance. In contrast to migration, both species generally avoided all levels of HIREC while on winter range (Lambert et al, 2022).

This avoidance response is also influenced by vegetation cover type where avoidance is greater in open areas such as in sagebrush shrublands and reduced in landscapes that provide more concealment cover such as in more rugged terrain or pinyon (*Pinus* sp.)–juniper (*Juniperus* sp.) woodlands (Sawyer et al. 2017; Lendrum et al. 2012; Northrup et al. 2015). Displacement of species due to avoidance of disturbances could increase competition for resources in adjacent habitats.

The greater the area that is open to leasing and development, the more likely impacts, such as habitat fragmentation and avoidance as described above, are to occur. However, the amount of land that is open to fluid mineral leasing or other mineral use is not necessarily indicative of the number of acres of habitat that would be directly disturbed. Restricting surface-disturbing activities from fluid mineral development through management actions would, therefore, reduce impacts on big game species and big game HPH in the decision area. Areas managed under NSO, CSU, and TL stipulations would limit surface disturbance and associated impacts, such as habitat removal, fragmentation, and human disturbance, in these areas.

NSO stipulations provide the greatest protection to big game and their habitats by prohibiting surface-disturbing activities in these areas. This prevents disturbance caused by fluid mineral development and would prevent direct impacts on big game as described above. CSU stipulations provide slightly less protection to big game and their habitats, since surface disturbing activities are allowed in these areas and species and habitats could be disturbed. However, CSU stipulations could protect big game and their habitats in certain instances by requiring special operational constraints, like co-locating facilities and expanding the use of existing development sites, or by moving the surface-disturbing activity to protect big game. TLs protect big game species during time periods when the species are most sensitive to disturbance, such as during birthing and wintering periods.

Alternative A

Under Alternative A, approximately 14 percent of big game HPH in the decision area would continue to be closed to fluid mineral leasing with the remaining 86 percent open to leasing (Table 3-49). Of that 86 percent, the majority of acres (67.5 percent) would be subject to TLs (Table 3-50). Table 3-51 shows these acres and percentages of leasing stipulations broken out by HPH for each species.

Table 3-49. Acres and Percentage Closed and Open to Fluid Mineral Leasing by Alternative in Big Game HPH in the Decision Area

	Alternative A		Alternative B		Alternative C		Alternative D	
	Acres	Percent of HPH	Acres	Percent of HPH	Acres	Percent of HPH	Acres	Percent of HPH
Closed to fluid mineral leasing	1,235,000	14.3	1,235,000	14	1,235,000	14	5,169,000	60
Open, subject to standard terms and conditions, or open subject to unmapped stipulations	7,411,000	85.7	7,411,000	86	7,411,000	86	3,476,000	40
Total	8,646,000	100.0	8,646,000	100	8,646,000	100	8,646,000	100

Source: BLM GIS 2022

Table 3-50. Fluid Mineral Leasing Stipulation Acres and Percentage by Alternative in Big Game HPH in the Decision Area*

	Alternative A		Alternative B		Alternative C		Alternative D	
	Acres	Percent of HPH	Acres	Percent of HPH	Acres	Percent of HPH	Acres	Percent of HPH
Open, subject to no surface occupancy (NSO)	1,990,000	23.0	2,163,000	25.0	2,163,000	25.0	1,188,000	13.7
Open, subject to controlled surface use (CSU)	2,632,000	30.4	7,406,000	85.7	7,406,000	85.7	3,476,000	40.2
Open, subject to timing limitation (TL)	5,837,000	67.5	7,176,000	83.0	7,176,000	83.0	3,448,000	39.9

Source: BLM GIS 2022

* Fluid mineral stipulations may overlap

Table 3-51. Fluid Mineral Leasing Stipulation Acres and Percentage by Big Game HPH in the Decision Area Under Alternative A *

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Elk migration and movement corridors	60,000	6	251,000	24	214,000	20	991,000	94	427,000	41
Elk production area	172,000	10	479,000	28	484,000	29	1,517,000	90	1,670,000	69
Elk severe winter range	520,000	15	1,281,000	37	858,000	25	2,921,000	85	2,505,000	73
Elk winter concentration area	391,000	11	1,005,000	29	841,000	24	2,932,000	85	2,360,000	68
Mule deer migration and movement corridors	27,000	4	188,000	25	146,000	19	726,000	96	354,000	47
Mule deer severe winter range	526,000	15	1,122,000	33	722,000	23	2,894,000	85	2,671,000	78
Mule deer winter concentration area	397,000	11	1,068,000	31	833,000	24	3,059,000	89	2,462,000	71
Pronghorn migration and movement corridors	11,000	23	3,000	7	15,000	31	38,000	78	35,000	74
Pronghorn winter concentration area	63,000	10	80,000	13	166,000	27	562,000	90	520,000	83
Bighorn sheep migration and movement corridors	12,000	11	7,000	6	9,000	8	103,000	89	41,000	36
Bighorn sheep production area	120,000	36	24,000	7	43,000	13	214,000	64	153,000	46

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Bighorn sheep winter range	352,000	35	151,000	15	113,000	11	652,000	65	473,000	47

Source: BLM GIS 2022

* Fluid mineral stipulations may overlap

In general, Alternative A would continue to rely on management guidance that does not reflect current conditions and issues and lacks a landscape-level approach to land planning. For example, Alternative A would not include the objective to co-locate, consolidate, and cluster localized disturbances as much as possible to maintain and conserve intact, connected HPH. This would make it harder to effectively and efficiently manage for big game habitat, as species and their habitat are dispersed throughout the decision area, and HPH would not be prioritized for protection.

The lack of comprehensive restrictions on fluid mineral development to protect big game would result in continued impacts to big game as discussed under *Nature and Type of Effects*. NSO, CSU, and TL stipulations would continue to be attached to oil and gas leases, and management emphasis for big game would continue to be defined for some areas according to objectives set forth in existing RMPs. However, planning and prioritization would lack the regional focus provided by the other action alternatives, and big game habitats would continue to be managed with less recognition of regional contexts and current CPW and ECMC recommendations. Therefore, big game abundance, distribution, habitat permeability, and condition would continue to be variable by field office across BLM Colorado.

Alternative B

Under Alternative B, the same proportion of big game HPH would be open and closed to fluid mineral leasing as under Alternative A (Table 3-49). However, more acres would be subject to NSO (2,163,000 acres; 25 percent), CSU (7,406,000 acres; 85.7 percent) and TL (7,176,000 acres; 83 percent) stipulations compared to Alternative A (Table 3-51). As described under *Nature and Type of Effects*, this would reduce impacts to big game and HPH within the decision area to a greater degree than under Alternative A. Reduction of impacts would be greatest in bighorn sheep production areas where 64 percent of production areas in the decision area would be subject to NSO stipulations under Alternative B (Table 3-52) compared to only 13 percent under Alternative A (Table 3-51). Alternative B implements a CSU surface density limitation of one pad per square mile and less than one linear mile of routes per square mile for oil and gas development. This would help to reduce fragmentation and increase permeability of HPH. Management under this alternative would be consistent with current CPW and COGMC recommendations, would mitigate direct and indirect impacts to big game HPH, and would help to maintain and conserve intact, connected HPH within the decision area. Alternative B would reduce impacts to big game and HPH to a greater extent than under the No Action Alternative, but is the least protective of the action alternatives.

Table 3-52. Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative B*

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Elk migration and movement corridors	60,000	6	991,000	94	230,000	22	991,000	94	835,000	79

3. Affected Environment and Environmental Consequences (Big Game Species and Habitat)

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Elk production area	172,000	10	1,517,000	90	504,000	30	1,517,000	90	1,517,000	90
Elk severe winter range	520,000	15	2,921,000	85	893,000	26	2,921,000	85	2,921,000	85
Elk winter concentration area	391,000	11	2,932,000	85	877,000	25	2,932,000	85	2,932,000	85
Mule deer migration and movement corridors	27,000	4	726,000	96	169,000	22	726,000	96	604,000	80
Mule deer severe winter range	526,000	15	2,894,000	85	828,000	24	2,894,000	85	2,894,000	85
Mule deer winter concentration area	397,000	11	3,059,000	89	865,000	25	3,059,000	89	3,059,000	89
Pronghorn migration and movement corridors	11,000	23	38,000	78	15,000	31	38,000	78	36,000	75
Pronghorn winter concentration area	63,000	10	562,000	90	167,000	27	562,000	90	562,000	90
Bighorn sheep migration and movement corridors	12,000	11	103,000	89	23,000	20	103,000	89	79,000	68
Bighorn sheep production area	120,000	36	210,000	63	214,000	64	214,000	64	214,000	64
Bighorn sheep winter range	352,000	35	652,000	65	271,000	27	652,000	65	652,000	65

Source: BLM GIS 2022

* Fluid mineral stipulations may overlap

Alternative C

Under Alternative C, acres open and closed to fluid mineral leasing and subject to NSO, CSU, and TL stipulations within HPH in the decision area would be the same as under Alternative B (**Table 3-53**). However, a 3 percent surface disturbance threshold on BLM-administered surface lands would be implemented under Alternative C. This would ensure that authorized uses and discrete anthropogenic disturbances associated with oil and gas development would be evaluated and restricted with 3 percent of the BLM surface of each DAU by HPH (unless such waivers, exceptions, or modifications apply). While this alternative only provides a disturbance threshold for oil and gas management, other anthropogenic disturbances and associated uses comprise this disturbance evaluation where other land uses on BLM surface lands could impact this threshold as it relates to the BLM’s management of oil and gas on BLM surface lands. This alternative would not limit any other non-oil and gas authorizations from exceeding this disturbance threshold.

Table 3-53. Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative C *

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Elk migration and movement corridors	60,000	6	991,000	94	230,000	22	991,000	94	835,000	79
Elk production area	172,000	10	1,517,000	90	504,000	30	1,517,000	90	1,517,000	90
Elk severe winter range	520,000	15	2,921,000	85	893,000	26	2,921,000	85	2,921,000	85
Elk winter concentration area	391,000	11	2,932,000	85	877,000	25	2,932,000	85	2,932,000	85
Mule deer migration and movement corridors	27,000	4	726,000	96	169,000	22	726,000	96	604,000	80
Mule deer severe winter range	526,000	15	2,894,000	85	828,000	24	2,894,000	85	2,894,000	85
Mule deer winter concentration area	397,000	11	3,059,000	89	865,000	25	3,059,000	89	3,059,000	89
Pronghorn migration and movement corridors	11,000	23	38,000	78	15,000	31	38,000	78	36,000	75
Pronghorn winter concentration area	63,000	10	562,000	90	167,000	27	562,000	90	562,000	90
Bighorn sheep migration and movement corridors	12,000	11	103,000	89	23,000	20	103,000	89	79,000	68
Bighorn sheep production area	120,000	36	210,000	63	214,000	64	214,000	64	214,000	64
Bighorn sheep winter range	352,000	35	652,000	65	271,000	27	652,000	65	652,000	65

Source: BLM GIS 2022

* Fluid mineral stipulations may overlap

Under this alternative, one bighorn sheep DAU, zero elk DAUs, three deer DAUs, and 4 pronghorn DAUs have already met or exceeded the 3 percent disturbance threshold (**Table 3-54**; see also **Tables L.B.3, L.E.3, L.M.3, and L.P.3 in Appendix L**). The bighorn sheep DAU RBS-12 is located in the west-central part of the state on the western border of the Rocky Mountain District Office. The Elk DAUs where disturbance is nearing the 3 percent threshold (i.e. at two percent) are located across the central and western parts of the state in the Rocky Mountain, Northwest, Upper Colorado River, and Southwest District

Table 3-54. Anthropogenic Disturbance Within Big Game High Priority Habitat: Alternative C

DAU	Anthropogenic Disturbance Under Alternative C	Actual Oil and Gas Disturbance	Oil and Gas Potential	Overlap with Existing Authorized Leases
Bighorn Sheep				
RBS-12	11%	0%	Low, No	0%
RBS-05	2%	0%	Medium, Low, No	0%
RBS-34	2%	0%	High, Medium	50%
Elk				
E-8	2%	0%	Medium, Low, No	0%
E-14	2%	0%	High, Medium, Low	38%
E-17	2%	0%	Low, No	0%
E-31	2%	1%	High, Medium, Low, No	53%
E-38	2%	0%	Low, No	0%
E-55	2%	0%	High, Low	0%
Mule Deer				
D-7	2%	0%	High, Medium, Low, No	40%
D-9	2%	0%	Medium, Low, No	0%
D-11	2%	1%	High, No	53%
D-12	4%	0%	High, Medium	53%
D-14	2%	0%	Medium, Low	0%
D-15	2%	0%	Low, No	0%
D-30	3%	1%	High, Medium, Low, No	45%
D-31	3%	0%	High, Medium, Low	0%
D-41	2%	1%	High, Medium, Low	57%
D-53	2%	0%	Low, No	0%
Pronghorn				
ANT-3	4%	1%	High, Medium, Low, No	32%
ANT-21	6%	3%	High, Medium, Low	41%
ANT-27	3%	0%	High, Medium, Low, No	11%
ANT-37	3%	0%	High, Medium, Low, No	0%
ANT-39	2%	0%	Low, No	0%

Note: Highlighted rows indicate DAUs above the 3% threshold.

Source: BLM GIS 2023

Offices. Mule deer DAU D-12 is located in the western part of the state in the Upper Colorado River District Office. D-30 and D-31 are located along the southern border of the state in the Rocky Mountain and Southwest District Offices. Antelope DAUs A-21, A-3, and A-37 are located in the northwest corner of the state in the Northwest District Office.

Alternative C provides flexibility in waivers, exceptions, and modifications for where 3 percent may not be an appropriate threshold or where exceeding 3 percent would support development opportunities on split-estate lands. This would reduce impacts to big game and HPH by reducing habitat fragmentation, increasing habitat permeability, and helping to mitigate impacts from direct and indirect habitat loss to a greater extent than under Alternatives A or B. However, the 3 percent disturbance is not calculated for split-estate or private lands under this alternative. Therefore, it does not account for the actual disturbance on the landscape since it is only being applied to BLM surface lands.

Alternative D

Under Alternative D, the greatest number and proportion of acres in HPH (5,266,000 acres; 61 percent) would be closed to fluid mineral leasing compared to all other alternatives (**Table 3-49**) since areas where oil and gas potential is not known, low, or moderate would be closed to future leasing. Under Alternative D, over half of each HPH type in the decision area would be closed to fluid mineral leasing (**Table 3-55**). Alternative D would also implement the 3 percent disturbance threshold as described under Alternative C but would take into account disturbance on all lands in the planning area not just BLM surface lands within the decision area.

Table 3-55. Fluid Mineral Leasing Stipulation Acres and Percentage in Big Game HPH in the Decision Area Under Alternative D *

HPH	Closed		Open CSU		Open NSO		Open Standard		Open TL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Elk migration and movement corridors	728,000	69	324,000	31	148,000	14	324,000	31	309,000	29
Elk production area	834,000	49	856,000	51	370,000	22	856,000	51	856,000	51
Elk severe winter range	2,274,000	66	1,167,000	34	452,000	13	1,167,000	34	1,167,000	34
Elk winter concentration area	1,906,000	55	1,418,000	41	495,000	14	1,418,000	41	1,418,000	41
Mule deer migration and movement corridors	534,000	71	218,000	29	84,000	11	218,000	29	204,000	27
Mule deer severe winter range	1,967,000	58	1,453,000	42	466,000	14	1,453,000	42	1,453,000	42
Mule deer winter concentration area	1,807,000	52	1,649,000	48	528,000	15	1,649,000	48	1,649,000	48
Pronghorn migration and movement corridors	40,000	83	9,000	18	7,000	15	9,000	18	9,000	18
Pronghorn winter concentration area	314,000	50	311,000	50	116,000	18	311,000	50	311,000	50
Bighorn sheep migration and movement corridors	113,000	98	2,000	2	1,000	1	2,000	2	2,000	2
Bighorn sheep production area	303,000	91	30,000	9	30,000	9	30,000	9	30,000	9
Bighorn sheep winter range	829,000	83	174,000	17	58,000	6	174,000	17	174,000	17

Source: BLM GIS 2022

* Fluid mineral stipulations may overlap

Under this alternative, three bighorn sheep DAUs, six elk DAUs, 14 deer DAUs, and three pronghorn DAUs and have already met or exceeded the 3 percent disturbance threshold (**Table 3-56**; see also **Tables L.B.1, L.E.1, L.M.1, and L.P.1, Appendix L**). Bighorn sheep DAUs where thresholds are exceeded are primarily located in the northwest/west-central part of the state in the Rocky Mountain and Upper Colorado River District Offices. Elk DAUs where thresholds have been met or exceeded are located in the Upper Colorado River, Rocky Mountain, and Southwest District Offices. Deer DAUs D-44 and D-12 have the highest level of disturbance percentages. D-44 is located in the northeastern part of the state and D-12 is located in the western part of the state in the Upper Colorado River Valley DO. Pronghorn DAUs A-21 and A-37 are located in the Northwest District Office and A-39 is located in the central part of the state along the western border of the Rocky Mountain District Office. Depending on the DAU, apart from oil and gas disturbance, existing anthropogenic sources contributing to disturbance shown in the table below include a combination of major roads, transmission lines, rail lines, infrastructure, and other vertical structures,

Table 3-56. Anthropogenic Disturbance Within Big Game High Priority Habitat: Alternative D

DAU	Anthropogenic Disturbance Under Alternative D	Actual Oil and Gas Disturbance	Oil and Gas Potential	Overlap with Existing Authorized Leases
Bighorn Sheep				
RBS-03	3%	0%	Low, No	0%
RBS-05	2%	0%	Medium, Low, No	0%
RBS-14	3%	0%	Low	0%
RBS-27	2%	0%	Low	0%
RBS-33	2%	0%	High, Medium, Low, No	0%
RBS-35	3%	0%	Low	0%
Elk				
E-8	2%	0%	Medium, Low, No	0%
E-10	2%	2%	High, Low, No	36%
E-14	3%	1%	High, Medium, Low, No	20%
E-16	2%	0%	Medium, Low, No	0%
E-17	2%	0%	Low, No	0%
E-19	8%	0%	Low	0%
E-21	2%	0%	High, Medium, Low	9%
E-26	10%	0%	High, Low, No	0%
E-27	13%	0%	Medium, Low, No	0%
E-30	2%	1%	High, Medium, Low, No	0%
E-31	2%	0%	High, Medium, Low, No	6%
E-33	3%	1%	High, Medium, Low, No	1%
E-38	2%	0%	Low, No	0%
E-39	3%	0%	Low, No	0%
E-51	2%	0%	Medium, Low, No	0%
E-53	2%	0%	Low	0%

3. Affected Environment and Environmental Consequences (Big Game Species and Habitat)

DAU	Anthropogenic Disturbance Under Alternative D	Actual Oil and Gas Disturbance	Oil and Gas Potential	Overlap with Existing Authorized Leases
Mule Deer				
D-5	2%	0%	High, Medium, Low	4%
D-7	2%	0%	High, Medium, Low, No	24%
D-8	2%	0%	Medium, Low, No	0%
D-9	2%	0%	Medium, Low, No	0%
D-10	3%	0%	Low, No	0%
D-11	2%	1%	High, No	51%
D-12	6%	2%	High, Medium	22%
D-14	3%	0%	Medium, Low	0%
D-15	3%	0%	Low, No	0%
D-17	3%	0%	Low, No	0%
D-19	2%	0%	Medium, Low, No	0%
D-20	2%	0%	High, Low, No	0%
D-22	2%	0%	Low, No	0%
D-24	2%	0%	High, Medium, Low, No	6%
D-27	3%	0%	Low, No	0%
D-30	2%	1%	High, Medium, Low, No	5%
D-31	3%	0%	High, Medium, Low	0%
D-32	3%	1%	Medium, Low	1%
D-34	2%	0%	Medium, Low, No	0%
D-36	2%	0%	High, Low, No	0%
D-38	2%	0%	Medium, Low, No	0%
D-40	2%	0%	Low, No	0%
D-41	4%	2%	High, Medium, Low	40%
D-43	2%	0%	High, Medium, Low, No	0%
D-44	7%	1%	High, Medium, Low	1%
D-45	2%	0%	Low	0%
D-48	2%	0%	Low	0%
D-49	2%	0%	High, Low	0%
D-50	3%	0%	Medium, Low, No	0%
D-51	3%	0%	High, Medium, Low	6%
D-52	2%	0%	High, Medium, Low, No	0%
D-53	3%	0%	Low, No	0%
D-54	2%	0%	Low	1%
D-55	3%	2%	Medium, Low	1%
Pronghorn				
ANT-1	2%	0%	High, Medium, Low	3%
ANT-3	2%	1%	High, Medium, Low, No	19%
ANT-4	2%	0%	Medium, Low	0%
ANT-20	2%	0%	Medium, Low, No	0%
ANT-21	8%	4%	High, Medium, Low	22%
ANT-23	2%	0%	Low, No	0%

DAU	Anthropogenic Disturbance Under Alternative D	Actual Oil and Gas Disturbance	Oil and Gas Potential	Overlap with Existing Authorized Leases
ANT-27	2%	0%	High, Medium, Low, No	10%
ANT-30	2%	0%	Medium, Low, No	0%
ANT-33	2%	0%	High, Medium, Low, No	0%
ANT-34	2%	0%	High, Medium, Low	0%
ANT-35	2%	0%	High, low	0%
ANT-37	3%	0%	High, Medium, Low, No	0%
ANT-39	3%	0%	Low, No	0%

Note: Highlighted rows indicate DAUs above the 3% threshold.

Source: BLM GIS 2023

There would also be less flexibility for waivers, exceptions, and modifications under this alternative. Therefore, Alternative D would have the most stringent restrictions on fluid mineral leasing and development within HPH in the decision area and would therefore provide the most protection to big game and HPH out of all the alternatives. Impacts as described under *Nature and Type of Effects* would be reduced to the greatest extent under Alternative D.

Cumulative Impacts

The analysis area used for analyzing cumulative impacts on big game is all HPH on all lands in Colorado. The larger analysis area is necessary because big game move across this larger landscape and animals and plants depend on ecosystems that extend over larger areas.

Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected and will likely to continue to affect big game include mineral exploration and development, residential and industrial development (including power lines and other ROWs), forestry, grazing, recreation, road construction, water diversion and withdrawals, weed invasion and spread, prescribed and wildland fires, land planning efforts, vegetation treatments, and habitat improvement projects.

Many of the actions described above have and will likely continue to alter habitat conditions, which then cause or favor other habitat changes. For example, wildland fire removes habitat, and affected areas are more susceptible to weed invasion, soil erosion, and sedimentation of waterways, all of which degrade habitats. In general, resource use activities have cumulatively impacted big game by causing habitat removal, fragmentation, weed spread, and disturbance from noise and increased human presence. Land planning efforts and vegetation, habitat, and weed treatments have offset some of these impacts by improving habitat connectivity, resistance, and resilience. Federal and state agency actions would generally mitigate impacts on big game, and cumulative impacts would be minimized. However, actions on private lands may not receive such analysis and would be more likely to contribute to cumulative impacts.

Ongoing and expected BLM planning efforts in Colorado may result in decisions that constrain oil and gas development which would contribute to reduced cumulative impacts to big game across the cumulative impacts area. Greater and Gunnison sage-grouse planning efforts, which may also result in decisions that constrain certain uses such as mineral development, ROW authorizations, and grazing, in certain habitats

where these species, which would also contribute to reduced cumulative impacts since these habitats overlap to some extent with big game HPH.

Climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions, vegetative health, and water flows and temperature. Such changes would alter habitat conditions, potentially creating conditions that could reduce seasonal habitats, and increase weeds, or pests.

Under all of the alternatives, oil and gas closures and stipulations, including NSO, CSU, and TL, would reduce impacts on big game by prohibiting or reducing surface-disturbing activities in certain areas. However, management under Alternative A would not include objectives to co-locate, consolidate, and cluster localized disturbance, and therefore, this alternative would have a greater incremental contribution to cumulative impacts on big game. This is because impacts, such as habitat alterations and disturbance, would not necessarily be limited and residual impacts mitigated, and concentrated areas of development could reduce habitat connectivity and functionality.

In contrast, under Alternatives B, C, and D, the BLM would place more restrictions on development than under Alternative A, including objectives to avoid, minimize, and mitigate development within HPH, which would reduce potential for habitat fragmentation. Therefore, all action alternatives would have a lower contribution to cumulative impacts on big game. Alternative D would include the fewest acres open and the most stringent restrictions for fluid mineral leasing. Therefore, Alternative D would provide the most protection and reduce impacts to big game to the greatest extent of all the alternatives. These protections would result in increased habitat connectivity and functionality.

3.3.2 Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds

Issue 1: How would fluid mineral leasing and development under the alternatives impact special status species and their habitat, including Gunnison and greater sage-grouse, Piping Plovers, Least Terns, Bald and Golden Eagles, other raptors, and special status birds?

Issue 2: How do alternatives contribute to access and conservation goals and objectives for fish and wildlife habitat, and hunting and fishing opportunities?

Issue 3: What are the impacts (including beneficial) towards efforts to stabilize and/or recover other species that are declining and may have conflicts with other management objectives on BLM lands? How are these effects different across alternatives?

Issue 4: How do big game populations and important habitat contribute to habitat for aquatic species and fish populations?

Analytical Methods and Assumptions

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area includes all BLM-administered lands and approximately 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Indicators

Indicators other wildlife species include the following:

- Potential for habitat loss and/or alteration to a degree that would influence a species' access to essential habitat features, such as food, cover, and breeding sites

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

- Potential for disturbance to a degree that would interfere with a species' ability to perform essential life history functions, such as daily and seasonal movements, foraging, and breeding.
- Potential for injury or mortality

Assumptions

- Wildlife habitat conditions are directly linked to vegetation conditions (**Section 3.3.3**); therefore, changes to vegetation reflect alterations of wildlife habitat.
- All actions in this plan would comply with Endangered Species Act of 1973 (ESA) regulations and follow guidance and recommendations for federally listed species, as specified in species-specific recovery plans.
- Short-term effects are defined as those that would occur over a time frame of 5 years or less, and long-term effects would occur over longer than 5 years.
- Impacts on wildlife from displacement depend on the location, extent, timing, or intensity of the disruptive activity. They also depend on specific species' tolerance to disturbance and overall habitat availability; impacts from displacement will be greater for wildlife species with limited habitat or a low tolerance for disturbance.

Methods of Analysis

The following analysis reviews the impacts each proposed alternative would have on other wildlife species within the decision area, including terrestrial mammals, migratory bird, fish and aquatic species, and special status species. Impacts on other wildlife species were analyzed based on the amount of habitats that would be open and closed to fluid mineral leasing and subject to stipulations such as NSO, CSU, and TL. Where these data were not available, the impacts are discussed qualitatively. The potential impacts discussed below were identified by reviewing the best available science and data.

Affected Environment

Habitat Types

Vegetation descriptions and habitat types important for big game in the decision area are provided in more detail in **Section 3.3.3**, Vegetation. Additional details regarding areas important to other wildlife, including terrestrial mammals, fish and aquatic species, and migratory birds, are presented here.

Alpine

Alpine ecosystems occur at elevations above 11,000 feet and comprise a small portion of the decision area. The landscape consists of sparse vegetation, dwarf plants, short grasses, and rocky terrain. Well-adapted species of wildlife that occupy these areas include American pika (*Ochotona princeps*), yellow-bellied marmot (*Marmota flaviventris*), brown-capped rosy-finch (*Leucosticte australis*), white-tailed ptarmigan (*Lagopus leucura*), and the boreal toad (*Anaxyrus boreas boreas*) which is classified as a BLM Sensitive Species. These species are sensitive to climate and habitat change, making them important indicator species of the health of the ecosystem and impacts from climate change (CPW 2022f).

Subalpine Forest

Subalpine forests are generally between 9,000 and 11,000 feet and makes up a large portion of the decision area, see **Section 3.3.3**, Vegetation for more on subalpine and boreal forests. A large variety of wildlife is found in subalpine forests. Bird species, including mountain chickadee (*Poecile gambeli*), red-breasted nuthatch (*Sitta canadensis*), gray jay (*Perisoreus canadensis*), Clark's nutcracker (*Nucifraga columbiana*), dusky grouse (*Dendragapus obscurus*), northern goshawk (*Accipiter gentilis*), and common raven (*Corvus corax*), are common in subalpine forests. Mammals like snowshoe hare (*Lepus americanus*); American marten (*Martes americana*);

short-tailed weasel (*Mustela erminea*); and big game species, such as moose (*Alces alces*), mule deer (*Odocoileus hemionus*), and elk (*Cervus canadensis*), are common to this ecosystem.

Montane Forest

Montane forests generally occur between 6,000 and 9,000 feet. Like alpine ecosystems, montane forests occupy a small part of the decision area; however, they include a large diversity of flora and fauna. Raccoon (*Procyon lotor*), North American porcupine (*Erethizon dorsatum*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), small mammals like the Albert's squirrel (*Sciurus aberti*), and 18 species of bats inhabit the montane forests of Colorado.

Pinyon-Juniper

Pinyon-juniper woodlands are widespread in the decision area, separating the plains with the high mountains, and occur in elevations from approximately 5,000 to 8,000 feet. The understory in these woodlands can vary drastically from a mixture of evergreen and deciduous shrubs to a dense herbaceous layer of forbs and perennial grasses, to no vegetation at all. Pinyon jay (*Gymnorhinus cyanocephalus*), gray vireo (*Vireo vicinior*), wild turkey (*Meleagris gallopavo*), and a variety of other bird species occupy pinyon-juniper woodlands. Common mammals include cottontail (*Sylvilagus* sp.), woodrat (*Neotoma* sp.), gray fox (*Urocyon cinereoargenteus*), mule deer, and mountain lion (*Puma concolor*).

Grass-Forb

Grasslands consist of foothill and mountain grasslands, mixed tallgrass prairies and short grass prairies and occur at a variety of elevations which are a considerable portion of the decision area. This habitat type supports a variety of bird species such as greater prairie-chicken (*Tympanuchus cupido*), lesser prairie-chicken (*Tympanuchus pallidicinctus*), sharp-tailed grouse (*Tympanuchus phasianellus*), grasshopper sparrow (*Ammodramus savannarum*), lark bunting (*Calamospiza melanocorys*), quail (spp.), ring-necked pheasant (*Phasianus colchicus*), burrowing owl (*Athene cunicularia*), and various species of hawks. Other key species such as white-tailed prairie dog (*Cynomys leucurus*), black-tailed prairie dog (*Cynomys ludovicianus*), and Gunnison prairie dog (*Cynomys gunnisoni*), are found in the grass-forb habitat types.

Mountain Shrubland

Generally, mountain shrublands occur between 6,500 and 9,500 feet and are found throughout the decision area, in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. Big game and large mammal species such as elk, mule deer, mountain lion, and black bear (*Ursus americanus*) are common in mountain shrublands. Smaller mammals, such as squirrels (*Sciuridae* sp.) and woodrat, and a variety of bird species are also common.

Sagebrush

Sagebrush ecosystems are typically referenced as high desert systems that generally are located between 5,000 and 10,000 feet. Sagebrush ecosystems and salt desert shrublands (described below) are located on the western slope and in the intermountain parks of the decision area. A variety of species are found in this ecosystem, such as Gunnison sage-grouse (*Centrocercus minimus*), greater sage-grouse (*Centrocercus urophasianus*), California brown bat (*Myotis californicus*), Mexican woodrat (*Neotoma mexicana*), deer mouse (*Peromyscus maniculatus*), Ord's kangaroo rat (*Dipodomys ordii*), black-tailed jackrabbit (*Lepus californicus*), white-tailed jackrabbit (*Lepus townsendii*), coyote, and a variety of reptiles. Sagebrush habitats are also important for big game species such as mule deer, see **Section 3.3.1, Big Game Species and Habitat.**

Salt Desert Shrubland

Salt desert shrublands consist of vegetation that is tolerant of saline or alkaline soils. These ecosystems generally occur between 4,500 and 7,000 feet and are composed of a variety of saltbush species. Reptiles such as the lesser earless lizard (*Holbrookia maculata*), long-nosed leopard lizard (*Gambelia wislizenii*), gopher snake (*Pituophis catenifer sayi*), and prairie rattlesnake (*Crotalus viridis*) are common. Kangaroo rat, jackrabbits, kit fox (*Vulpes macrotis*), and larger mammals, such as desert bighorn sheep (*Ovis canadensis*), also occupy these habitat types.

Riparian Areas and Wetlands

Riparian areas and wetlands are found at a variety of elevations in areas near rivers, lakes, streams, and marshes. Riparian and wetlands compose a small portion of the decision area but is composed of a large diversity of vegetation. Aquatic species, such as cutthroat trout (*Oncorhynchus clarkii*), chub (*Gila* spp.), and a variety of mussels, are found in the waterways. Boreal toad, North American beaver (*Castor canadensis*), jumping mouse (*Zapodidae* sp.), sandhill crane (*Grus canadensis*), great blue heron (*Ardea herodias*), waterfowl, flycatchers (*Empidonax* spp.), northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), checkered whiptail (*Cnemidophorus tesselatus*) and big game species such as moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*), occupy riparian and wetland habitats. Most wildlife species depend on riparian and wetland habitats for part of their lifecycle because these areas are considered to be one of the most productive ecosystems on the planet. Riparian and wetland habitats produce enormous amounts of food, attracting a wide variety of animal species. Wetlands are used by many wildlife species for some or all of their life cycles. Detritus is a term for the microscopic organic particles created when dead plant parts decompose in water. Many small water insects, crustaceans, and fish that provide food for larger predatory fish, reptiles, amphibians, birds, and mammals are fed by this enhanced material (EPA 2022).

These habitat types are also important for migratory bird species. Wetland complexes in the San Luis Valley (Blanca Wetlands) and North Park (Junction Butte and surrounding areas) are important shorebird nesting and bird migration stopovers because of the vegetative and natural features they provide. Additional habitat for these species includes high desert shrubland containing greasewood (*Sarcobatus* spp.), and rabbitbrush (*Chrysothamnus* spp., *Ericameria* spp.) communities.

Wildlife

Terrestrial Mammals

Colorado has approximately 124 native species of mammals that occupy various habitats throughout the state. Key habitats for many terrestrial mammals are grasslands, shrublands, and wetlands. Some of the most significant threats to these habitat types on public lands are habitat loss and fragmentation from development or modifications such as fire and fire suppression, dams and water management, and other ecosystem modifications such as mowing or tree thinning. Other threats include invasive plant species, expanded recreation use, alteration, and conversion to cropland (Rondeau et al. 2011).

Migratory Birds

Colorado falls within two migratory bird flyways, the Pacific Flyway and the Central Flyway. Riparian and wetland ecosystems are key habitats of migrating birds. Riparian habitats are important stopover habitat for migrating birds, providing food and water resources as well cover for rest. Riparian and wetland ecosystems have declined dramatically over the past hundred years, primarily due to land changes from human-caused sources (van Riper III et al. 2008). Resource extraction, energy and commercial development, urbanization, and conversion to cropland are the main factors.

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

For the 13th consecutive year, the Bird Conservancy of the Rockies (Bird Conservancy) has monitored landbirds as part of the Integrated Monitoring in Bird Conservation Regions (IMBCR) program. IMBCR is based on a spatially balanced sampling strategy that gives inference to avian populations at different scales, from local management units to entire states or bird conservation regions (BCRs), aiding in conservation at the local and governmental levels (McLaren et al. 2021). BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. These regions are a hierarchical framework of nested ecological units. The overall goal of BCRs is to accurately identify the migratory and resident bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities by ecoregion. BCR lists are updated every 5 years by the USFWS; the Birds of Conservation Concern (BCC) 2021 (BCC 2021) is the most recent update. The BCC 2021 is intended to stimulate coordinated, collaborative, and proactive conservation actions among international, federal, state, tribal and private partners (USFWS 2021). The USFWS recommends that the BCC regional lists be consulted in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

The state of Colorado falls within three BCRs: regions 10, 16, and 18. BCR 10 is the smallest in the state and is located in the upper northwestern portion of Colorado. Field technicians completed surveys between May 27th and June 12th, 2020, and detected 75 bird species, including 15 priority species. BCR 16 occupies the majority of the state and encompasses the central to western region of the state. Point count surveys were conducted between May 15th and July 12th, 2020, and detected 156 bird species, including 23 priority species. BCR 18 covers the eastern portion of the state and field technicians detected 83 bird species including 18 priority species during surveys conducted between May 15th and June 12th, 2020. Statewide, results from data collected by field technicians from the Bird Conservancy in 2020 detected 205 bird species, including 41 priority species, see **Table 3-57** below for the complete list of priority bird species designated by CPW (McLaren et al. 2021).

Table 3-57. Priority Bird Species Designated by CPW

Species	Scientific Name	Status ¹
American bittern	<i>Botaurus lentiginosus</i>	T2
American white pelican	<i>Pelecanus erythrorhynchos</i>	T2
Bald eagle	<i>Haliaeetus leucocephalus</i>	SSC,T2
Band-tailed pigeon	<i>Patagioenas fasciata</i>	T2
Black rosy-finch	<i>Leucosticte atrata</i>	T2
Black tern	<i>Chlidonias niger</i>	T2
Bobolink	<i>Dolichonyx oryzivorus</i>	T2
Brewer's sparrow	<i>Spizella breweri</i>	T2
Brown-capped rosy-finch	<i>Leucosticte australis</i>	T1
Burrowing owl	<i>Athene cunicularia</i>	ST,T1
Cassin's finch	<i>Haemorhous cassinii</i>	T2
Cassin's sparrow	<i>Peucaea cassinii</i>	T2
Chestnut-collared longspur	<i>Calcarius ornatus</i>	T2
Ferruginous hawk	<i>Buteo regalis</i>	SSC,T2
Flammulated owl	<i>Psiloscops flammeolus</i>	T2
Golden eagle	<i>Aquila chrysaetos</i>	T1
Grace's warbler	<i>Setophaga graciae</i>	T2
Grasshopper sparrow	<i>Ammodramus savannarum</i>	T2
Gray vireo	<i>Vireo vicinior</i>	T2
Greater prairie-chicken	<i>Tympanuchus cupido</i>	T2
Greater sage-grouse	<i>Centrocercus urophasianus</i>	SSC,T1

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Species	Scientific Name	Status ¹
Juniper titmouse	<i>Baeolophus ridgwayi</i>	T2
Lark bunting	<i>Calamospiza melanocorys</i>	T2
Lazuli bunting	<i>Passerina amoena</i>	T2
Lesser prairie-chicken	<i>Tympanuchus pallidicinctus</i>	ST,T1
Lewis's woodpecker	<i>Melanerpes lewis</i>	T2
Loggerhead shrike	<i>Lanius ludovicianus</i>	T2
Long-billed curlew	<i>Numenius americanus</i>	SSC,T2
Mountain plover	<i>Charadrius montanus</i>	SSC,T1
Northern bobwhite	<i>Colinus virginianus</i>	T2
Northern goshawk	<i>Accipiter gentilis</i>	T2
Northern harrier	<i>Circus cyaneus</i>	T2
Olive-sided flycatcher	<i>Contopus cooperi</i>	T2
Peregrine falcon	<i>Falco peregrinus</i>	SSC,T2
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>	T2
Prairie falcon	<i>Falco mexicanus</i>	T2
Purple martin	<i>Progne subis</i>	T2
Rufous hummingbird	<i>Selasphorus rufus</i>	T2
Sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	T2
Sandhill crane	<i>Grus canadensis</i>	SSC,T1
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	SSC,SE,T1
Short-eared owl	<i>Asio flammeus</i>	T2
Swainson's hawk	<i>Buteo swainsoni</i>	T2
Thick-billed longspur	<i>Rhynchophanes mccownii</i>	T2
Upland sandpiper	<i>Bartramia longicauda</i>	T2
Veery	<i>Catharus fuscescens</i>	T2
Virginia's warbler	<i>Leiothlypis virginiae</i>	T2
White-faced ibis	<i>Plegadis chihi</i>	T2
White-tailed ptarmigan	<i>Lagopus leucura</i>	T1
Willow flycatcher	<i>Empidonax traillii</i>	SE,T1
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	SSC,T1

Source: McLaren et al. 2021

¹ T1 = species of highest conservation priority in the state; T2 = important in light of forestalling population trends or habitat conditions; SSC = State Special Concern; SE = State Endangered; ST = State Threatened (Colorado Parks and Wildlife 2015)

Climate change may also be a contributing factor to changes in migratory bird habitat. Migration patterns are aligned with key weather patterns and resource availability, such as food, water, and suitable nesting habitat. Variability in weather patterns from climate change alters habitat ranges, which impacts resource availability and shifts migrations patterns (NEEF 2022).

Fish and Aquatic Species

Fish and aquatic species occupy lakes, rivers, streams, and marshes. In Colorado, lakes support 25 species of conservation concern. Most natural lake habitats occur in subalpine and montane zones. Other important habitats include montane rivers, as well as larger rivers in the eastern plains and western parts of the state (CPW 2022g). Most species of native trout prefer cold-water habitats and are sensitive to rising temperatures associated with climate change. Other aquatic species, such as the Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), bonytail (*Gila elegans*), and humpback chub (*Gila cypha*), survive in warmwater habitats.

A threat to native aquatic species is the introduction of nonnative species. Aquatic nuisance species are invasive plant and animal species such as the zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena*

rostriformis bugensis), New Zealand mudsnail (*Potamopyrgus antipodarum*), Asian carp (*Cyprinus carpio*), rusty crayfish (*Orconectes rusticus*), and Eurasian watermilfoil (*Myriophyllum spicatum*). These species can have severe impacts on aquatic ecosystems. They can also introduce pathogens and disease, such as viral hemorrhagic septicemia, to fish species (CPW 2022h).

Special Status Species

The BLM is mandated to ensure that Special Status Species are protected in accordance with the ESA, the BLM's Land Use Planning Handbook, BLM Manual 6840, Special Status Species Management, and all other applicable laws, rules, regulations, policies, standards, and guidelines.

Special status species are those that:

- have been proposed for listing or are listed under the ESA as threatened or endangered,
- are candidates for listing as threatened or endangered under the provisions of the ESA,
- have been designated by a BLM state director as sensitive.

The BLM cooperates with the USFWS to identify and manage critical habitat and other suitable habitats for listed species, with the ultimate goal of species recovery and viability. Candidate species are managed to maintain viable populations to avoid listing. State of Colorado and BLM sensitive species are treated similarly. The BLM, USFWS, and State of Colorado have developed formal and informal agreements to provide guidance on species management. Consultation is required on any action proposed by the BLM or another federal agency that “may affect” an ESA-listed species or its habitat.

Greater and Gunnison Sage-Grouse

In Colorado, there are two species of sage-grouse: greater sage-grouse and Gunnison sage-grouse. The greater sage-grouse is the largest of the seven grouse species in North America. Compared with the greater sage-grouse, the Gunnison sage-grouse is slightly smaller, it differs genetically, and it differs in its mating dance or display. Key habitats for both species of sage-grouse include large areas of intact sagebrush and sagebrush steppe ecosystems. In early life stages, mesic riparian areas are also important. Newly hatched grouse chicks rely on food and water resources in mesic riparian areas. Adult birds eat mainly sagebrush leaves. A specialized digestive system and well-developed ceca⁴ allow for the digestion and expulsion of toxins from sagebrush. Chicks rely on insects and gradually incorporate herbaceous forbs and wildflowers until their digestive system becomes more developed (Sauls 2006).

Populations of the Gunnison sage-grouse are scattered and geographically isolated from one another in portions of southwestern Colorado and southeastern Utah (CPW 2005) (**Figure 3-8, Appendix D**, Sage-grouse Habitat; note **Figure 3-8** includes only sage-grouse habitat on BLM-administered surface and mineral estate). It is federally listed as threatened due to widespread population decline from habitat loss and degradation. The 2020 USFWS Recovery Implementation Strategy for Gunnison Sage-grouse outlines three top priority strategies for the protection and conservation of the species which are as follows; 1) actions and activities are defined as those that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future, 2) actions and activities are those that remove, reduce, or mitigate major threats or fill knowledge gaps and prevent continued population or habitat quality decline or some other significant negative impact, and 3) actions and activities are all other actions necessary to provide for full recovery of the species (USFWS 2020). Greater sage-grouse has also experienced range wide population decline and was once considered a candidate species under the ESA. However, in 2015 the

⁴ Ceca are paired microbe-filled chambers that are filled with liquid matter from the large and small intestines.

USFWS decided to not list greater sage-grouse due to a massive effort in land protections and conservation efforts from federal, state, tribal, and private organizations. Although greater sage-grouse are not listed, they are a BLM sensitive species across their range.

Sage-grouse are considered an indicator species for sagebrush ecosystems because they depend completely on sagebrush. The health of the population indicates the health of the ecosystem. They are also called an “umbrella” species because conservation efforts aimed at the recovery of sage-grouse also benefit other sagebrush-obligate species, such as mule deer, pronghorn, elk, and many others. At least 350 plant and animal species fall under the sage-grouse “umbrella.”

Gunnison and greater sage-grouse both are affected by widespread habitat loss and currently occupy a fraction of their historical range. Population abundances have been on a rapid decline since the 1960s. Even after taking into account the strong cyclic behavior of sage-grouse population dynamics, populations have declined markedly relative to both pre-settlement anecdotal numbers, and the records kept in the last 30 years where the peak in the cycle of bird numbers has declined (BLM 2015b).

The main driver for this decline is habitat loss, alteration, and fragmentation. Changes in the landscape ecology of sagebrush habitat are mainly due to land use practices, such as urbanization, development (commercial and energy), and resource extraction. Other contributing factors leading to this widespread population decline are encroachment of nonnative invasive species, such as cheatgrass (*Bromus tectorum*), and native species, such as pinyon-juniper woodlands. Other contributing factors include environmental impacts from wildfire and climate change (Coates et al. 2017).

The downward trend of greater sage-grouse and its sagebrush-dominated habitat throughout its historical range have become a focus of wildlife and land managers in recent years. With the recent interest in the long-term well-being of greater sage-grouse and the sagebrush ecosystem, the CPW, BLM, and Forest Service have committed to ensuring that this species remains a high priority for management (BLM 2015b). Existing protections, including restrictions if the disturbance density exceeds 1 disturbance per 640 acres and/or a 3 percent disturbance threshold, are in place for this habitat. (BLM 2015b). Conservation of sage-grouse and their habitats in Colorado is a state-wide effort in collaboration with various agencies, as mentioned above. There are existing management plans in place such as the Colorado Greater Sage-grouse Conservation Plan (CCP) and the GRSG management under the 2015 ARMPA for BLM that focus on the conservation of habitat and mitigation measures to promote the recovery of the species. These plans were written in response to the widespread decline of the species. This plan was developed to support a range of goals that, if met, will aid in the species’ recovery and lead to its removal from the state’s Species of Concern list (CPW 2008). **Table 3-58** and **Table 3-59**, below, show the acreage of greater and Gunnison sage-grouse habitats within the decision area.

Table 3-58. Acres of Greater Sage Grouse Habitat in the Decision Area

Habitat Type	Acres
PHMA	1,101,000
GHMA	1,079,000
LCHMA	168,000

Source: BLM GIS 2020

*Acres are rounded to nearest 1,000.

PHMA: Areas identified as having the highest habitat value for maintaining sustainable GRSG populations and include breeding, late brood-rearing, and winter concentration areas.

GHMA: Areas that are occupied seasonally or year-round and are outside of PHMAs.

LCHMA: Areas that have been identified as broader regions of connectivity important to facilitate the movement of GRSG and maintain ecological processes.

Table 3-59. Acres of Gunnison Sage Grouse Habitat in the Decision Area

Habitat Type	Acres
Occupied	555,000
Unoccupied	392,000

Source: BLM GIS 2022

*Acres are rounded to nearest 1,000.

Gray wolf

In Colorado, carnivore species such as the gray wolf (*Canis lupus*) are supported by healthy populations of ungulate species, predominately big game species as described in **Section 3.3.1**, Big Game Species and Habitat. Top-down predator-prey interactions allow predators to play a significant role in ecological communities (Ditmer et al. 2022). These interactions can occur directly through predation or indirectly through the behavioral changes of prey species and other carnivores. This may have cascading effects on ecosystems, such as decreased prey populations and altered habitats. Humans may benefit from carnivores such as existence, aesthetic values, and revenue generated from tourism or hunting, as well as indirectly via changes in prey behavior and richness (Ditmer et al. 2022). Hunting-related income is significant to rural communities, and license purchases help fund CPW programs for wildlife conservation (CPW 2022i). Carnivores, however, can also cause adverse effects on humans, such as safety risks and the devouring of domestic animals, which can result in significant financial losses and emotional toll (Ditmer et al. 2022). To sustainably manage ungulate numbers that will support both carnivore populations and possibilities for recreational hunting, management must also take steps to reduce agricultural damage and other wildlife-human conflicts (CPW 2022i).

The effects from wolves on prey abundance, and management decision that influence hunting on these populations is a large-scale complex issue that cannot be generalized as there are a multitude of factors to be considered. Wolves as well as other mesocarnivores can greatly impact big game movement, mortality or recruitment, and seasonal habitat use in conjunction with other variables that are outlined in the HMP population objectives, and are as follows; forage quality and quantity, drought, winter severity, habitat loss or degradation, competition with other grazers, disease, vehicle collisions, other predators, and hunter harvest (CPW 2022i). Hence, it is difficult to clearly identify a single component that drives herd performance. The social tolerance of wolves and ungulates as well as the local environments may be affected by herd declines in both positive and negative ways. Likely, wolves may be anticipated to contribute to local ungulate herd reductions or distribution changes, both of which may have beneficial and adverse impacts, assuming they flourish in sufficient numbers for an extended period of time (CPW 2022i).

Federally Endangered, Threatened, Proposed, and Candidate Species

The ESA mandates the protection of species listed as threatened or endangered of extinction and the habitats on which they depend. Section 7 of the ESA clarifies the responsibility of federal agencies to use their authority to carry out programs for the conservation of listed species. In addition, federal agencies must consult with the USFWS to ensure that any action authorized, funded, or carried out by the agency is “. . . not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species.” **Table 3-60**, below, displays the federally listed mammal, bird, fish, and insect species that may be present in the decision area.

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Table 3-60. Federally Listed Species That May Exist in the Decision Area

Species	Status*	Habitat Description	Critical Habitat Present (Y/N)?
Mammals			
Black-footed ferret <i>Mustela nigripes</i>	E	Depends on prairie dog colonies; limited to open habitats such as grasslands, steppe, and shrub steppe. An estimated 99–148 acres of prairie dog colony are needed to support one ferret. The biological factors required for reintroduction are as follows: <ul style="list-style-type: none"> • Large areas of occupied prairie dog colony habitat • Prairie dogs distributed in large complexes of multiple, closely spaced colonies • High and naturally occurring densities of prairie dogs and prairie dog burrows, as well as sites where prairie dog habitat has been created or expanded through human intervention • Annual sylvatic plague mitigation for both ferrets and prairie dogs • Limits on threats that reduce prairie dog populations, occupied areas, or densities below those required by ferrets • Regular ferret and prairie dog population monitoring and health checks (Great Plains Conservation Network Prairie Dog Working Group 2022) 	N
Canada lynx <i>Lynx canadensis</i>	T	Occupies moist boreal forests composed of spruce and fir tree species with high densities of snowshoe hare and other prey; requires cold, snowy winters.	Y
Gray wolf <i>Canis lupus</i>	E	Habitat generalist that requires ungulate prey, but it can prey upon beaver and other small mammals, birds, and fish; it may also scavenge.	Y
New Mexico meadow jumping mouse <i>Zapus hudsonius luteus</i>	E	Endemic to riparian areas along rivers, streams, or wetlands that contain primarily forbs and sedges. Needs access to flowing water in New Mexico, Arizona, and a small area of southern Colorado.	Y
Preble's meadow jumping mouse <i>Zapus hudsonius preblei</i>	T	Requires well-developed riparian habitat near grasslands that contain a dense community of grasses, forbs, and shrubs.	Y
Birds			
Eastern black rail <i>Laterallus jamaicensis</i> ssp. <i>jamaicensis</i>	T	Requires dense vegetation cover that allows for movement below the canopy, typically in marshes, wetlands, and grasslands.	N
Gunnison sage-grouse <i>Centrocercus minimus</i>	T	Requires sagebrush communities (especially big sagebrush) for hiding and thermal cover, food, and nesting; open areas with sagebrush stands for leks; a sagebrush-grass-forb mix for nesting; and wet meadows for rearing chicks.	Y
Mexican spotted owl <i>Strix occidentalis lucida</i>	T	Occupies mixed-conifer forests that contain old-growth and mature trees. May also occupy canyons with riparian or mixed-conifer communities.	Y

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Species	Status*	Habitat Description	Critical Habitat Present (Y/N)?
Piping plover <i>Charadrius melodus</i>	T	For breeding, it needs sandy beaches with scattered tufts of grass, sparsely vegetated shores, or shallow lakes, rivers, or ponds. May build nests in open, sandy flats with shells or cobble.	Y
Southwestern willow flycatcher <i>Empidonax traillii extimus</i>	E	For breeding, it requires riparian tree and shrub communities along rivers, wetlands, and lakes; for wintering, it needs brushy grasslands, shrubby clearings or pastures, and woodlands near water.	Y
Whooping crane <i>Grus americana</i>	E	Breeds in wetland habitat in Canada; then, it migrates south. Requires wetland mosaics for migration. May use a variety of habitat types but prefers shallow, seasonally, or semi-permanently flooded palustrine wetlands for roosting and feeding.	Y
Yellow-billed cuckoo <i>Coccyzus americanus</i>	T	Uses riparian, deciduous woodlands with dense undergrowth; nests in tall cottonwood and mature willow riparian areas, moist thickets, orchards, and abandoned pastures.	Y
Fish			
Bonytail <i>Gila elegans</i>	E	Occupies warm waters of rivers, in or near deep or swift waters regardless of turbidity. May also be found in reservoirs. Requires riverine habitats where competition from nonnative fish is minimal or absent.	Y
Colorado pikeminnow <i>Ptychocheilus lucius</i>	E	Occupies warm waters of the Colorado River main stem and tributaries; deep, low-velocity eddies, pools, runs, and nearshore features; uninterrupted streams for spawning migration and young dispersal; and floodplains, tributary mouths, and side canyons. These are highly complex systems.	Y
Greenback cutthroat trout <i>Oncorhynchus clarkia stomias</i>	T	Needs cold-water streams and lakes with adequate spawning habitat (riffles), often with shading cover; the young shelter in shallow backwaters.	N
Humpback chub <i>Gila cypha</i>	T	Occupies warmwater, canyon-bound reaches of the Colorado River main stem and larger tributaries; requires turbid waters with fluctuating hydrology. The young require low-velocity, shoreline habitats, such as eddies and backwaters.	Y
Pallid sturgeon <i>Scaphirhynchus albus</i>	E	Requires large, free-flowing riverine habitat with strong currents and gravel or sandy substrates. May also be found in reservoirs.	N
Razorback sucker <i>Xyrauchen texanus</i>	E	Occupies warmwater reaches of the Colorado River main stem and larger tributaries; some reservoirs; and low-velocity, deep runs, eddies, backwaters, side canyons, and pools. It needs cobble, gravel, and sand bars for spawning. For nurseries, it uses tributaries, backwaters, and floodplains.	Y
Rio Grande cutthroat trout <i>Oncorhynchus 3-116orruga virginalis</i>	C	Endemic to the Rio Grande, Pecos, and possibly the Canadian River Basins in New Mexico and Colorado. Restricted to small headwater streams where the organic matter, such as nitrogen and phosphorous, is imported into the system.	N

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Species	Status*	Habitat Description	Critical Habitat Present (Y/N)?
Insects			
Monarch butterfly <i>Danaus plexippus</i>	C	Breeds typically in patches of milkweed. Winters in high-altitude Mexican conifer forests or coastal California conifer or eucalyptus groves. In Colorado, flight times are from June through September, and it may be found in open fields, prairies, meadows, and marshes. It uses a variety of habitat, such as herbaceous wetlands, shrub wetlands, woodlands, grasslands, croplands, savannas, sand or dunes, orchards, or suburban.	N
Pawnee montane skipper <i>Hesperia leonardus montana</i>	T	Endemic to Colorado in dry, open ponderosa pine woodlands with moderately steep slopes with soils from Pikes Peak granite. Requires blue grama grass and prairie gayfeather plants.	Y
Uncompahgre fritillary butterfly <i>Boloria acrocneuma</i>	E	Found in areas associated with large patches of snow willow above 12,400 feet in altitude. Endemic to northeast-facing slopes that provide a cooler, wetter microhabitat.	N

Sources: USFWS 2022; NatureServe Explorer 2022

*E = endangered; T = threatened; C = candidate

Environmental Consequences

This section discusses impacts on non-big-game wildlife species, including terrestrial mammals, fish and aquatic species, and migratory birds from proposed management actions of other resources and resource uses. Habitat types are described in **Section 3.3.3**, Vegetation. Existing conditions concerning big game and descriptions of habitat requirements are described in **Section 3.3.1**, Big Game.

Nature and Type of Effects

All Fish and Wildlife Species

On BLM-administered lands and federal mineral estate in the decision area, mineral exploration, development, and associated ROW use would have both short- and long-term effects on wildlife, including terrestrial wildlife, migratory birds, fish and aquatic species, and special status species. Impacts on fish and wildlife would be most pronounced in areas with the highest development potential and with the least stringent restrictions. However, all lands with existing lease rights have the potential to be influenced by development activities.

Development and use of roads, ROWs, facilities, well pads, oil and gas wells, water disposal wells, and pipelines would reduce, alter, and fragment habitats. These activities would also cause noise and disturbance, which may lead to behavioral alterations. Species would likely avoid developed areas over the long term, and competition for resources in nearby habitats may increase as species are displaced.

Areas closed to fluid mineral leasing would provide the greatest protection to wildlife species and their habitats by prohibiting any activities related to fluid mineral exploration and development in these areas with no exceptions. As such, closures avoid impacts on wildlife, such as disturbance and habitat alterations, as described above. NSO stipulations would provide similar protections, however, waivers, exceptions, or modifications could be applied to allow fluid mineral exploration and development, and subsurface exploration and directional drilling could occur. CSU stipulations provide slightly less protection to wildlife and their habitats, since surface-disturbing activities are allowed, and species and habitats could be disturbed.

However, CSU stipulations mitigate impacts on wildlife and their habitats in certain instances by requiring special operational constraints or by moving the surface-disturbing activity to protect wildlife. TLs protect wildlife species during time periods when the species are most sensitive to disturbance, such as during breeding, nesting, brood rearing or calving periods, or habitat use of severe winter range and winter concentration areas.

Terrestrial Wildlife and Migratory Birds

Impacts on terrestrial wildlife, migratory birds, and their habitats include surface disturbance that leads to loss of vegetation that provides essential habitat characteristics for wildlife. Surface disturbance may also reduce the availability of seasonally important habitat, such as grasslands, shrublands, and wetlands, which terrestrial wildlife and migratory birds rely on for foraging, reproduction, and cover. Clearing of shrublands and woodlands and facility occupation would result in long-term modification of habitat functionality for terrestrial wildlife. This is because vegetation that provides greater horizontal and vertical ground cover or more diverse structural or flowering forms may serve important functional roles to many wildlife groups. This includes overwinter cover for non-hibernating small mammals, substrate for invertebrate prey of migratory birds and sage-grouse, and supplemental sources of nutritious herbaceous forage for herbivores.

Fluid mineral development (well pads, roads, and associated structures) would physically fragment habitat across the landscape. This would reduce intact expanses of habitat and increase edge habitats within the habitat matrix. In terms of functional connectivity, development patterns (scale and distribution) could influence animal movement patterns and may, depending on species mobility and behavioral responses, create absolute barriers. Interference with a species' movement pattern that decreases the ability of a species to breed or overwinter could lead to substantial population declines. Surface-disturbing activities can alter plant community composition and decrease species diversity and may lead to the proliferation of noxious weeds and invasive plant species. All of these can reduce the habitat quality for resident and migratory wildlife species.

The avoidance of otherwise functional habitats due to human activity adds substantially to overall loss of habitat. Impacts on terrestrial wildlife from constructing and operating well pads and ancillary facilities (including maintenance activities) would include habitat loss, alteration, and disturbance. Although the response is species-specific, migratory birds tend to avoid siting nests near disturbance. Inglefinger and Anderson (2004) found the nesting density of sagebrush-associated birds was reduced by 40 to 60 percent within 330 feet of roads accessing natural gas fields in Wyoming, with as few as 10 vehicle trips per day. Another study (Gilbert and Chalfoun 2011) documented 10 to 20 percent declines in the abundance of sage sparrow and Brewer's sparrow in developed natural gas fields.

Excluding or limiting development in big game HPH would benefit those nongame wildlife species that rely on similar habitats as big game species. These primarily include species associated with pinyon-juniper, upland big sagebrush, and mountain shrub vegetation types, as described under the Affected Environment.

Aquatic Wildlife

The existing field office RMPs outline stipulations that prohibit surface occupancy within a buffer around mapped perennial, intermittent, and ephemeral streams which include riparian areas, fens, wetlands, and water impoundments. However, as stated above waivers, exceptions, or modifications could be applied. While impacts would likely be minimal in these areas it is important to note what the impacts could be if development occurs in aquatic habitats. Examples include increased vehicle use and construction of roads and facilities. These actions could alter habitat by causing an increase in impervious surfaces, loss of

streamside vegetation, bankside erosion, turbidity, water quality alteration, water depletion, and loss of connectivity. These habitat alterations may lead to loss of recruitment, stress, habitat alteration, and habitat loss. Altering habitat can make it less functional for native species or more favorable to other species such as invasives, or other natives species with a higher tolerance to disturbance. Loss or reduction of streamside vegetation or cover may increase water temperature, leading to stress and reduced productivity, and affecting food webs. Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity/salinity, and turbidity can lead to direct mortality or lead to loss of habitat functionality.

Special Status Species

Potential short-term impacts on special status species include injury, mortality, disturbance, and displacement due to increased human presence, vehicle traffic, and heavy machinery use. Potential long-term impacts include removal, fragmentation, and alteration of habitats due to construction of roads and facilities and long-term avoidance of developed areas. In general, special status species are more sensitive to disturbance and habitat loss due to low tolerances, narrow distributions, and/or specialized habitat uses. The existing field office RMPs include management direction and allocations that address special status species management and protection that would continue with the proposed amendments, though potential impacts are disclosed below.

For example, many studies assessing impacts of energy development on greater sage-grouse have found negative effects on populations and habitats (Holloran 2005; Naugle et al. 2011; Taylor et al. 2012; Smith and Dwyer 2016; Green et al. 2017). Oil and gas development is negatively associated with lek attendance (Green et al. 2017; Hanser et al. 2018) and may adversely affect recruitment (Green et al. 2017). Additionally, noise from industrial activity may disrupt greater sage-grouse communication, which is at low frequency and potentially masked by low-frequency noise from equipment and vehicles, and also potentially interfere with acoustical signals that attract females to leks (Gibson and Bradbury 1986; Gratson 1993; Blickley et al. 2012). Noise disturbance may contribute to a decrease in lek attendance (Holloran 2005; Blickley et al. 2012; Blickley and Patricelli 2012), avoidance of otherwise suitable habitat (Patricelli et al. 2013), and elevated stress levels (Blickley et al. 2012).

Similarly, noise associated with development may influence behavior patterns, or result in flushing of other special status wildlife, such as Mexican spotted owls and yellow-billed cuckoos. The construction of well pads, roads, and associated structures in nesting, roosting, forested, and riparian habitats may result in loss of habitat components used by Mexican spotted owls, such as large logs, large snags, and hardwoods (USFWS 1993, 2012). The likelihood for these effects to occur would be reduced through surface use and seasonal restrictions in existing RMPs. In sensitive riparian areas, development can inhibit hydrological processes that affect proper functioning ecological conditions necessary to support yellow-billed cuckoo, greenback cutthroat trout, and other federally listed species (USFWS 2009).

Gray wolves require minimal exposure to humans (USFWS 1987) and may alter their behavior to avoid human encounters (Zimmerman et al. 2014). If fluid mineral exploration and development activities encroach on wolf habitat, disturbances from human presence, vehicles, and equipment may cause them to avoid these areas. This could interfere with movement and wolves' abilities to access prey. Activities may also lead to behavioral alterations of prey species, such as fleeing or habitat avoidance, which could interfere with wolves' ability to locate and hunt prey (Zimmerman et al. 2014). Wolves are particularly sensitive to human activity near den sites and may abandon them if disturbed (USFWS 1987). They are also sensitive to prolonged or substantial human disturbances at the initial rendezvous site (USFWS 1987).

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

All federal actions would comply with ESA consultation requirements, and all implementation actions would be subject to further special status species review before site-specific projects are authorized or implemented. Federal regulations and BLM policy protecting threatened, endangered, and sensitive species require consideration of conservation measures for reducing the potential impacts from permitted activities. If adverse impacts are identified, mitigation measures, including avoidance, would be implemented to minimize or eliminate the impacts.

Alternative A

Under Alternative A, approximately 13.8 percent of the decision area would remain closed to oil and gas leasing, while the remaining approximately 86.2 percent of the decision area would remain open to fluid mineral leasing. **Table 3-61** shows the acres of the decision area proposed by alternative including acres closed to oil and gas leasing, and acres of applied stipulations under each alternative. Similarly, management measures were also considered for special status species, those acres of the decision area proposed by alternative, including acres of critical habitats closed to oil and gas leasing, and acres of critical habitats with applied stipulations under each alternative are shown in **Table 3-62**. The development of new leases and permits and oil and gas development activities would result in impacts on wildlife and special status species as described under *Nature and Type of Effects*.

Table 3-61. Fluid Mineral Leasing Stipulation Acres by Sage-Grouse Habitat in the Decision Area by Alternative

Habitat	Alternative A	Alternative B	Alternative C	Alternative D
Greater sage-grouse	6,625,000	7,655,000	7,655,000	6,495,000
Closed	456,000	456,000	456,000	848,000
PHMA	316,000	316,000	316,000	484,000
GHMA	131,000	131,000	133,000	338,000
LCHMA	9,000	9,000	9,000	26,000
Open Standard	1,892,000	1,892,000	1,892,000	1,500,000
PHMA	785,000	785,000	785,000	617,000
GHMA	948,000	948,000	948,000	740,000
LCHMA	159,000	159,000	159,000	143,000
Open NSO	1,128,000	1,129,000	1,129,000	922,000
PHMA	785,000	785,000	785,000	617,000
GHMA	295,000	296,000	296,000	259,000
LCHMA	48,000	48,000	48,000	46,000
Open CSU	484,000	1,504,000	1,504,000	1,112,000
PHMA	158,000	600,000	600,000	432,000
GHMA	276,000	761,000	761,000	553,000
LCHMA	51,000	143,000	143,000	126,000
Open CSU-TL	785,000	785,000	785,000	617,000
PHMA	784,000	784,000	784,000	617,000
GHMA	1,000	1,000	1,000	0
LCHMA	0	0	0	0
Open TL	1,879,000	1,889,000	1,889,000	1,496,000
PHMA	785,000	785,000	785,000	617,000
GHMA	948,000	948,000	948,000	740,000
LCHMA	146,000	155,000	155,000	139,000

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Habitat	Alternative A	Alternative B	Alternative C	Alternative D
Gunnison sage-grouse	1,497,000	2,520,000	2,520,000	1,357,000
Closed	137,000	137,000	137,000	696,000
Occupied	32,000	32,000	32,000	425,000
Unoccupied	104,000	104,000	104,000	271,000
Open Standard	811,000	811,000	811,000	251,000
Occupied	523,000	523,000	523,000	130,000
Unoccupied	287,000	287,000	287,000	121,000
Open NSO	135,000	140,000	140,000	71,000
Occupied	101,000	105,000	105,000	63,000
Unoccupied	34,000	34,000	35,000	8,000
Open CSU	207,000	735,000	735,000	175,000
Occupied	84,000	474,000	474,000	81,000
Unoccupied	23,000	261,000	261,000	94,000
Open TL	208,000	698,000	698,000	163,000
Occupied	110,000	471,000	471,000	91,000
Unoccupied	98,000	227,000	227,000	72,000

Source: BLM GIS 2022

*Acres are rounded to nearest 1,000.

PHMA: Areas identified as having the highest habitat value for maintaining sustainable greater sage-grouse populations and include breeding, late brood-rearing, and winter concentration areas.

GHMA: Areas that are occupied seasonally or year-round and are outside of PHMAs.

LCHMA: Areas that have been identified as broader regions of connectivity important to facilitate the movement of GRSG and maintain ecological processes.

Table 3-62. Fluid Mineral Leasing Stipulation Acres by Proposed and Designated Critical Habitat in the Decision Area by Alternative

Species ¹	Alternative A	Alternative B	Alternative C	Alternative D
Closed	165,000	165,000	165,000	663,000
Colorado pikeminnow	2,000	2,000	2,000	2,000
Gunnison sage-grouse	130,000	130,000	130,000	578,000
Mexican spotted owl	27,000	27,000	27,000	67,000
Preble's meadow jumping mouse	0	0	0	1,000
Razorback sucker	2,000	2,000	2,000	2,000
Southwestern willow flycatcher	0	0	0	0
Open Standard	700,000	700,000	700,000	202,000
Colorado pikeminnow	1,000	1,000	1,000	1,000
Gunnison sage-grouse	613,000	613,000	613,000	165,000
Mexican spotted owl	52,000	52,000	52,000	11,000
Preble's meadow jumping mouse	1,000	1,000	1,000	0
Razorback sucker	0	0	0	0
Southwestern willow flycatcher	1,000	1,000	1,000	1,000

3. Affected Environment and Environmental Consequences (Special Status Species and Other Wildlife, including Terrestrial Mammals, Fish and Aquatic Species, and Migratory Birds)

Species ¹	Alternative A	Alternative B	Alternative C	Alternative D
Open NSO	129,000	140,000	140,000	76,000
Colorado pikeminnow	1,000	1,000	1,000	0
Gunnison sage-grouse	99,000	104,000	104,000	58,000
Mexican spotted owl	14,000	20,000	20,000	4,000
Preble's meadow jumping mouse	4,000	0	0	
Razorback sucker	0	0	0	0
Southwestern willow flycatcher	0	0	0	0
Open CSU	163,000	643,000	643,000	146,000
Colorado pikeminnow	1,000	1,000	1,000	1,000
Gunnison sage-grouse	141,000	576,000	576,000	128,000
Mexican spotted owl	0	40,000	40,000	0
Preble's meadow jumping mouse	5,000	1,000	1,000	0
Razorback sucker	0	0	0	0
Southwestern willow flycatcher	0	0	0	0
Open CSU-TL	0	0	0	0
Open TL	182,000	602,000	602,000	125,000
Colorado pikeminnow	1,000	1,000	1,000	0
Gunnison sage-grouse	114,000	532,000	532,000	105,000
Mexican spotted owl	52,000	52,000	52,000	11,000
Preble's meadow jumping mouse	1,000	1,000	1,000	0
Razorback sucker	0	0	0	0
Southwestern willow flycatcher	1,000	1,000	1,000	1,000

Source: BLM GIS 2022

*Acres are rounded to nearest 1,000.

Please note that open stipulations (NSO, CSU, TLs) overlap

¹Bonytail, humpback chub, yellow-billed cuckoo, and New Mexico meadow jumping mouse habitat would not be affected across all alternatives.

Specific leases would be subject to standard terms and conditions, or open subject to unmapped stipulations. Overall, 20.8 percent of the decision area would continue to be open to fluid minerals and subject to NSO, 26.2 percent would be subject to CSUs, and 53.2 percent would be subject to TLs. These stipulations with existing waivers, exceptions, and modifications would continue to provide some protections to wildlife and special status species by reducing surface disturbance and associated impacts. Those stipulations that overlap big game HPH are shown in **Table 3-50**; other wildlife species associated with these habitat types (i.e., species associated with pinyon-juniper, upland big sagebrush, and mountain shrub vegetation types, as described under the Affected Environment) would experience similar levels of protections from applying stipulations in big game HPH. However, wildlife and special status species habitats would continue to be managed with less recognition of regional contexts and current CPW and ECMC recommendations. As a result, there would be potential for habitat loss and alteration as well as disturbance, injury, and mortality.

Alternative B

Under Alternative B, the same proportion of the decision area would be closed (13.8 percent) and open (86.2 percent) to fluid mineral leasing as under Alternative A (**Table 3-61** and **Table 3-62**). However, the areas subject to NSO, CSU, and TL stipulations would increase relative to Alternative A – 22.1 percent of

the decision area would be subject to NSO, 62.9 percent would be subject to CSU, and 63.5 percent would be subject to TLs. A greater proportion of big game HPH would be subject to stipulations (**Table 3-50**). As a result, protections to wildlife and special status species, particularly those species associated with pinyon-juniper, upland big sagebrush, and mountain shrub vegetation types, would occur over a larger area, and associated impacts, such as potential for disturbance and habitat loss and alterations, would decrease in both magnitude and extent.

Alternative B implements a surface disturbance density limitation of one pad per square mile and less than one linear mile of routes per square mile for oil and gas development. This limitation would align management with current CPW and COGFC recommendations. It would mitigate impacts to wildlife and special status species by dispersing or co-locating development. This would help maintain large blocks of connected habitat with minimal disturbance. As such, impacts to wildlife and special status species, such as loss of habitat features and functionality, would be reduced relative to the No Action Alternative.

Alternative C

Under Alternative C, the same proportion of the decision area would be closed (13.8 percent) and open (86.2 percent) to fluid mineral leasing as under Alternative A (**Table 3-61** and **Table 3-62**). However, the areas subject to NSO, CSU, and TL stipulations would increase relative to Alternative A and would be the same as for Alternative B (22.1 percent NSO, 62.9 percent CSU, and 63.5 percent TL), including the same amount of big game HPH subject to stipulations (**Table 3-50**). As described for Alternative B, protections to wildlife and special status species would occur over a larger extent, and associated impacts, such as potential for disturbance and habitat loss and alterations, would decrease relative to Alternative A.

In addition to the surface disturbance density limitation of one pad per square mile and less than one linear mile of routes per square mile for oil and gas development, Alternative C would include a 3 percent surface disturbance threshold. This would ensure that authorized uses and discrete anthropogenic disturbances cover less than 3 percent of HPH on BLM-administered surface lands within the decision area. This additional limitation would further reduce impacts to wildlife and special status species by reducing the overall level of habitat loss and disturbance. This would also help reduce habitat fragmentation and maintain connectivity since a greater amount of functional habitat would remain overall. As such, impacts to wildlife and special status species would be reduced relative to the No Action Alternative. However, private lands would not apply to the surface disturbance threshold calculation, so disturbances in these areas could detract from overall habitat availability, connectiveness, and functionality.

Alternative C provides flexibility in waivers, exceptions, and modifications for where 3 percent may not be an appropriate threshold or where exceeding 3 percent would support development opportunities on split-estate lands. Waivers, exceptions, and modifications to the 3 percent surface disturbance threshold could increase impacts to wildlife and special status species by contributing to disturbance and habitat loss or alterations.

Alternative D

Under Alternative D, areas where oil and gas potential is unknown, low, or moderate would be closed to future leasing. As a result, the BLM would close the largest amount of acreage (44.8 percent of the decision area) to oil and gas leasing and have the fewest acres open, subject to standard terms and conditions, or open subject to unmapped stipulations (55.2 percent of the decision area) compared with Alternative A (see **Table 3-61** and **Table 3-62**).

A reduction of total allowable area for leasing would decrease the quantity of wells permitted and other associated facilities (roads, well pads, etc.), which would reduce disturbances associated with exploration, transportation, construction, and drilling activities compared with Alternative A. The direct and indirect impacts as described in the *Nature and Type of Effects* to wildlife and special status species from these activities would decrease. This is because the area over which activities that could cause disturbance, habitat loss, and habitat alteration would be reduced as well as the overall amount of activities.

Closures in special status species' habitats such as Gunnison sage-grouse, greater sage-grouse, parachute beardtongue, and Preble's jumping mouse would increase and associated species would experience fewer impacts, such as potential for disturbance and habitat alterations. Since special status species are generally more susceptible to disturbances and habitat loss, increased closures would help reduce threats from oil and gas development and promote their recovery.

Under Alternative D, disturbance generated from oil and gas related activities would decrease relative to Alternative A because a larger portion of the decision area would be closed to oil and gas leasing. These additional closures would result in fewer open acres subject to NSO (14.4 percent of the decision area) and TL (34.1 percent of the decision area) stipulations (**Table 3-50**). The increase in open acres subject to CSU (31.9 percent of the decision area) would allow some use and occupancy of surface lands while protecting identified resource values, such as wildlife habitat.

Alternative D would also implement a 3 percent disturbance threshold and a surface disturbance density limitation of one pad per square mile and less than one linear mile of routes per square mile for oil and gas development. Impacts to wildlife from implementing these limitations would be the same as described for Alternative C. Additionally, private lands would apply to the surface disturbance threshold and there would be less flexibility for waivers, exceptions, and modifications under this alternative. As a result, the overall level of disturbance would be lower and the potential for impacts such as behavioral disturbance and habitat alterations would be reduced.

Overall, Alternative D would have the most stringent restrictions on fluid mineral leasing in the decision area and would therefore provide the most protection to wildlife and special status species out of all the alternatives. These protections would maintain wildlife habitat connectivity and functionality and reduced impacts as described under *Nature and Type of Effects*.

Cumulative Impacts

The cumulative impact analysis area is the planning area. Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected and will likely to continue to affect fish, wildlife, and special status species include mineral exploration and development (fluid and other minerals), residential and industrial development (including power lines and other ROWs), vegetation treatments, fire and fuels management, livestock grazing, agricultural developments, recreation, road and trail construction, and greater and Gunnison sage-grouse planning efforts.

Many of the actions described above have and will likely continue to alter habitat conditions, which then cause or favor other habitat changes. For example, wildland fire removes wildlife habitat features, and affected areas are more susceptible to weed invasion, soil erosion, and sedimentation of waterways, all of which further degrade habitats. In general, resource use activities, such as energy, mineral, and agricultural developments have cumulatively impacted wildlife and special status species by causing habitat removal, fragmentation, weed spread, and disturbance from noise and increased human presence. Land planning efforts and vegetation, habitat, and fuels treatments have offset some of these impacts by improving habitat

connectivity, resistance, and resilience. In particular, planning efforts for greater and Gunnison sage-grouse may result in decisions that constrain certain uses such as mineral development, ROW authorizations, and grazing, and contribute to restoration of shrubland habitats. Additionally, similar planning efforts for aquatic species exist that constrain certain uses within a buffer around riparian areas, fens, wetlands, and water impoundments. As such, these planning efforts would reduce cumulative impacts on wildlife species associated with these habitat types.

Climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions, vegetative health, and water flows and temperature. Such changes would alter habitat conditions, potentially creating conditions that could favor certain species or communities, weeds, or pests.

Under all of the alternatives, oil and gas closures and stipulations, including NSO, CSU, and TL, would reduce the incremental contribution to cumulative impacts on fish and wildlife habitats by prohibiting or reducing surface-disturbing activities in certain areas. However, management under Alternative A would not include objectives to co-locate, consolidate, and cluster localized disturbance, and therefore, this alternative would have a greater incremental contribution to cumulative impacts on wildlife species. This is because impacts, such as habitat alterations and disturbance, would not necessarily be dispersed or co-located, and concentrated areas of development could reduce habitat connectivity and functionality.

In contrast, under Alternatives B, C, and D, the BLM would place more restrictions on development than under Alternative A, including objectives to disperse or co-locate development, which would reduce potential for habitat fragmentation. Therefore, all action alternatives would have a lower incremental contribution to cumulative impacts on wildlife and special status species. Alternative D would include the fewest acres open to and the most stringent restrictions for fluid mineral leasing. Therefore, Alternative D would provide the most protection and reduce the contribution to cumulative impacts to wildlife and special status species to the greatest extent of all the alternatives. These protections would maintain wildlife habitat connectivity and functionality.

3.3.3 Vegetation

Issue 1: What is the impact to affected vegetation from the alternatives, including potential limitations from oil and gas development?

Issue 2: How do the alternatives contribute to achieving vegetation objectives as it pertains to habitat effectiveness for big game on these vegetation communities?

Issue 3: How would vegetation management intended for wildlife habitat improvement adversely alter lands with potential wilderness character?

Issue 4: How might vegetation be altered in terms of alteration or increase of forage or water supplies for livestock?

Analytical Methods and Assumptions

The following analysis reviews the impacts each proposed alternative would have on specific vegetation communities, including at-risk species and noxious weed and invasive plant species. Vegetation communities were selected for their overall presence and importance for big game habitat, specifically within migratory corridors. While other ecosystem types may be present within big game migratory corridors in the decision area, they are not discussed below due to either minimal surface coverage, or because they do not represent an important resource for big game or the environment. For each alternative, big game habitat was overlaid with mapped vegetation types to present a quantitative analysis. Where these data were not available, the

impacts are discussed qualitatively. The potential impacts discussed below were identified by reviewing the best available science and data.

Indicators for vegetation include the following:

- Disturbance and/or loss of plant communities, plant populations, or individual plants

Assumptions

- Annual climatic fluctuation would continue to influence the health and productivity of plant communities.
- Surface disturbance, including temporary, would remove plant material until reclamation.

Methods of Analysis

Impacts were determined by assessing which actions, if any, would result in changes to vegetation types in the decision area, including riparian and wetland vegetation, and invasive and noxious weeds. Protecting big game HPH would indirectly improve vegetation communities that overlap with big game HPH. Some impacts are direct, while others are indirect and affect vegetation through a change in another resource. Direct impacts on vegetation include disrupting, damaging, or removing vegetation, thereby reducing the area, amount, or condition of native vegetation. Included among these are actions that reduce total numbers of plant species and actions that reduce or cause the loss of diversity, vigor, or structure of vegetation, or that degrade its function for wildlife habitat.

Indirect impacts are those that are not linked to one action, such as decreased plant vigor or health, loss of habitat suitable for vegetation colonization due to surface disturbance, introduction of invasive or noxious weeds or conditions that enhance the spread of weeds, or the general loss of habitat due to surface occupancy or soil compaction.

Existing anthropogenic disturbance within HPH within the planning area and decision area was calculated for each DAU. The full methods and data are located in **Appendix L** and are summarized for each species in **Section 3.3.1**, Big Game.

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area for vegetation resources is BLM-administered lands in the State of Colorado. The overall acreages in each vegetation type could change under any alternative, from both project-related actions and other actions outside of the scope of this RMPA/EIS. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Vegetation serves a variety of beneficial functions, such as providing food and cover for animals, stabilizing soils, and providing plant products for human uses. In Colorado, approximately 3,322 plant taxa are currently known, with 84 percent of these plant species native to the state (BLM 2022d). Some of these species are generalists, which means they tolerate a wide variety of soil chemistry, soil depth and texture, aspect, elevation, and precipitation timing and amount. Other species may be more limited in the physical conditions they tolerate, such as those associated with riparian areas and wetlands or those associated with saline soils.

The presence of plant species in the decision area can range from extremely common to scarce. Those that are particularly scarce or rare may be classified as BLM sensitive species, threatened species, or endangered species. In contrast, some of the most common species are highly adaptable and not native; invasive weeds

are very competitive with native species. Whether the State of Colorado considers these weeds noxious or invasive species, they can have a marked negative effect on native plant vegetation.

On a national scale, similar geographic areas are divided into ecoregions by a variety of factors, including elevation, climate, and geology. Six level III ecoregions and 35 level IV ecoregions exist in Colorado, and many continue into ecologically similar parts of adjacent states (Chapman et al. 2006). As shown in **Table 3-63**, the decision area falls primarily in the Colorado Plateau ecoregion and secondarily in the Southern

Table 3-63. Ecoregions in the Decision Area

Ecoregion	Total Acres
High Plains	276,000
Southern Tablelands	1,285,000
Arizona/New Mexico Plateau	385,000
Colorado Plateau	5,327,000
Wyoming Basin	1,323,000
Southern Rockies	4,414,000
Grand Total	13,010,000

Source: EPA GIS 2022

Rockies ecoregion (Chapman et al. 2006). Colorado’s tertiary ecoregions include the Arizona/New Mexico Plateau, High Plains, Southern Tablelands, and Wyoming Basin. These ecoregions are subdivided based on the landscapes’ physical characteristics, and further divided into vegetation communities, which are named according to the types of plant species contained in them. A description of each major vegetation community in the decision area follows (**Figure 3-9, Appendix D, Ecoregions**).

Vegetation Types in the Decision Area

Alpine

Alpine vegetation is typically found above 11,000 feet in elevation. It is defined as vegetation that occurs above the elevation at which forests can grow. It is heavily influenced by the harsh growing conditions of long, cold winters; heavy snows; and intensive solar radiation found in the high mountains. Alpine vegetation occurs in only a tiny fraction of the decision area. It is characterized by low-growing shrubs, such as arctic willow (*Salix arctica*); numerous sedge (*Carex* spp.) species; grasses such as alpine bluegrass (*Poa alpina*); and a variety of highly specialized forb species. Alpine habitats above tree line offer a productive habitat for elk and less frequently, bighorn sheep during the summer and early fall; they can be heavily used by elk.

Subalpine Forest

The subalpine forest vegetation type is found in the decision area above 9,500 feet in elevation. Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) characterize the overstory of this vegetation type. Aspen also may be present in some areas but is typically successional to spruce and fir. The understory in this vegetation type is generally sparse and dominated by sedges, whortleberry (*Vaccinium myrtillus*), and heartleaf arnica (*Arnica cordifolia*). Mountain brome (*Bromus marginatus*), Thurber’s fescue (*Festuca thurberi*), slender wheatgrass (*Elymus trachycaulus*), wild strawberry (*Fragaria* spp.), and an abundance of other forbs may occur where the tree canopy lets sunlight through.

Spruce-fir forests with intermingled aspen stands are an example of prime elk habitat. The spruce-fir forest provides cover, and the aspen understory provides a source of quality forage (BLM 2022d).

Montane Forest

The montane forest vegetation type generally occurs between 7,500 and 9,500 feet in elevation and comprises a small component of the decision area. This vegetation type typically includes ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and aspen (*Populus tremuloides*), singularly and in combination with one another. Soils and fire history influence the understory vegetation and where and in what combinations these species occur. Many mountain shrub species are found in montane forests. The more common species include birchleaf mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), Gambel oak (*Quercus gambelii*), Rocky Mountain juniper (*Juniperus scopulorum*), black chokecherry (*Prunus virginiana*), and roundleaf snowberry (*Symphoricarpos rotundifolius*). The herbaceous component is generally sparse but contains many of the same grasses and forbs found in the mountain shrub vegetation type, described above.

Elk, mule deer, and bighorn sheep can use most vegetation types occurring in Colorado during different times of the year. However, some vegetation types, such as aspen, are far more productive than others. The most productive habitat for elk is aspen, where the extremely productive understory supports large numbers of elk. Ponderosa pine forests can be an exception because they often support a relatively robust, herbaceous understory; therefore, they can be quite productive for elk as well (BLM 2022d).

Pinyon-Juniper

The pinyon-juniper vegetation type occurs between 5,800 and 7,500 feet and occupies more of the decision area than any other vegetation type. Pinyon-juniper woodland is dominated by Utah juniper and Colorado pinyon in varying proportions, depending on the soil, slope, aspect, and elevation. The understory is typically sparse and variable; it may contain remnant shrubs such as Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), birchleaf mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), snakeweed (*Gutierrezia sarothrae*), yucca (*Yucca harrimaniae*), potato cactus (*Opuntia fragilis*), muttongrass (*Pos fendleriana*), Indian ricegrass (*Achnatherum hymenoides*), and bottlebrush squirreltail (*Elymus elymoides*). Primary forbs in this type are western tansy mustard (*Descurainia pinnata*), scarlet globemallow (*Sphaeralcea coccinea*), rock goldenrod (*Petroradia pumila*), lobeleaf groundsel (*Packera utilobate*), and numerous species of *Penstemon*, *Arabis*, *Astragalus*, *Lomatium*, *Erigeron*, and *Machaeranthera*.

Pinyon-juniper is typically not heavily used by elk during the summer. However, studies on elk's winter ranges show that elk select for vegetation dominated by ponderosa pine and pinyon-juniper stands with low crown density (Cooper 1988). Some studies have shown that bighorn sheep may select mountain mahogany in both winter and summer over other vegetation types (Wockner et al. 2003), where they utilize mountain mahogany and other low woody species as thermal and escape cover.

Grass-Forb

The grass-forb vegetation type is a significant component of the decision area and occurs across a wide range of elevations. In some cases, its presence is related to perennial soil characteristics; in other cases, it is a result of disturbances such as fire, avalanche, rangeland projects, or drought. Grass and forb productivity is closely tied to annual precipitation and soil water content (Jones et al. 2017). In disturbed areas, it is considered an early successional stage to other vegetation types. The dominant grasses and forbs depend primarily on elevation and secondarily on soil type. Typical grass species include bottlebrush squirreltail (*Elymus elymoides*), western wheatgrass (*Pascopyrum smithii*), saline wildrye (*Leymus salinus*), galleta grass (*Pleuraphis jamesii*), needle-and-thread grass (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), blue grama (*Bouteloua gracilis*), and bluegrasses (*Poa* spp.). Common forbs include scarlet globemallow (*Sphaeralcea coccinea*), longleaf phlox (*Phlox longifolia*), wild onion (*Allium* spp.), and biscuitroots (*Lomatium*

and *Cymopterus* spp.) These species can also be found in each of the different shrub, scrub, and sagebrush vegetation types described below.

Grass-forb vegetation provides the primary forage source for big game, such as elk, and is heavily utilized during the spring and summer. In Colorado, bighorn sheep prefer habitat dominated by grasses and low shrubs (Zeigenfuss et al. 2000). New growth of grasses provides the main food source for elk in the early spring, with a shift to forbs starting in the late spring (NPS 2004). Forage class figures indicate that over a full year, big game forage is an average of approximately 51 percent grasses and 26 percent forbs (NPS 2004).

Mountain Shrub

The mountain shrub vegetation type occurs at elevations ranging from 7,000 to 9,000 feet. Birchleaf mountain mahogany, Utah serviceberry, and Gambel oak are prominent overstory components. The soils, slope, aspect, and fire history influence the character and distribution of this vegetation type, resulting in several diverse communities. These communities are distinguished by one or a combination of the prominent shrub species, along with one or more of the following species: black chokecherry, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), wild crabapple (*Peraphyllum ramosissimum*), fendlerbush (*Fendlera rupicola*), roundleaf snowberry, Utah juniper (*Juniperus osteosperma*), Rocky Mountain juniper, and Colorado pinyon pine (*Pinus edulis*).

Common herbaceous species include elk sedge (*Carex geyeri*), Letterman's needlegrass (*Achnatherum lettermanii*), Kentucky bluegrass (*Poa pratensis*), muttongrass (*Poa fendleriana*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail, western wheatgrass, slender wheatgrass (*Elymus trachycaulus*), and nodding brome (*Bromus anomalus*). Many forb species are abundant. Among the most widespread and dominant are western yarrow (*Achillea millefolium*), lupine (*Lupinus* spp.), biscuitroot (*Lomatium* spp.), and aspen peavine (*Lathyrus lanzwertii*).

Elk and deer typically use grass-shrub and valley meadows during the winter months. Bighorn sheep may be found in mountain shrub vegetation along steeper slopes and inside canyons. Shrubs are the predominant class of forage used by elk feeding within forest types during winter; shrubs comprise approximately 23 percent of the annual diet (NPS 2004). Extremely productive habitats that commonly occur near aspen include oakbrush and mountain shrub habitats. Oakbrush habitat provides food and a good source of cover. Because oakbrush provides important security, it is not uncommon for elk to spend their days in oakbrush (BLM 2022d).

Sagebrush

The sagebrush rangeland vegetation type is widespread and occupies a significant portion of the decision area. This vegetation type typically occurs on deeper soils at elevations ranging from 5,000 to 7,500 feet. The sagebrush community is dominated by Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) at the lowest elevations, Wyoming big sagebrush at mid-elevations, and mountain big sagebrush at the highest elevations. Black sagebrush (*Artemisia nova*) also occurs as a dominant shrub on some soils across this elevation range. The sagebrush type can also occur on steeper, rockier sites, where it is usually successional to woodland types and has resulted from removal of the tree canopy by fire or other natural disturbances.

Snakeweed, Utah serviceberry, rabbitbrush (genus *Ericameria* or *Chrysothamnus*), and four-wing saltbush (*Atriplex canescens*) can be secondary shrubs in the sagebrush vegetation type. The sagebrush vegetation type contains a variable understory that can include western wheatgrass, galleta grass, bottlebrush squirreltail, Indian ricegrass, blue grama, Sandberg bluegrass, muttongrass, needle-and-thread grass, prairie Junegrass (*Koeleria macrantha*), and many forbs. Among the most prominent are scarlet globemallow and longleaf phlox.

Pronghorn habitat is primarily a grass-dominated sagebrush steppe ecosystem. Common species found within the grassland communities include blue grama grass (*Bouteloua gracilis*), sedge, sagebrush, and fescue (Halbritter 2011).

Salt Desert Shrub

The salt desert shrub vegetation type is commonly found on saline and other droughty soils in the driest portions of the decision area below 6,000 feet. Plant densities in some salt desert communities, such as those found on Mancos Shale-derived soils, can be extremely low; those sites are sometimes classified as barren. The following shrubs characterize this drought-tolerant vegetation type: shadscale (*Atriplex confertifolia*), Gardner's saltbush (*Atriplex gardneri*), mat saltbush (*Atriplex 3-130orrugate*), black greasewood, four-wing saltbush, black sagebrush, winterfat (*Krascheninnikovia lanata*), snakeweed, and prickly pear cactus (*Opuntia polyacantha*). The numbers of individuals for each species vary, and species can be found in various combinations depending on the area's soil type and disturbance history. Native grasses in this vegetation type include western wheatgrass, galleta grass, bottlebrush squirreltail, Salina wildrye (*Leymus salinus*), and Indian ricegrass (on better-condition sites). Many different forbs are present; some of the most common include wild buckwheats (*Eriogonum* spp.), wild onion, and biscuitroots.

A number of BLM sensitive species and threatened or endangered plant species (see **Appendix J**) are primarily or exclusively found within this plant community. The endangered clay-loving wild buckwheat (*Eriogonum pelinophilum*) and threatened Colorado hookless cactus (*Sclerocactus glaucus*) are both found in the salt desert shrub community (Spackman et al. 1997).

Riparian Areas and Wetlands

Riparian

The riparian vegetation type is always associated with water. It extends from the lowest to highest elevations in the decision area. Approximately 1 to 2 percent of Colorado is covered with riparian or wetland vegetation (Lyon and Sovell 2000). Although small in area, it is a significant vegetation type because of its productive and diverse plant communities. Within the broad category of riparian vegetation are many distinct, interwoven plant communities. Among the most widespread are communities dominated by narrowleaf cottonwood (*Populus angustifolia*) above 5,800 feet in elevation and Fremont cottonwood (*Populus fremontii*), generally below this elevation. These communities are distinguished by various associated shrubs and trees, including thinleaf alder (*Alnus tenuifolia*), blue spruce (*Picea pungens*), Douglas-fir, sandbar willow (*Salix exigua*), skunkbush sumac (*Rhus trilobata*), Wood's rose (*Rosa woodsii*), and red osier dogwood (*Cornus sericea*). Some willow-dominated communities are also present, with sandbar willow occurring alone or in combination with strappleaf willow (*Salix ligulifolia*) or other willow species. Thinleaf alder forms a common community along the edge of many streams.

Shrub-dominated communities are found along some higher stream terraces; these include skunkbush sumac, seep willow (*Baccharis salicina*), New Mexico privet (*Forestiera pubescens*), and silver buffaloberry (*Shepherdia argentea*). Small pockets of scouringrush horsetail (*Equisetum hyemale*) can be found at lower elevations. Ephemeral and lower-elevation drainages are often dominated by black greasewood (*Sarcobatus vermiculatus*) and alien tamarisk (*Tamarix chinensis*). Detailed descriptions of these communities can be found in the Field Guide to the Wetland and Riparian Plant Associations of Colorado (Carsey et al. 2003).

Elk may intensively browse in willow if herbaceous forage is available; however, willow is not considered a necessary habitat component for elk survival (Baker et al. 2012). Moose use willows extensively year around and rely heavily on willow production for summer browse (Stumph and Wright 2007).

Wetlands

Wetlands in the decision area are very infrequent and typically much smaller than riparian areas. Though they often share some species with riparian communities, wetlands are characterized by vegetation that is inundated with water during some time of the year or soils that are saturated with water during all or part of the year (Carsey et al. 2003). Wetlands are most often associated with standing water, such as lakes, reservoirs, and ponds. However, many of the remaining wetlands in the decision area are associated with stock ponds and are not natural in origin. They may be in any of the other vegetation types in the decision area, and they mainly exist naturally as hanging gardens, springs, and seeps.

Plant species that may commonly be found in wetlands include Geyer willow (*Salix geyeriana*), water sedge (*Carex aquatilis*), cattail (*Typha angustifolia* and *Typha latifolia*), Mancos columbine (*Aquilegia micrantha*), Eastwood's monkeyflower (*Mimulus eastwoodiae*), scouringrush horsetail, thinleaf alder, hardstem bulrush (*Schoenoplectus acutus*), and, in some degraded areas, salt cedar (*Tamarix ramosissima*) (Carsey et al. 2003).

Elk, deer, and pronghorn may utilize wetland ponds as sources of water, but wetlands do not represent an integral part of habitat for any big game species analyzed in this document.

Invasive Species and Weeds

Weeds are plants considered nonnative in origin with invasive and highly competitive characteristics. Weeds can disrupt an ecosystem's function, conflict with an area's management objectives, and compete with native vegetation for space, light, and limited nutrients. Invasive species can also reduce cover and forage for big game species. Serious infestations of invasive species such as cheatgrass can create a monoculture, effectively locking the area into a cycle of wildfire and invasive annual grasses.

When an individual species is identified as a substantial economic threat, it is designated by the State of Colorado as a noxious species. Noxious weeds and invasive species of concern can be found in every plant community present in the decision area. The Record of Decision for Vegetation Treatments using Herbicides on Bureau of Land Management Lands in 17 Western States (BLM 2007) and the Colorado Noxious Weed Act (CNWA 2009) discuss how herbicides and other removal techniques are to be applied to BLM-administered lands, including mitigation measures, standard operating procedures, and analysis of active and inactive ingredients by herbicide. **Appendix K** contains a full list of Colorado noxious weeds.

Special Status Species

Per BLM's 6840 Manual, Special status species are those that:

- Have been proposed for listing or officially listed as threatened or endangered;
- Are candidates for listing as threatened or endangered under the provisions of the ESA;
- Have been designated by a BLM state director as sensitive.

The USFWS, in cooperation with other federal agencies, manages the federal threatened and endangered species and designated critical habitat, with the ultimate goal of species recovery and viability. The BLM cooperates with the USFWS to identify and manage critical habitat for listed species in addition to habitat previously designated. Candidate species are managed to maintain viable populations to avoid listing. State of Colorado and BLM sensitive species are treated similarly. The BLM, USFWS, and State of Colorado have developed formal and informal agreements to provide guidance on species management. Consultation is required on any action proposed by the BLM or another federal agency that may affect a listed species or critical habitat.

Environmental Consequences

Nature and Type of Effects

Surface disturbance could occur as a result of permitted mineral exploration activities, as well as changes to wildlife distribution and concentration, as a result of disturbance or habitat loss associated with those activities. Permitted surface-disturbing activities often involve vegetation removal, which would reduce the condition of native vegetation communities and individual native plant species, alter age class distribution, reduce connectivity, and encourage the spread of invasive species. Resource management for wildlife habitat, such as avoidance, minimization, and mitigation of impacts on big game HPH would reduce impacts on vegetation over the short term, and could improve vegetation conditions over the long term.

Mineral management decisions and activities could disturb soils and cause erosion, topsoil and biological soil crust loss, and soil compaction. This could affect vegetation's ability to regenerate and could facilitate weed introduction and spread. Soil compaction results in decreased vegetation cover and more exposure of the soil surface to erosion (Burton et al. 2008). Soil compaction may also affect the size and abundance of plants by reducing moisture availability and precluding adequate taproot penetration to deeper horizons (Ouren et al. 2007). Furthermore, surface-disturbing activities can increase dust, which could cover existing vegetation and impair plant photosynthesis and respiration. Resulting impacts could include lowered plant vigor and growth rate, altered or disrupted pollination, and increased susceptibility to disease, drought, or insect attack. As a result, surface-disturbing activities could affect the density, composition, and frequency of species in an area, thus affecting native vegetation condition.

Reclamation of land after placing subsurface or temporary facilities in highly degraded areas may benefit vegetation if more desirable species become established. Reclamation and mitigation can reintroduce a native seed source into areas where noxious weeds and invasive species dominate the landscape. Reclamation could also affect individual plant species through introduction of weeds or new genetic material into local populations by way of seedings or plantings. Despite the use of best reclamation practices, desired results of vegetation condition may not always be achieved due to such factors as weather patterns, seed availability, or unproven restoration techniques.

Impacts are more likely to occur in areas without stipulations to prevent surface disturbance. Some vegetation types, such as salt desert shrub and sagebrush, take longer to recover from disturbance, especially during prolonged drought, and are more susceptible to weed invasion. Impacts on these communities would be greater than for other desired vegetation communities, such as mountain shrub, which generally responds more favorably to disturbance and are less prone to weed invasion. Fewer impacts on vegetation would occur in previously disturbed or developed areas because past and current use has already impacted these areas, although further impacts could still occur.

Impacts Common to All Alternatives

Under all alternatives, vegetation would continue to be removed or damaged where new and ongoing oil and gas development takes place.

Alternative A

Under the No Action Alternative, the current RMPs would not be amended and existing stipulations with existing waivers, exceptions, and modifications would not change so there would be no alteration to impacts on vegetation. Vegetation would continue to be affected from oil and gas development across BLM-administered lands in Colorado as described under *Nature and Type of Effects*. There would continue to be new leases and permits which could increase the overall impact on vegetation across the decision area.

Alternative B

There would be no additional closures under Alternative B, thus impacts on vegetation under this alternative would be similar to those under Alternative A. However, with inclusion of the “1 in 640” surface disturbance density evaluation, impacts in HPH would be greatly decreased, and vegetation resources would be protected from surface disturbance due to oil and gas development. By keeping disturbance in HPH to 1 per square mile, vegetation condition would be maintained overall compared to the No Action Alternative. Dust would be limited to those areas and their impact would be greatly decreased in the rest of the HPH, which would not occur under Alternative A. The individual outputs of each disturbance area would be the same as under Alternative A.

Alternative C

Alternative C would establish a 3 percent disturbance threshold in addition to the “1 in 640” surface disturbance density evaluation described under Alternative B. This component of Alternative C would ensure that authorized uses for oil and gas and its disturbances would be limited to a maximum of 3 percent of each DAU. The 3 percent disturbance threshold would limit impacts on vegetation across a landscape scale, and the potential for disturbance would be dispersed across a larger area. When compared with Alternative A, the concentration of localized disturbance would increase impacts on individual plants, but would decrease impacts across vegetation populations and communities.

Alternative D

Alternative D would propose additional closures to oil and gas development. Similar to Alternative C, Alternative D would implement the 3 percent surface disturbance threshold with a more restrictive application, including less flexibility for waivers, exceptions, and modifications. Among the alternatives, Alternative D would have the greatest emphasis on conservation of HPH through management to first avoid impacts from oil and gas development, limiting surface disturbance and thus impacts on vegetation.

When compared to Alternative A and the other action alternatives, Alternative D would reduce the impacts on vegetation from oil and gas development to the greatest extent. The lack of surface disturbance in closed areas and increased restrictions on waivers, exceptions, and modifications would prevent surface disturbing activities across HPH in the decision area.

Cumulative Impacts

BLM, Forest Service, NPS, and adjacent state, tribal, county, and privately owned land surrounding the planning area are the cumulative effects analysis area for vegetation. Ongoing and planned actions in and near the planning area would influence vegetation conditions and management effectiveness across the state. The time frame for cumulative environmental consequences for future actions is 15 years.

Portions of the planning area adjoin National Forest System lands which may have their own land management plan guiding vegetation and fuels management in their administrative area. Vegetation management, including fire and fuels management, is becoming more broadly consistent across federal landownerships, due to changes in federal law, regulation, and policy. Consistent vegetation management among agencies will lead to a movement toward desired conditions for vegetation condition in this region.

The cumulative impacts of past and present actions on vegetation in the planning area include those described under Impacts Common to All Alternatives. Impacting factors include historical and ongoing livestock grazing and fire suppression, including policies established in the early 1900s and carried forward in other forest and land management plans and other state and local policies throughout the broader landscape, which have resulted in current vegetation conditions that are departed from historical conditions. This has resulted in a

landscape with increased pinyon-juniper densities and invasive annual grasses and a greater potential for uncharacteristically large, severe fires compared with historical conditions. Ongoing climate trends, including more frequent extreme fire weather, combine with and exacerbate these conditions.

The importance of vegetation management including fuels treatments, wildland fire management, and managing for wildlife habitat is widely recognized by state and Federal agencies and private landowners. Actions taken outside the planning area include Federal and state-funded hazardous fuel reduction projects on Forest Service and BLM-administered lands, which generally aim to move vegetation conditions and fuel loading toward historical conditions and restore historical fire regime groups.

Reasonably foreseeable future actions in the planning have the potential to impact vegetation; these are generally projects that would substantially alter vegetation conditions, including projects which disturb the land's surface, increase the potential for invasive weed spread, or increase the risk of human-caused fire. Anticipated projects include energy and mineral exploration and development, lands, realty, and cadastral survey decisions, livestock grazing and agriculture, timber removal, and travel and transportation decisions that create new routes or roads.

Planning efforts from the BLM or other agencies, particularly those that limit or constrain mineral development, may combine with this project cumulatively to reduce impacts on vegetation. For instance, efforts to protect special status species, such as greater sage-grouse and Gunnison sage-grouse, may overlap with or be adjacent to big game HPH, which would limit surface disturbance and development.

Proposed management activities under the action alternatives would contribute to the cumulative effects of vegetation management by other agencies and stakeholders. These efforts would contribute to landscape restoration and ecological resilience on a broad scale, with a focus on achieving desired vegetation conditions, restoring more natural fire regimes, and reducing the potential for uncharacteristically large and severe fires. Alternative D, which has additional fluid mineral leasing closures compared with the other action alternatives and the most stringent lease stipulations, would have the greatest contribution toward these effects. Alternative C would have the next greatest contribution, since it would not close additional acres when compared with Alternative A but would include the density and disturbance lease stipulations. Alternative B would have slightly lesser contributions due to the addition of the density stipulation, but not the disturbance stipulation.

3.4 SOCIAL SYSTEMS

3.4.1 Native American Religious Concerns

Issue 1: How would each alternative's management of oil and gas affect Native American Tribes' access to sacred sites and traditional gathering areas?

Analytical Methods and Assumptions

The analysis of impacts on Native American religious concerns is based on the following assumptions:

- The significance of the impact is determined in consultation with contemporary Native American communities.
- The decision area includes areas where the BLM may assert applicable treaties, treaty rights, economic resource rights, and religious rights for potentially 39 Tribes.
- Increases in access, including hunting and fishing recreation access, can accelerate deterioration of a site through normal use or vandalism.

- The planning area may intersect with archaeological sites or heritage resource locations which may not be recognized as important by Native American Tribes.
- The BLM will continue to follow all existing regulatory procedures and guidance for the consideration of impacts for site-specific projects.
- Stipulations that protect big game animals, other wildlife, plants, or other resources may provide incidental protections for areas with economic and resource rights and sacred sites for Tribes.
- Stipulations that restrict access related to mineral development for the protection of big game animals, other wildlife, plants, or other resources may also restrict Tribes' access to areas of economic and resource rights and to sacred sites.
- Conservation of intact, connected big game HPH and the resulting effects on abundance of wildlife may be valued by many tribal members.

Scope of the Analysis

The scope of the analysis is limited to the considerations of the effects of new or changed oil and gas management decisions designed to maintain, conserve, and protect big game corridors and habitat. The geographic scope is the entire planning area. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Religious practices are integral to federally recognized Tribes, and the United States has designated the protection of Native American Tribes' inherent freedom to exercise their religious practices. This protection includes access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rights (American Indian Religious Freedom Act 1978, [AIRFA]).

Native American tribal treaty rights, uses, and interests in the planning area may include both the exercise of economic and resource rights and those uses and resources that are tied to traditional cultural practices (Executive Order 13007). These rights were retained through treaty-making processes from 1778 to 1871. Through these treaties, American Indian Tribes transferred land to the United States but retained rights that were not expressly granted through the exchange (MOU 2021). Treaties are agreements between sovereign nations; however, in 1871, the United States government no longer recognized Native American sovereignty and entered into agreements—and not treaties—with Native Americans. An example is the Brunot - Agreement.⁵ Although the Brunot Agreement is an exception to the legal status of treaties, the BLM will consider this agreement, along with treaty rights, as a source of legal authority for the BLM to account for the reserved treaty rights (Horn 2016).

Heritage resources are those resources, both human and natural, created by activities from the past that remain to inform present and future societies of that past. Issues and concerns may include treaty rights and trust resources, such as land, water, minerals, and natural resources; sacred sites, traditional uses, and areas of traditional cultural and religious importance; and any other areas of concern to Native Americans. The importance and significance of impacts are best determined by Native American Tribes defining what is culturally and spiritually important to them. The land use planning process allows the potential to identify

⁵ In 1873, the Brunot Agreement between the Utes and the US government took 3.7 million acres from the Ute Reservation in western Colorado. An important provision reserved for the Utes the right to "hunt upon said land so long as the game lasts and the Indians are at peace with the white people." The Utes still retain this right (Southern Ute Indian Tribe 2022).

areas of traditional cultural or religious importance on a landscape scale and better accommodate tribal concerns.

The BLM cannot know the full extent to which tribal practices and trends involve natural resource uses and spiritual and religious ceremonies in the planning area. The BLM consults on a government-to-government basis with Native American Tribes; these exchanges can include culturally sensitive information. For Tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over publicly identifying and evaluating these resources, unless the resources are in imminent danger of damage or destruction.

Four federally recognized Native American Tribes govern reservations adjacent to the planning area; the Southern Ute Tribe, the Ute Mountain Ute Tribe, the Ute Indian Tribe of the Uintah and Ouray Reservation, and the Navajo Nation. Additionally, the BLM has identified a total of 39 Tribes as consulting parties and possibly cooperating agencies (See Section 4.2). Tribes may request to engage or not to engage with the BLM at different levels depending on their interest in the project, including formal government-to-government consultation. Tribal leaders have been invited to participate in engagement opportunities to identify any potential conflicts with tribal members' uses of the planning area for cultural, religious, and economic purposes, including access to sacred locations on BLM-administered lands. BLM will work with Tribes to seek alternatives and resolve potential conflicts that may arise, per Secretarial Order 3403. Government-to-government consultation will continue throughout the RMPA process to ensure that the concerns of tribal groups are considered in the development of the RMPA.

Reasonably Foreseeable Trends and Planned Actions

Ongoing trends of better access, increasing recreational use, and more human activity in the planning area could result in direct disturbance or alterations to resources important to tribal communities today.

The significance of impacts depends on the perspective and context of the affected Tribes. Therefore, the severity of impacts will be determined by federally recognized Tribes defining what is culturally or spiritually important to them. Additionally, heritage resources that are identified as important through tribal consultation will change as programs continue to be developed to work with students, adults, and elders to reconnect them to their traditional lands and resources.

Environmental Consequences

Impacts Common to All Alternatives

The analysis area for Native American Religious Concerns are BLM-administered lands and resources in the decision area. Defining areas as open to oil and gas leasing and each subsequent stage of leasing, geophysical exploration, approving APDs, and rights-of-way and operations are associated with potential impacts on Native American Tribal Concerns. The BLM would continue its efforts to consult Tribes on a government-to-government basis and through other means to identify religious concerns and other tribal interests from changes in the availability or allocations of lands for oil and gas leasing and potential subsequent development.

The types of impacts that could occur or be identified in consultation include the following:

- Disturbance of locations or landscapes associated with traditional beliefs, sacred sites, resource gathering areas, hunting and fishing areas, water sources, ancestral sites, human remains, trails, and treaty assets
- Decreased tribal member access or interference with the exercise of cultural uses and practices, such as resource gathering, hunting or religious ceremonies

- Increased public access and human presence, which could lead to increased vandalism and unauthorized collection of ancestral sites
- The potential for erosion, pollution, habitat loss, and less tangible changes to natural features and resources that tribal members consider sacred
- Alterations of visual and aural aspects of the cultural landscape's setting that would change the landscape and make it no longer usable by tribal members

Under all alternatives, the BLM would continue to manage BLM-administered lands and resources in a manner that accommodates Native American religious traditions, practices, and beliefs, as guided by directives contained in BLM Manual 1780 (Tribal Relations), AIRFA, Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001), EO 13007 (Indian Sacred Sites), EO 13175 (Tribal Consultation), Secretarial Order 3403, Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters (November 15 2021) and Secretarial Order 3317, DOI Policy on Consultation with Indian Tribes (December 1, 2011).

Current and planned oil and gas development would continue to be assessed on an individual basis in consultation with Tribes to determine whether religious concerns, tribal interests or access to traditional use areas, or resources are present or would be affected. The existing field office RMPs include management direction and allocations that may address tribal resources, tribal access, and protections that would continue with the proposed amendments.

Alternative A

Under the No Action Alternative, the current RMPs that are in effect in the decision area would not change and existing allocations and stipulations would remain the same. The types of potential impacts on access, resources use, setting, and sacred sites, if present, would be the same as described under *Impacts Common to all Alternatives*. The maintenance and protection of big game corridors that may be valued by tribal members would not change. The potential for disturbance and access impacts from leasing and ongoing development would not change, but there would continue to be new leasing and permitting in areas open to leasing. Specific uses and concerns would be identified through government-to-government consultation for site-specific actions.

Alternative B

Acres closed to leasing would be the same as those under Alternative A and the potential for impacts on access, resources use, and sacred sites would be similar to Alternative A. However, areas open to leasing with NSO, CSU, and TL stipulations would increase, reducing the potential for future disturbance and access impacts associated with oil and gas development. The surface disturbance density evaluation would limit the density of potential disturbances and facilitate avoidance of locations or resources important to Tribes. The reduction in potential future disturbance due to oil and gas development would help maintain and conserve intact, connected big game habitat corridors that may be valued by tribal members. The types of potential impacts on access, resources use, setting, and sacred sites, if present, would be the same as described under *Impacts Common to all Alternatives*. Specific uses and concerns would be identified through government-to-government consultation for site-specific actions.

Alternative C

Impacts from acres closed to leasing, NSO, CSU, and TL surface stipulations and the "one disturbance per square mile" threshold would be the same as Alternative B. The potential for impacts on access, resources use, and sacred sites would be similar to Alternative B. The addition of a 3 percent disturbance threshold

may facilitate further avoidance of disturbance in areas where resources may be present. The reduction in potential future disturbance due to oil and gas development would help maintain and conserve intact, connected big game habitat corridors that may be valued by tribal members. The types of potential impacts on access, resources use, setting, and sacred sites, if present, would be the same as described under *Impacts Common to all Alternatives*. Specific uses and concerns would be identified through government-to-government consultation for site-specific actions.

Alternative D

Alternative D would increase the percentage of the decision area that would be closed to leasing from 13.8 percent to 44.8 percent substantially decreasing the potential for future impacts from oil and gas development on access, resources use, and sacred sites. Stipulations on the areas open to leasing would further reduce the potential for disturbance from oil and gas development. The large reduction in potential future disturbance due to oil and gas development would help maintain and conserve intact, connected big game HPH and corridors that may be valued by tribal members to a greater extent than the other alternatives. The types of potential impacts on access, resources use, setting, and sacred sites, if present, would be the same as described under *Impacts Common to all Alternatives*. Specific uses and concerns would be identified through government-to-government consultation for site-specific actions.

Cumulative Effects

The cumulative effects analysis areas for Native American Religious Concerns and tribal interests is the planning area. The types of impacts on Native American Religious Concerns and tribal interests that have occurred in the past are as follows:

- Changes to the setting and loss of integrity to areas of traditional cultural and religious importance, traditional use areas, and sacred sites
- Loss of sovereignty, access to lands and natural resources
- Changes in land use (agriculture, mineral development, timber production, energy development, and livestock grazing)
- Impacts of natural processes, such as erosion, weathering, and fire
- Decline in abundance and access to native fish, game, plant and animal species and supporting habitats

Past, present, and reasonably foreseeable future actions and trends with potential for cumulative impacts on Native American Religious Concerns and tribal interests include energy development, mineral estate income, population growth, sprawl and urbanization, access changes, transportation development, RMP efforts for BLM districts in Colorado that may result in decisions that constrain oil and gas development, and growth in recreation. These would continue to affect tribal access, rights, and interests. Because the locations of important traditional cultural and religious sites, sacred sites, and sites important to other traditional activities in the planning area are confidential, they may be impacted through ignorance. Information about resources and properties of interest to Native Americans and information needed to ensure that tribal interests are considered in Federal management and decision-making is gathered through consultation and collaboration with Native American tribal governments. There is potential for cumulative effects from continuing trends and future actions in the planning area, in particular oil and gas development, under all alternatives. However, under all alternatives this would occur in the context of federal regulations, review, and ongoing consultation which would reduce the potential for impacts.

Under all alternatives, oil and gas closures and stipulations like NSO, CSU, and TL could reduce impacts on Native American religious concerns or tribal interests by prohibiting or reducing oil and gas related

development activities in BLM-administered portions of the planning area. This could also impact Tribes' access to areas of economic and resource rights or to sacred sites. Management under Alternative A would likely produce the largest contribution to cumulative impacts among the alternatives. Under Alternatives B, C, and D, the BLM would place more restrictions on oil and gas development than under Alternative A. Because of this, all action alternatives would contribute less to cumulative impacts than the no action alternative. Under Alternative D, the fewest acres would be open to oil and gas development and have the most restrictions on fluid mineral leasing among the alternatives. Alternative D would contribute the least to cumulative impacts on Native American Religious Concerns and tribal interests out of all the alternatives.

3.4.2 Cultural Resources

Issue 1: How would each alternative affect cultural resources across the planning area? Where and how will potential oil and gas development limitations affect cultural resources?

Issue 2: What impact do big game populations have on cultural resources on BLM land in Colorado?

Cultural resources are locations of human activity, occupation, or use. They include expressions of human culture and history in the physical environment, such as archaeological sites, historic buildings and structures, and historic trails. Cultural resources can also be natural features, plants, and animals or places that are considered to be traditionally important or sacred to a culture, subculture, or community. The significance of these places is derived from the role the resource plays in a community's cultural identity, as defined by its beliefs, practices, history, and social institutions.

The BLM is responsible for managing cultural resources on BLM-administered lands in accordance with the regulations, statutes, and policies described in detail in the BLM Manual 8100 series (BLM 2004a). Historic properties are cultural resources that are or are potentially eligible for listing on the National Register of Historic Places. The BLM is required by 54 USC 306108 (commonly known as Section 106 review of the National Historic Preservation Act [NHPA]) to take into consideration the effect of its undertakings on historic properties, regardless of jurisdiction, including nonfederal lands overlying federal mineral estate or tribal trust minerals.

Analytical Methods and Assumptions

The analysis area for cultural resources are the BLM-administered lands and resources in the decision area.

The analysis of impacts on cultural resources from changes in the availability of lands for oil and gas leasing will:

- Describe—in general—the BLM's legal obligations under relevant laws, regulations, and policies for cultural resources, including Section 106.
- Describe the potential impacts and protections for cultural resources associated with the different types of constraints under consideration, including closures, NSO stipulations, CSU stipulations, and timing limitations
- Compare the alternatives in general terms regarding the potential for impacts on cultural resources based on the level of constraints proposed under each alternative
- Discuss the potential for impacts on cultural resources from alterations to the setting, changes in access, changes in travel routes, erosion, unauthorized collection, or vandalism

The analysis of impacts on cultural resources is based on the following assumptions:

- Many sites and other cultural resources are present in the decision area that have not been inventoried and that are not currently known.
- Archaeological sites and locations of cultural resources that may be important to tribal groups exist in areas where cultural surveys have not been conducted, or where tribal consultation has not identified resources; these sites and locations have not been evaluated for listing on the National Register of Historic Places (NRHP).
- The analysis focuses on general management over a large and varied decision area; the analysis does not break out or quantify the details and locations of cultural resources of the individual proposed big game corridors.
- Oil and gas leasing allocations and stipulations considered in this planning process could have the direct impact on cultural resources by precluding other access and uses. They also may affect the risk of potential impacts in the future from subsequent decisions and approval requirements.
- To implement subsequent site-specific actions, the BLM will comply with Section 106 of the NHPA and abide by all laws, requirements, guidance, and Colorado State Historic Preservation Office (SHPO) agreement protocols relevant to determining the impacts on cultural resources.
- Existing protections for cultural resources specified in RMPs will continue.
- Development of existing leases would be required to conform to new objectives to the extent consistent with lease rights.
- Stipulations that protect certain big game animals, other wildlife, habitat, or other resources may provide incidental protections for collocated cultural resources. Conversely, these stipulations may result in adverse effects on historic properties if they result in any ground disturbing activities or changes in use that results in wildlife congregation areas.

Scope of the Analysis

The scope of the analysis is limited to the programmatic⁶ consideration of the effects of new or changed oil and gas management decisions—designed to maintain, conserve, and protect big game corridors and HPH—on recorded or undiscovered cultural resources. The geographic scope of the analysis is the decision area of approximately 8.3 million acres of BLM-administered surface lands and 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Cultural resources represent a fragile and irreplaceable part of American heritage. They are identified through a variety of methods, including, but not limited to, field inventories, historical documentation, and consultation. The BLM's cultural resources program in Colorado manages a wide variety of archaeological and prehistoric and historic sites. These include over 50,000 known and recorded archaeological and historic sites, 60 sites listed on the NRHP, and 5 national historic landmarks. The full range of cultural resource types is present within the decision and planning areas; however, archaeological sites comprise most of the recorded cultural resources and are the most likely cultural resource type to be identified and encountered in federal actions involving mineral estate or land use decisions.

Historic properties are cultural resources that are listed on the NRHP or that meet specific criteria for eligibility for listing on the NRHP. The regulations found at 36 CFR 800, Protection of Historic and Cultural

⁶ General and broad-based discussion of impact potential, not site or corridor specific.

Properties, outline the steps for identifying and evaluating historic properties, for assessing the impacts of federal actions on historic properties, and for consulting with SHPO, Tribes, local governments, and other interested parties to avoid, reduce, or minimize adverse effects. This process does not require historic properties to be preserved or even nominated for listing; however, it does require the federal agency consider the effects its actions and decisions may have on historic properties and resolve adverse effects, when identified.

Cultural resources must be evaluated for their significance under National Register criteria and for their integrity of location, design, setting, materials, workmanship, feeling, and association. A property is considered eligible for listing on the NRHP if it meets one of the four National Register Criteria and retains sufficient integrity of these elements (NPS 1997). As outlined in 36 CFR 60, historic properties include prehistoric and historic archaeological sites and places considered important to Native Americans; historic properties must meet one or more of these criteria (NPS 1997):

- The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association.
- The property has an association with events that have made a significant contribution to the broad patterns of American history.
- The property embodies the distinctive characteristics of a type, period, or method of construction; it represents the work of a master; it possesses high artistic values; or it represents a significant and distinguishable entity whose components may lack individual distinction.
- The property yields, or may be likely to yield, information important in prehistory or history.

Where the BLM manages the surface, the BLM is responsible for all proactive cultural resource management requirements under NHPA, FLPMA, Native American Graves Protection and Repatriation Act (NAGPRA), the Archaeological Resources Protection Act (ARPA), AIRFA, and other applicable laws and executive orders. The BLM is responsible for ensuring the agency meets all its legal obligations under these laws and other relevant legal authorities. Additionally, BLM can meet its Section 106 requirements under a nationwide programmatic agreement and state protocol, if in place. This streamlines the consultation process requirements with the SHPO for undertakings and contains stipulations regarding proactive management programs. If these state protocols are not appropriate then 36 CFR 800 would apply, or agency would identify an alternative process through a programmatic agreement.

The existing field office RMPs include management direction and allocations that address cultural resource management and protections; these would continue under the action alternatives. BLM RMP guidance also directs the cultural resources programs to classify all cultural properties into defined use categories based on their nature and relative preservation value. Currently, these categories include recorded historic properties or cultural resources that are “projected to occur” (those yet to be identified or recorded).

The condition and preservation of cultural resources in the decision area vary according to land use and the natural setting of the site. Sites are susceptible to natural wind and water erosion, as well as ground disturbance from multiple uses, development, recreation, and vandalism. The BLM strives to avoid adverse effects to historic properties as a result of its undertakings. Conflicts occur, however, when those adverse effects cannot be avoided. In these instances, the agency works to minimize or mitigate those effects.

Reasonably Foreseeable Trends and Planned Actions

Sites will continue to be susceptible to natural wind and water erosion, looting, vandalism, oil and gas development, mining, infrastructure ROWs, and neglect, which will diminish their preservation condition. Continued trends in more intensive use of BLM-administered lands and increased recreation and access would likely contribute to the loss of integrity of cultural resources. Where there is federal involvement, oil and gas leasing and development generally have a degree of direct effects on archaeological sites, which can vary depending on the project proposal. Typically, these sites are avoided in accordance with lease stipulations. However, visual impacts on adjacent sacred areas, state and federal historic properties, and cultural landscapes may increase as new fields are developed. Impacts resulting from the development, access, and operation of oil and gas facilities without federal involvement would continue.

Environmental Consequences

Impacts Common to All Alternatives

The analysis area for cultural resources are the BLM-administered lands and subsurface resources in the decision area. No inventory or sensitivity modeling of cultural resources was developed for the decision area, but the vast majority of recorded cultural resources in the decision area are archaeological sites. The allocations that the BLM takes in the decision area have the potential to result in impacts on cultural resources, which may be beneficial or adverse.

The changing of availability or allocations of lands for oil and gas leasing would directly impact cultural resources. Oil and gas leasing open allocations and stipulations considered in this planning process may cause direct impacts on cultural resources by precluding other cultural access, traditional uses and interpretation. Management actions that restrict or limit surface activities and disturbance conversely reduce the potential for human-caused direct impacts, and they may result in beneficial impacts because the cultural resource and its setting remains undisturbed.

Implementing management actions and planning decisions will be analyzed under Section 106 and any identified adverse effects will be avoided, minimized, or mitigated. Impacts of the alternatives can be described as increasing the risk or likelihood of an adverse effect under Section 106 of the NHPA occurring from subsequent exploration, development, production, abandonment, and reclamation phases of any permitted development. These activities involve surface disturbance that could have direct and indirect impacts on cultural resources, including damaging, destroying, or displacing artifacts and features, facilitating removal of artifacts, and constructing features that would be out of character with an historic or traditional setting. These activities may include the introduction of new visual, atmospheric, or audible elements in the landscape that affect the qualities of cultural resources by diminishing their use, integrity, or cultural significance. Construction of roads, and other support facilities on or off of the lease and involve surface disturbance. or removal of vegetation cover and can also increase the potential for erosion, which can also impact the physical integrity of archaeological sites. The BLM will also engage Tribes in government-to-government consultation to identify resources of traditional and/or religious significance and resolve any potential adverse effects to those resources.

Adverse direct effects relate to the destruction, damage, or permanent removal of part or all of a cultural resource, which could result from management decisions that allow for surface and subsurface ground-disturbing actions. The leasing allocations allow or restrict certain land uses and provide varying degrees of cultural resource protection ranging from closure to open with NSO, CSU and/or timing limitations. Restrictions on surface-disturbing activities benefit cultural resources by protecting them from damage, destruction, or illicit collection.

Surface allocations and stipulations that protect certain big game animals, other wildlife, plants, or other resources may provide incidental protections for collocated cultural resources. Conversely, these stipulations may result in impacts from surface disturbance on archaeological sites from redirecting uses and animal travel and congregation areas. Trampling of artifacts and other damage by wildlife is a potential impact where sites are present and if allocations result in increased crowding, denuding of surface vegetation, and erosion. There is a potential for restrictive allocations in one area to facilitate impacts on cultural resources off-lease that would need to be considered in site-specific assessments. For example, would an NSO allocation induce more potential for surface disturbance or alterations to setting impacts on cultural resources, if present, in adjacent areas due to directional drilling.

The main indicator used to assess impacts on cultural resources is the number of acres subject to direct surface or subsurface disturbances. The BLM assumes cultural resources locations and features exist across the planning area. This indicator provides a relative comparison of management actions within each alternative and does not attempt to quantify specific numbers of sites affected. Common to all alternatives, this broad scale analysis compares the alternatives on the basis of the allocations type and their relative constraints on leasing. This analysis does not include a location- or project-specific assessment of the effects of ongoing or future oil and gas development. The existing field office RMPs include management direction and allocations that address cultural resource management and protections that would continue with the proposed amendments.

Alternative A

Under the No Action Alternative, the potential for impacts resulting from existing leases, and ongoing development would not change. Authorized and pending leases would continue in areas open to leasing, however the development of existing leases would be required to conform to the new objectives of this planning action to the extent consistent with lease rights. Acres closed to leasing and open with NSO restrictions total 1,792,000 and 2,878,000 respectively. These allocations are the most protective of cultural resources from potential impacts associated with oil and gas leasing and development such as surface disturbance of archaeological sites and features, unauthorized collection, introduction of visual, atmospheric, or audible elements that affect the qualities of cultural resources. The nature and types of potential impacts on cultural resources would be the same as described under *Impacts Common to all Alternatives*. Current and planned oil and gas development activities would continue to be assessed on an individual basis to define an appropriate and inclusive Area of Potential Effect (APE), and determine whether cultural resources are present, whether those resources are eligible for listing on the NRHP, whether the federal action would result in adverse effect, and whether these adverse effects can be resolved through the consultation process by applying avoidance, minimization, and mitigation standards.

Alternative B

Acres closed to leasing would be the same as those under No Action Alternative and the protections from potential impacts on cultural resources would be similar to Alternative A in the closed areas. However, areas open to leasing with NSO, CSU, and TL stipulation would increase compared to Alternative A, reducing the potential for future surface disturbance and other potential impacts to the integrity of cultural resources associated with oil and gas development. Closed and NSO allocations are the most protective of cultural resources from potential impacts associated with oil and gas leasing and development. The surface disturbance density evaluation would limit the density of potential disturbances and facilitate avoidance of cultural resource locations. The nature and types of potential impacts on cultural resources would be the same as described under *Impacts Common to all Alternatives*. Current and planned oil and gas development activities would continue to be assessed on an individual basis to define an appropriate and inclusive APE,

and determine whether cultural resources are present, whether those resources are eligible for listing on the NRHP, whether the federal action would result in adverse effect, and whether these adverse effects can be resolved through the consultation process by applying avoidance, minimization, and mitigation standards.

Alternative C

Acres closed to leasing, NSO, CSU, and TL surface stipulations, and the surface disturbance density evaluation would be the same as Alternative B, reducing the potential for future surface disturbance and other potential impacts to the integrity of cultural resources associated with oil and gas development when compared with Alternative A. The addition of a 3 percent disturbance threshold may further facilitate avoidance of impacts in areas where cultural resources may be present. The nature and types of potential impacts on cultural resources would be the same as described under *Impacts Common to all Alternatives*. Current and planned oil and gas development activities would continue to be assessed on an individual basis to define an appropriate and inclusive APE, and determine whether cultural resources are present, whether those resources are eligible for listing on the NRHP, whether the federal action would result in adverse effect, and whether these adverse effects can be resolved through the consultation process by applying avoidance, minimization, and mitigation standards.

Alternative D

Under Alternative D, the percentage of the decision area that would be closed to leasing would be increased from 13.8 percent to 44.8 percent, substantially decreasing the potential for future impacts from oil and gas development on cultural resources. Stipulations on the areas open to leasing would further reduce the potential for ground disturbance and impacts on cultural resources from oil and gas development. The nature and types of potential impacts on cultural resources would be the same as described under *Impacts Common to all Alternatives*. Current and planned oil and gas development activities would continue to be assessed on an individual basis to define an appropriate and inclusive APE, and determine whether cultural resources are present, whether those resources are eligible for listing on the NRHP, whether the federal action would result in adverse effect, and whether these adverse effects can be resolved through the consultation process by applying avoidance, minimization, and mitigation standards. The types of impacts on cultural resources would be the same as described under *Impacts Common to all Alternatives*.

Cumulative Effects

The cumulative effects analysis areas for cultural resources is the planning area. Past and present actions that have affected cultural resources are oil and gas exploration, development, and production; increased recreation and tourism; urban community development; livestock grazing; mineral development; land use authorizations for ROWs; road construction associated with a variety of uses; and climate change. For past and present federal undertakings and resolution of adverse effects have occurred minimizing impacts on cultural resources. Activities on private land or that are privately financed may not have been subject to review and most regulations on uses. Future actions with the potential to affect cultural resources are similar to past and present actions. Actions would be conducted in the context of federal regulations and state review and significant impacts are not anticipated.

The potential for cumulative effects on cultural resources from oil and gas development in the decision area varies somewhat by alternative. The nature and type of potential impacts on cultural impacts are the same for all alternatives as described under *Impacts Common to all Alternatives*. The variation of impacts among the alternatives can only be indicated by the differences in the acres of allocation and stipulations in absence of site-specific information. Under all alternatives, oil and gas closures and NSO stipulations would reduce the potential for impacts associated with oil and gas leasing and development such as surface disturbance of

archaeological sites and features, unauthorized collection, introduction of visual, atmospheric, or audible elements that affect the qualities of cultural resources. Areas subject to CSU, and TL stipulations would reduce impacts on cultural resources by targeted restriction that would still provide leasing opportunities on BLM-administered portions of the planning area. The Section 106 process would be completed for all implementation actions and would address site-specific impacts on cultural resources in the APE.

Management under Alternative A would produce the greatest potential for contributing to cumulative impacts on these resources. Under Alternatives B, C, and D, the BLM would place more restrictions on oil and gas development than under Alternative A. Due to this, all action alternatives would have less potential for contributing to cumulative impacts on cultural resources than the no action alternative. Under Alternative D, the fewest acres would be open to oil and gas development and the most stringent restrictions for fluid mineral leasing among the alternatives would be adopted. Alternative D would have the least potential for impacts on cultural resources, compared to the other alternatives.

3.4.3 Socioeconomics

Issue 1: What is the economic impact associated with potentially decreased levels of oil and gas development?

Issue 2: How will protection of big game HPH influence management of energy resources and social and economic values?

Issue 3: How will BLM's management decisions affect the values people and communities enjoy from public lands in the planning area?

This section provides a detailed discussion of existing socioeconomic conditions at the county level for all counties in Colorado, which is the planning area and socioeconomic analysis area for this statewide EIS. The planning area is defined as the geographic region within which social and economic conditions may affect or be affected by the BLM's land use decisions. This extends to all 64 counties in Colorado. The issues identified for analysis are each addressed specifically in the impacts discussion that follows.

While the socioeconomic analysis area identified for this baseline information comprises the entire State of Colorado, a subset of counties were identified for more detailed examination based on the greater potential for social and/or economic impacts in these areas as a result of management decisions. This was determined based on the extent and degree of overlap of Federal mineral estate and big game priority habitat. Those counties with at least 20 percent of land and/or at least 150,000 acres that is BLM-administered surface and/or subsurface mineral estate with overlapping big game priority habitat were highlighted as areas with greater potential for impacts to social and economic conditions as a result of BLM management decisions (see **Table 3-64**, below). In total, 13 counties, collectively referred to in this document as the primary socioeconomic analysis area, were identified for more detailed analysis and presented in the following discussions (**Figure 3-10, Appendix D, Primary Socioeconomic Analysis Area**). **Appendix M, Complete Socioeconomic Indicators by County Tables**, includes the socioeconomic values for all counties in Colorado. **Table 3-65**, below, shows the field offices associated with the primary socioeconomic analysis area, according to the percentage of the county located within the field office.

Table 3-64. BLM-Administered Land Within the Big Game HPH for Each County in the Planning Area

Counties	BLM-administered Surface Land Within Big Game HPH		BLM-administered Subsurface/Split Estate Land Within Big Game HPH		County with High Potential for Impact from BLM-Management Decisions ¹
	Acres	Percentage of Total Acres in County	Acres	Percentage of Total Acres in County	
Adams	0	0 percent	1,000	0 percent	No
Alamosa	13,000	3 percent	2,000	0 percent	No
Arapahoe	0	0 percent	11,000	2 percent	No
Archuleta	6,000	1 percent	16,000	2 percent	No
Baca	0	0 percent	13,000	1 percent	No
Bent	0	0 percent	1,000	0 percent	No
Boulder	1,000	0 percent	7,000	2 percent	No
Broomfield	0	0 percent	0	0 percent	No
Chaffee	55,000	8 percent	22,000	3 percent	No
Cheyenne	0	0 percent	1,000	0 percent	No
Clear Creek	0	0 percent	1,000	0 percent	No
Conejos	140,000	17 percent	19,000	2 percent	No
Costilla	0	0 percent	0	0 percent	No
Crowley	0	0 percent	0	0 percent	No
Custer	8,000	2 percent	58,000	12 percent	No
Delta	147,000	20 percent	41,000	6 percent	Yes
Denver	0	0 percent	0	0 percent	No
Dolores	71,000	10 percent	69,000	10 percent	No
Douglas	0	0 percent	3,000	1 percent	No
Eagle	156,000	14 percent	30,000	3 percent	Yes
El Paso	3,000	0 percent	1,000	0 percent	No
Elbert	0	0 percent	2,000	0 percent	No
Fremont	302,000	31 percent	128,000	13 percent	Yes
Garfield	424,000	22 percent	117,000	6 percent	Yes
Gilpin	1,000	1 percent	4,000	4 percent	No
Grand	96,000	8 percent	59,000	5 percent	No
Gunnison	338,000	16 percent	163,000	8 percent	Yes
Hinsdale	120,000	17 percent	3,000	0 percent	No
Huerfano	51,000	5 percent	76,000	7 percent	No
Jackson	116,000	11 percent	99,000	10 percent	No
Jefferson	0	0 percent	15,000	3 percent	No
Kiowa	0	0 percent	6,000	1 percent	No
Kit Carson	0	0 percent	0	0 percent	No
La Plata	15,000	1 percent	38,000	4 percent	No
Lake	15,000	6 percent	1,000	0 percent	No
Larimer	18,000	1 percent	43,000	3 percent	No
Las Animas	7,000	0 percent	85,000	3 percent	No
Lincoln	0	0 percent	1,000	0 percent	No
Logan	0	0 percent	2,000	0 percent	No
Mesa	610,000	29 percent	76,000	4 percent	Yes
Mineral	0	0 percent	4,000	1 percent	No
Moffat	1,062,000	35 percent	393,000	13 percent	Yes
Montezuma	110,000	8 percent	47,000	4 percent	No

Counties	BLM-administered Surface Land Within Big Game HPH		BLM-administered Subsurface/Split Estate Land Within Big Game HPH		County with High Potential for Impact from BLM-Management Decisions ¹
	Acres	Percentage of Total Acres in County	Acres	Percentage of Total Acres in County	
Montrose	548,000	38 percent	79,000	6 percent	Yes
Morgan	0	0 percent	10,000	1 percent	No
Otero	0	0 percent	0	0 percent	No
Ouray	17,000	5 percent	10,000	3 percent	No
Park	63,000	4 percent	152,000	11 percent	Yes
Phillips	0	0 percent	0	0 percent	No
Pitkin	16,000	3 percent	6,000	1 percent	No
Prowers	0	0 percent	2,000	0 percent	No
Pueblo	1,000	0 percent	8,000	1 percent	No
Rio Blanco	950,000	46 percent	205,000	10 percent	Yes
Rio Grande	55,000	9 percent	18,000	3 percent	No
Routt	63,000	4 percent	151,000	10 percent	Yes
Saguache	273,000	13 percent	66,000	3 percent	Yes
San Juan	5,000	2 percent	0	0 percent	No
San Miguel	268,000	33 percent	61,000	7 percent	Yes
Sedgwick	0	0 percent	0	0 percent	No
Summit	1,000	0 percent	8,000	2 percent	No
Teller	19,000	5 percent	17,000	5 percent	No
Washington	0	0 percent	0	0 percent	No
Weld	2,000	0 percent	24,000	1 percent	No
Yuma	0	0 percent	5,000	0 percent	No

Source: BLM GIS 2023

¹The counties in bold font are the counties with high potential for impact from BLM management decisions and were selected for the primary socioeconomic analysis area. In these counties, at least 20 percent of the land and/or at least 150,000 acres is BLM administered surface and/or subsurface land within the big game priority habitat.

Table 3-65. Field Offices for Associated Counties in the Primary Socioeconomic Analysis Area

BLM Field Office ¹	Associated Counties	Percent of Field Office Made up by County
Colorado River Valley FO	Garfield	36
Grand Junction FO	Eagle	35
Gunnison FO	Mesa	79
Little Snake FO	Gunnison	65
Royal Gorge FO	Moffat	62
	Routt	33
	Fremont	3
	Park	4
San Luis Valley FO	Saguache	31
Uncompahgre FO	Montrose	39
	San Miguel	13
	Delta	22
White River FO	Rio Blanco	72

Source: BLM GIS 2023

*The counties in the primary socioeconomic analysis area, which are shown in the table, are the counties with high potential for impact from BLM management decisions. In these counties, at least 20 percent of the land and/or at least

150,000 acres is BLM administered surface and/or subsurface land within the big game priority habitat.
¹Kremmling FO and Tres Rios FO have only small portions of the highlighted counties with high potential impacts, so they are not included in this table, however, data is provided for Kremmling FO and Tres Rios FO in the sections below as appropriate.

Affected Environment

Social and Economic Conditions

Population and Migration

Historical and projected population growth are important socioeconomic indicators that provide valuable information on the impact of economic changes in a community, such as boom and bust cycles in employment or a regional economic downturn. **Table 3-66** shows the historical and projected population for the primary socioeconomic analysis area, which includes the counties in the planning area with high potential for impact from BLM management decisions, and the state overall (see **Table M-1, Appendix M, Historical and Projected Population**, for population data for all 64 counties in Colorado). The historical estimates and projections were prepared by the Colorado State Demography Office. **Figure 3-11, Appendix D, Projected Population Change (2020-2040)**, shows the percent change in projected population, from 2020 to 2040, for all 64 counties in Colorado.

Table 3-66. Historical and Projected Population

Geography	Historical Population			Projected Population		Projected Change 2020 to 2040	
	2010	2015	2020	2030	2040	Total	Percentage
State and Planning Area Overall							
Colorado	5,050,332	5,446,593	5,784,156	6,416,217	7,073,418	1,289,262	22.3
Counties in the Primary Socioeconomic Analysis Area							
Delta	30,889	30,039	31,248	33,518	35,506	4,258	13.6
Eagle	52,057	52,780	55,642	60,216	69,698	14,056	25.3
Fremont	46,854	47,213	49,013	50,001	51,215	2,202	4.5
Garfield	56,150	57,495	61,780	71,971	86,470	24,690	40
Gunnison	15,309	15,826	16,939	18,561	19,870	2,931	17.3
Mesa	147,155	148,774	155,950	176,032	202,388	46,438	29.8
Moffat	13,806	13,038	13,258	12,841	12,621	(-) 637	(-) 4.8
Montrose	41,188	41,457	42,800	48,201	53,418	10,618	24.8
Park	16,262	15,975	17,412	19,013	19,201	1,789	10.3
Rio Blanco	6,617	6,621	6,520	6,261	5,908	(-) 612	(-) 9.4
Routt	23,439	23,824	24,825	29,241	33,472	8,647	34.8
Saguache	6,144	6,183	6,389	6,611	6,672	283	4.4
San Miguel	7,356	7,825	8,052	9,370	10,741	2,689	33.4

Source: Colorado Department of Local Affairs, State Demography Office 2022

The population of Colorado in 2020 was 5,784,156. The projected population growth from 2020 to 2040 for Colorado is 22.3 percent. Of the counties in the primary socioeconomic analysis area, the highest absolute population growth from 2020 to 2040 is projected for Mesa County, with an increase of over 46,000 people, and the highest absolute population decline is projected for Moffat County, with a decrease of over 600 people.

Income and Employment

Historical and current income and employment data help set up the background and can provide context for the impacts analysis that examines the effects from each alternative on jobs, labor income, and economic

output. Areas with lower per capita income or household income and areas with higher unemployment rates might be more sensitive to changes in economic contributions such as employment and labor income.

Table 3-67 displays per capita income and household income for the counties within the primary socioeconomic analysis area (see **Table M-2, Appendix M, Per Capita Income and Household Income**, for data for all 64 counties in Colorado). Per capita income in 2021 was highest in San Miguel County (\$109,613) and lowest in Fremont County (\$41,017; BEA 2022a). Median household income was highest in Eagle County (\$91,338) and lowest in Saguache County (\$48,413; US Census Bureau 2022). **Figure 3-12, Household Income**, and **Figure 3-13, Per Capita Income, Appendix D**, shows the median household income and the per capita income, respectively, for all counties in Colorado.

Table 3-67. Per Capita Income and Household Income (2021)

Geography	Per Capita Income (\$)¹	Median Household Income (\$)
State and Planning Area Overall		
Colorado	70,706	80,184
Counties in the Primary Socioeconomic Analysis Area		
Delta	46,042	51,803
Eagle	97,255	91,338
Fremont	41,017	53,411
Garfield	67,123	77,212
Gunnison	59,514	63,341
Mesa	52,121	62,127
Moffat	49,227	58,583
Montrose	50,789	57,225
Park	57,127	77,775
Rio Blanco	54,745	58,239
Routt	98,371	83,725
Saguache	43,959	48,413
San Miguel	109,613	70,965

Source: BEA 2022a, US Census Bureau 2022

¹Per capita income shown above is per capita personal income and includes income from labor (such as wages and salary disbursements), personal dividends, personal interest, adjusted proprietors' income, adjusted rental income, and personal transfer payments, excluding personal contributions for social insurance.

Table 3-68 shows average annual unemployment rates from 2012 through 2022 for the counties within the primary socioeconomic analysis area (see **Table M-3, Appendix M, Average Annual Percentage Unemployment (2012-2021)**, for data for all 64 counties in Colorado). In 2022, unemployment in Colorado was 3.0 percent; unemployment peaked in 2012 and 2020. Within the primary socioeconomic analysis area, the county with the highest rate of unemployment in 2022 was Fremont County (4.7 percent). Gunnison and Routt Counties had the lowest unemployment rates in 2022 (2.5 percent for each county; BLS 2023).

Table 3-68. Average Annual Percentage Unemployment (2012–2022)

Geography	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
State and Planning Area Overall											
Colorado	8.0	6.7	5.0	3.7	3.1	2.6	3.0	2.7	6.8	5.4	3.0

Geography	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Counties in the Primary Socioeconomic Analysis Area											
Delta	9.8	8.8	7.0	5.5	4.7	3.6	3.7	3.2	6.1	5.7	3.6
Eagle	7.3	5.9	4.2	3.0	2.6	2.2	2.5	2.2	8.9	4.8	2.6
Fremont	11.8	10.5	8.2	5.9	4.9	4.0	4.9	4.4	7.2	7.5	4.7
Garfield	8.6	7.3	5.2	4.0	3.3	2.7	3.0	2.6	6.3	5.1	3.0
Gunnison	6.1	5.4	4.0	2.8	2.2	1.9	2.3	2.1	6.2	4.0	2.5
Mesa	9.8	8.6	6.2	5.3	5.1	3.7	3.8	3.3	6.9	5.8	3.4
Moffat	8.4	6.8	5.7	4.4	3.8	3.1	3.4	3.3	5.6	5.1	3.2
Montrose	10.5	9.3	6.8	4.9	4.0	3.0	3.4	3.0	6.2	5.4	3.4
Park	6.9	6.0	4.6	3.3	2.7	2.2	2.6	2.4	5.4	4.2	2.6
Rio Blanco	8.5	7.7	5.9	5.1	4.8	3.6	3.9	3.5	5.1	5.9	3.7
Routt	7.3	5.8	4.1	3.1	2.5	2.2	2.5	2.1	7.4	4.6	2.5
Saguache	11.2	11.1	8.7	5.9	4.7	4.1	4.4	3.9	6.6	6.2	3.4
San Miguel	8.0	6.6	4.7	3.6	3.1	2.6	3.2	2.7	10.2	5.5	3.1

Source: BLS 2023

*Data is not seasonally adjusted

Key economic sectors can be identified when examining data by industry. Industry specific information can show employment levels, the distribution and growth of jobs, and average wages. This data highlights the industries that are growing or shrinking in the analysis area and provides context on the contribution of each industry to the local economy. **Table 3-69** displays the most recent employment data by industry sector for the State of Colorado (the total for all 64 counties in the planning area), revealing the top economic sectors. In 2021, the three private industry sectors with the highest percentage of total employment within the planning area were professional and technical services (9.7 percent), health care and social assistance (9.1 percent), and retail trade (8.7 percent). From 2010 to 2021, the three industry sectors that added the highest employment growth rate in the planning area were transportation and warehousing (130.7 percent growth), management of companies and enterprises (61 percent growth), and construction (49.1 percent growth; see **Table 3-69**). **Table 3-70** shows labor earnings by industry sector for the planning area (the total for all 64 counties in Colorado). From 2010 to 2021, the three industry sectors with the highest percent growth in labor earnings were construction (102.2 percent), transportation and warehousing (97.7 percent), and accommodations and food services (74.8 percent) (see **Table 3-70**).

Table 3-69. Estimated Non-Government Employment in Colorado by Industry (2010–2021)

	2010	2021	Percentage of Total Employment in 2021 [±]	Percentage Change 2010-2021
Total employment	3,143,637	3,945,819	—	25.5
Non-services related	429,332	540,904	13.7	26
Farm	45,101	47,988	1.2	6.4
Forestry, fishing, and related activities	11,750	13,423	0.3	14.2
Mining (including fossil fuels)	48,728	37,994	1	-22
Construction	185,291	276,197	7	49.1
Manufacturing	138,462	165,302	4.2	19.4
Services related	2,259,681	2,895,813	73.4	28.2
Utilities	8,738	9,401	0.2	7.6
Wholesale trade	101,457	120,434	3.1	18.7
Retail trade	298,985	341,676	8.7	14.3
Transportation and warehousing	78,550	181,227	4.6	130.7
Information	83,591	89,824	2.3	7.5

3. Affected Environment and Environmental Consequences (Socioeconomics)

	2010	2021	Percentage of Total Employment in 2021 [±]	Percentage Change 2010-2021
Finance and insurance	191,501	251,294	6.4	31.2
Professional and technical services	273,909	381,312	9.7	39.2
Management of companies and enterprises	32,391	52,152	1.3	61
Administrative and waste services	185,584	211,660	5.4	14.1
Educational services	59,323	77,829	2	31.2
Health care and social assistance	280,604	359,593	9.1	28.1
Arts, entertainment, and recreation	86,224	100,129	2.5	16.1
Accommodation and food services	232,845	281,218	7.1	20.8
Other services, except public administration	166,692	199,105	5	19.4

Source: BEA 2022b

[±] Percentages do not add to 100 because government jobs are not included.

Table 3-70. Estimated Earnings in Colorado by Industry, 2010–2021 (2022 Dollars in Thousands)

	2010	2021	2021 Percentage of Total Labor Earnings [±]	Change 2010–2021 (\$)	Percentage Change 2010-2021
Labor earnings	202,987,784	307,060,578	—	104,072,794	51.3
Non-services related	34,874,253	55,649,390	18.1	20,775,137	59.6
Farm	1,365,356	1,373,330	0.4	7,974	0.6
Forestry, fishing, and related activities	316,437	346,513	0.1	30,076	9.5
Mining (including fossil fuels)	8,645,100	13,281,070	4.3	4,635,970	53.6
Construction	11,584,078	23,426,915	7.6	11,842,837	102.2
Manufacturing	12,963,283	17,221,562	5.6	4,258,279	32.8
Services related	129,917,007	206,430,757	67.2	76,513,750	58.9
Utilities	1,505,516	2,097,616	0.7	592,100	39.3
Wholesale trade	10,433,423	14,701,625	4.8	4,268,202	40.9
Retail trade	11,753,092	16,139,021	5.3	4,385,929	37.3
Transportation and warehousing	5,717,329	11,305,792	3.7	5,588,463	97.7
Information	9,927,956	12,034,743	3.9	2,106,787	21.2
Finance and insurance	12,447,438	18,341,084	6.0	5,893,646	47.3
Professional and technical services	25,853,433	42,657,576	13.9	16,804,143	65.0
Management of companies and enterprises	5,721,719	8,856,950	2.9	3,135,231	54.8
Administrative and waste services	8,540,896	12,124,229	3.9	3,583,333	42.0
Educational services	2,551,637	3,645,215	1.2	1,093,578	42.9
Health care and social assistance	19,682,099	26,800,938	8.7	7,118,839	36.2
Arts, entertainment, and recreation	2,389,310	3,784,374	1.2	1,395,064	58.4

	2010	2021	2021 Percentage of Total Labor Earnings [‡]	Change 2010–2021 (\$)	Percentage Change 2010–2021
Accommodation and food services	6,708,894	11,727,208	3.8	5,018,314	74.8
Other services, except public administration	7,626,461	10,241,092	3.3	2,614,631	34.3

Source: BEA 2022b

[‡] Percentages do not add to 100 because government labor earnings are not included.

The industry sectors that BLM management decisions tend to impact are agricultural, mining, and recreation/tourism. **Table 3-71** presents employment and labor earnings in these sectors as a percentage of the total for each county in the primary socioeconomic analysis area (see **Table M-4, Appendix M, County-Level Employment and Labor Earnings by Sector, as a Percentage of Total (2021)**, for data for all 64 counties in Colorado). Saguache County has a relatively large share of total employment (15.7 percent) and labor earnings (16.5 percent) in the farm industry. Forestry, fishing, and related activities is a relatively small share of total employment or labor earnings in any county in the primary socioeconomic analysis area; however, Moffat County has the highest percentage of employment in the forestry, fishing, and related activities, with 2.1 percent of total employment in Moffat County. Rio Blanco County has a relatively large share of mining employment (12.3 percent) relative to the total. San Miguel County and Eagle County have a large percent of employment in the arts, entertainment, and recreation industry (10.1 percent and 8.1 percent, respectively). San Miguel and Eagle Counties also have relatively large shares of employment (15.4 percent and 14.8 percent, respectively) and labor earnings (8.9 percent and 7.4 percent, respectively) in the accommodation and food services industry.

Table 3-71. Employment and Labor Earnings by Sector for the Primary Socioeconomic Analysis Area, as a Percentage of Total for the County (2021)

Indicator	County	Industrial Sector				
		Non-services Related			Services Related	
		Farm	Forestry, Fishing, and Related Activities	Mining (Including Fossil Fuels)	Arts, Entertainment, and Recreation	Accommodation and Food Services
Employment	Delta	9.8	2	0.9	2	5.4
	Eagle	0.5	0.3	0.4	8.1	14.8
	Fremont	4.6	0.5	0.6	3	7.2
	Garfield	2.1	0.4	2.3	3.2	8.2
	Gunnison	2.2	0.6	3	7.2	10.9
	Mesa	2.9	0.5	2	2	8
	Moffat	8.4	2.1	5.7	1.4	7.5
	Montrose	5.6	1.3	0.6	1.8	6.6
	Park	3.3	1.2	0.8	3.1	6.7
	Rio Blanco	9.8	n.d.	12.3	1.7	5.9
	Routt	3.8	0.7	1.2	7.1	10.9
	Saguache	15.7	n.d.	n.d.	2.8	2.8
San Miguel	1.9	n.d.	0.5	10.1	15.4	

Indicator	County	Industrial Sector				
		Non-services Related			Services Related	
		Farm	Forestry, Fishing, and Related Activities	Mining (Including Fossil Fuels)	Arts, Entertainment, and Recreation	Accommodation and Food Services
Labor Earnings	Delta	1.1	0.5	0	0.1	1.3
	Eagle	0.1	0	n.d.	2.7	7.4
	Fremont	0.2	0.1	0.3	0.6	2
	Garfield	0.1	0.1	0.1	0.9	2.9
	Gunnison	0.2	n.d.	n.d.	3.9	5.4
	Mesa	0.2	0.1	0	0.3	2.8
	Moffat	1.2	0.3	7.5	0.4	2.2
	Montrose	0.8	0.3	0	0.4	2.2
	Park	0	0.2	0.1	0.2	1.2
	Rio Blanco	1.3	n.d.	n.d.	0.6	2.1
	Routt	0	0.1	0.6	2.8	4.6
	Saguache	16.5	n.d.	n.d.	n.d.	n.d.
San Miguel	0	n.d.	n.d.	4.8	8.9	

Source: BEA 2022b, 2022c

n.d. = not disclosed in source data

Income is composed of labor earnings, which are wages paid to employed workers, and nonlabor income, which includes investment income and entitlements such as Medicaid, Medicare, Social Security, unemployment, and welfare programs. **Table 3-72** shows the total personal income for the primary socioeconomic analysis area and the value of nonlabor income as a percentage of total income (**Table M-5**, Labor and Nonlabor Income by County, 2021, in **Appendix M**, provides the data for all 64 counties in Colorado). Within the primary socioeconomic analysis area, nonlabor income is proportionally high in Delta, Routt, and San Miguel Counties, where it accounts for 57.9 percent, 56.1 percent, and 55.8 percent of total income, respectively. Nonlabor income as a percentage of total income was lowest in Moffat, Park, and Rio Blanco Counties, where it accounted for 44.6, 42.7, and 44.8 percent, respectively.

Table 3-72. Labor and Nonlabor Income by County in the Primary Socioeconomic Analysis Area, 2021

Geography	Per Capita Personal Income (\$)	Total Personal Income (\$000)	Nonlabor Income Percentage of Total Income		
			All Nonlabor Income	Dividends, Interest, and Rent	Transfer Payments
State and Planning Area Overall					
Colorado	70,706	410,948,218	37.6	20.8	16.8
Counties in the Primary Socioeconomic Analysis Area					
Delta	46,042	1,457,743	57.9	22.1	35.8
Eagle	97,255	5,419,735	45.0	36.2	8.8
Fremont	41,017	2,036,961	54.0	17.5	36.5
Garfield	67,123	4,172,419	51.2	34.9	16.3
Gunnison	59,514	1,028,465	46.3	29.5	16.8
Mesa	52,121	8,200,469	46.0	17.7	28.3
Moffat	49,227	649,057	44.6	15.7	28.9
Montrose	50,789	2,192,453	52.1	21.6	30.6
Park	57,127	1,012,294	42.7	20.9	21.8
Rio Blanco	54,745	354,530	44.8	19.6	25.2
Routt	98,371	2,468,236	56.1	45.7	10.5

Geography	Per Capita Personal Income (\$)	Total Personal Income (\$000)	Nonlabor Income Percentage of Total Income		
			All Nonlabor Income	Dividends, Interest, and Rent	Transfer Payments
Saguache	43,959	284,457	49.3	19.9	29.4
San Miguel	109,613	885,019	55.8	47.5	8.3

Source: BEA 2022b

Public Finance

Taxes on BLM-Related Activities in the Planning Area

The State of Colorado and various local governments collect a variety of revenues related to the use of natural resources. The following is a description of major sources of revenue and the potential link to BLM resources and resource uses.

Tax revenue at the state level is collected from various sources, including the following:

- State business income taxes and personal income taxes on employee earnings are collected for earnings on employment and industries.
- Colorado severance tax is imposed on nonrenewable natural resources that are removed from the Earth. Natural resources that are subject to severance taxation include metallic minerals, molybdenum, oil and gas, oil shale, and coal. Rates of taxation vary by mineral resource. For example, the oil and gas rate ranges from 2 to 4 percent of gross income based on the size of the operation; the rate for metallic minerals is 2.25 percent of gross income. Severance taxes from oil and gas production in the state amounted to \$325.0 million in fiscal year 2022 (Colorado Legislative Council Staff 2023). Revenues from mineral extraction are discussed in further detail below.
- Fuel tax is imposed on gasoline and special fuel acquired, sold, imported, or used in Colorado. Visitors to BLM-administered lands pay taxes for vehicles for travel for recreation or other purposes.
- State sales tax is imposed at a rate of 2.9 percent. This tax is imposed on purchases directly or indirectly associated with BLM-administered lands and resource use (that is, purchases of recreation equipment and purchase of household goods by livestock operators who use BLM-administered lands).

At the local level, taxes that can be impacted by BLM-administered land uses include the following:

- Local sales tax is imposed at a variable rate based on jurisdiction. It is imposed on purchases directly or indirectly associated with BLM-administered lands and resource use, as described above for the state sales tax.
- Local lodging tax is imposed on those staying in the region at lodging for recreational visits or other purposes.
- Other local taxes, such as the automobile rental tax and the passenger facility charge, may be paid by visitors to BLM-administered lands.
- Property tax is determined based on local mill levy rates and property valuations. Should valuation of properties be impacted by local access to BLM-administered lands, property tax rates may be impacted by decisions affecting management of these lands.

Livestock operators on BLM-administered lands pay state and local sales taxes on goods and services purchased in support of their businesses; they also pay gasoline taxes when fueling motor vehicles and pay

business income taxes. Employees of livestock businesses pay personal income taxes on their earnings. Additionally, specific revenue streams are associated with public land laws governing the return of receipts from other land uses. For example, under the Taylor Grazing Act, a portion of BLM grazing revenue is returned to the county of origin; 50 percent of Section 15⁷ fees collected are returned to counties, and 12.5 percent of Section 3⁸ fees are returned to counties. Contributions from grazing vary by county and may have a higher level of importance at the local level for some communities.

Payments in Lieu of Taxes (PILTs)

PILTs are federal payments to local governments that help offset losses in property taxes due to nontaxable federal lands within their boundaries.⁹ However, PILT is not guaranteed and subject to annual Congressional budget appropriations.

BLM-administered lands fall under Section 6902 of the PILT law, which establishes a formula for calculating payments for qualifying acres of entitlement lands. Payment is typically made directly to the eligible local government. Section 6902 of the PILT act states that PILTs may be used by recipients (usually counties) for any governmental purpose and are not required to be further distributed to other local government units.

The Department of the Interior computes payments authorized under Section 6902 of the act using the greater of the following two alternatives: (1) \$2.94 (in 2022) multiplied by the number of acres of qualified federal surface land, reduced by the amount of funds received by the locality in the prior fiscal year, such as the Secure Rural Schools program or the mineral leasing program; or (2) \$0.42 (in 2022) multiplied by the number of acres of qualified federal surface land in the unit of local government, with no deduction for the prior year's payments. Both alternatives are subject to a population ceiling limitation computed by multiplying the county population by a corresponding dollar value (adjusted annually for inflation) contained in the act.

PILTs are transferred to state or local governments, as applicable, and are in addition to other federal revenues, including those from grazing fees. Colorado counties received approximately \$44.2 million in PILTs in 2022 for federal lands totaling over 23.7 million acres, 34.4 percent of which were BLM-administered land (see **Table 3-73**; see **Table M-6, Appendix M, Estimated BLM-Related PILT Revenue**, for data for all 64 counties in Colorado).

⁷ Section 15 lands are public lands that lie outside a grazing district administered by the BLM under Section 15 of the [Taylor Grazing Act](#). The BLM authorizes livestock grazing on these lands by issuing leases to private parties.

⁸ Section 3 of the Taylor Grazing Act concerns grazing permits issued on BLM-administered lands within the grazing districts established under the act. It gave leasing preference to landowners and homesteaders in or adjacent to the grazing district lands.

⁹ Public Law 94-565, dated October 20, 1976, was rewritten and amended by Public Law 97-258 on September 13, 1982, and was codified at 31 United States Code 69. The law recognizes that local governments' inability to collect property taxes on federally owned land can create a financial impact. PILTs are in place to help mitigate the financial impact.

Table 3-73. Estimated BLM-Related PILT Revenue

Geography	2022 Total PILTs to County (\$000)	Total Approximate Entitlement Acres (thousand acres)	2022 Average Payment per Acre	BLM Acreage (thousand acres)	Estimated BLM-related Portion of PILT Revenue to County (\$000)
State and Planning Area Overall					
Colorado	\$44,195	23,703	—	8,159	\$13,734
Counties in the Primary Socioeconomic Analysis Area					
Delta	\$955	404	\$2.36	199	\$469
Eagle	\$2,500	851	\$2.94	235	\$691
Fremont	\$1,244	455	\$2.73	351	\$959
Garfield	\$3,476	1,189	\$2.92	670	\$1,960
Gunnison	\$1,771	1,633	\$1.09	334	\$362
Mesa	\$3,871	1,557	\$2.49	961	\$2,389
Moffat	\$981	1,672	\$0.59	1,482	\$869
Montrose	\$2,848	981	\$2.90	597	\$1,736
Park	\$1,953	705	\$2.77	72	\$200
Rio Blanco	\$629	1,499	\$0.42	1,140	\$478
Routt	\$1,925	663	\$2.90	80	\$234
Saguache	\$1,176	1,397	\$0.84	343	\$289
San Miguel	\$1,276	488	\$2.62	315	\$824

Source: US DOI 2022

Energy and Mineral Development

Mineral development under the BLM is managed under three main categories: leasable, locatable, and salable minerals/mineral materials. Each is subject to different federal laws and implementing regulations.

Leasable minerals are a category of mineral resources made available for exploration and development by mineral leasing. They are specific types of mineral resources described by the Mineral Leasing Act of 1920. They include fluid leasables (such as crude oil and natural gas), solid leasables (such as coal), nonenergy leasables (such as sodium, phosphate, and potassium), and geothermal energy.

Locatable minerals are sometimes called hard rock minerals and may include deposits of gold, silver, lead, zinc, copper, molybdenum, uranium, gypsum, chemical-grade limestone, and other rare or high-value minerals and metals. Rights to locatable minerals are obtained by staking mining claims, unlike leasable minerals where rights are obtained via mineral leases. Locatable minerals include any valuable mineral deposits that are subject to exploration and production under the Mining Law of 1872, as amended.

Salable minerals/mineral materials are common minerals sold or given away at the BLM's discretion. Salable minerals are defined as lower-value, common variety materials, such as rock, gravel, and soil. The term "salable minerals" is synonymous with "mineral materials" and can also be called "common variety minerals." The BLM has discretion to manage the sale or removal of these materials, with the sale regulated by commercial permits. Salable minerals are also sometimes provided free of charge to local governments for public projects under free-use permits.

Revenues from oil, gas, and coal extraction come from bonus bids, royalties, and rents paid by producers on public lands. These funds are collected and subsequently distributed to the federal and state government. The Department of the Interior, through the Office of Natural Resources Revenue (ONRR), collects a set percentage of the sales value of federal oil, natural gas, and coal; this is known as a royalty. In August 2022,

the U.S. Congress passed H.R. 5376 - Inflation Reduction Act of 2022 (the IRA), which updated federal oil and gas leasing terms, including the royalty rate, rental rate, and minimum bonus bid rate. The IRA increased federal royalty rates for new oil and natural gas leases from 12.5 percent to 16.67 percent (H.R. 5376 2022). Federal royalties for coal remain at the previously set rate of 12.5 percent for surface coal and 8 percent for coal extracted from underground mines (GAO 2021).

Leaseholders can competitively bid, pay an initial bonus (that is higher than the minimum bonus bids), and subsequently pay rent (until production is established) for the right to develop the resources on public lands (the IRA eliminated the option for noncompetitive lease sales). The IRA increased the annual rental rates for new competitive oil and gas leases from \$1.50 per acre (or fraction thereof) in the first 5 years and \$2.00 per acre each year thereafter to \$3 per acre from the first 2 years, \$5 per acre for years 3 through 8, and \$15 per acre thereafter. Federal coal leases require payment of an annual rental fee of not less than \$3 per acre or fraction thereof (BLM 2022e). The IRA also increased the minimum bonus bid from \$2 per acre to \$10 per acre.

Other revenues that are not included in the royalty, rent, or bonus categories include minimum royalties, estimated royalties, and expression of interest fees. Approximately 50 percent of revenues go to the US Treasury and 49 percent of federal mineral revenues are transferred to the Colorado State Treasurer. The portion of revenue allocated to the state, in turn, is distributed to counties, cities, and school districts based on Senate Bill 08-218. Lease revenues and royalties thus provide an additional economic contribution to the state and county from mineral resource extraction. **Table 3-74** provides revenue collected from oil and gas and coal development in the primary socioeconomic analysis area in 2021, prior to implementation of the IRA. Royalties from oil and gas leases in Garfield County, which totaled \$122,465,012, were notably the highest among all counties in the primary analysis area. **Figure 3-14, Appendix D**, Oil and Gas Revenue, shows the total oil and gas revenue for all of the 64 counties across Colorado, and **Table M-7, Appendix M**, Rents, Royalty, and Bonus Revenue Collected (Fiscal Year 2021), shows the oil and gas and coal revenue data in all 64 counties in Colorado. The revenue shown does not factor in the new royalty rates, rental rates, and minimum bonus bids for new leases from the IRA. Revenue and production from new oil and gas leases is expected to change as a result of the IRA, but the magnitude of this change is not yet known.

Table 3-74. Rents, Royalty, and Bonus Revenue Collected for the Primary Socioeconomic Analysis Area (Fiscal Year 2021)

County ¹	Commodity	Revenue (\$) ²			
		Rents	Royalties	Bonus	Other Revenues
State and Planning Area Overall					
Colorado	Oil & Gas	1,278,655	349,915,704	1,200,513	17,378,294
	Coal	206,700	20,495,694	1,609,760	60,571
Counties in the Primary Socioeconomic Analysis Area					
Delta	Oil & Gas	28,821	52,761	0	2,017
	Coal	42,399	0	0	0
Garfield	Oil & Gas	130,285	122,465,012	0	7,188,885
	Coal	27,972	0	0	0
Gunnison	Oil & Gas	90,354	2,008,477	0	92,983
	Coal	55,098	6,691,250	606,000	0
Mesa	Oil & Gas	66,049	9,455,361	0	598,626
Moffat	Oil & Gas	114,874	5,449,516	0	550,710
	Coal	48,111	8,913,310	0	55,292
Montrose	Oil & Gas	0	0	0	1,657

County ¹	Commodity	Revenue (\$) ²			
		Rents	Royalties	Bonus	Other Revenues
Rio Blanco	Oil & Gas	336,128	60,301,947	273	4,910,068
	Coal	5,685	2,742,819	0	5,279
Routt	Oil & Gas	35,705	4,133	0	6,063
	Coal	13,137	265,472	0	0
San Miguel	Oil & Gas	8,471	896,017	0	30,965

Source: ONRR 2022

¹Eagle, Fremont, Park, and Saguache Counties did not receive rents, royalties, or bonus revenue in 2021 and are excluded from the table above.

In fiscal year 2021, oil and gas development on BLM-administered lands directly contributed \$6.1 billion to Colorado's economy and supported about 22,300 jobs in Colorado (BLM 2022f).

Fluid Minerals on BLM-Administered Lands in the Planning Area

The following description of fluid minerals on BLM-administered lands in Colorado is taken from the BLM's 2022 Briefing Book as well as data on federal wells provided by BLM (BLM 2022g, BLM 2022h). **Table 3-75** shows the number of producing federal oil and gas wells in each field office by well type for the planning area (all 64 counties in Colorado).

Table 3-75. Number of Producing Federal Oil and Gas Wells by Field Office and Well Type in Colorado (2022)

Field Office ¹	Directional	Horizontal	Vertical	Total
Royal Gorge	25	328	249	602
San Luis Valley	0	0	0	0
Kremmling	0	0	0	0
Colorado River Valley	2,629	29	255	2,912
Little Snake	43	15	331	388
Tres Rios	90	46	180	282
Grand Junction	147	18	173	338
White River	865	7	1,214	2,083
Gunnison	0	0	0	0
Uncompahgre	0	0	0	0
Total	3,799	443	2,402	6,605

Source: BLM 2022h

¹Data for Canyons of the Ancients National Monument, Gunnison Gorge National Conservation Area, and Roan Plateau were not available.

Royal Gorge Field Office (RGFO). The RGFO manages approximately 600 producing oil and gas wells across eastern Colorado. The RGFO ensures wells comply with federal regulatory requirements on drilling and production operations and final abandonment of a well. The RGFO routinely monitors and verifies production records to ensure accurate royalty payments to the federal government.

San Luis Valley Field Office (SLVFO). Ninety-nine percent of the SLVFO-administered lands are open to potential leasing. The 1991 RMP projected that the planning area will involve a maximum of 10 APDs and seven geophysical notices of intent per year. This level of activity will result in an estimated 40 acres of surface disturbance per year. Currently, no producing oil and gas wells are on federal mineral estate in the San Luis Valley.

Kremmling Field Office (KFO). The primary fluid mineral resources being developed are oil, carbon dioxide gas, and some methane gas. The KFO has a long history of oil and gas drilling and production activity, with nearly 675 wells having been drilled since the early 1920s. Most of these wells are in the central portion

of Jackson County in the McCallum and surrounding fields. New wells drilled within the KFO's jurisdiction over the next 20 years will be targeted at the Coalmont Niobrara Formation. The high potential area for oil and gas falls entirely within Jackson County. Interest in oil and gas leasing is mainly in Jackson County.

Little Snake Field Office (LSFO). There are about 390 producing federal oil and gas wells within the LSFO boundaries. The reasonably foreseeable development scenario forecasts that more than 3,000 new wells could be drilled in the LSFO's jurisdiction over the next 20 years. The majority of the wells will be targeted at tight sand and shale formations¹⁰ containing natural gas. The main development areas for these new wells will be in the Hiawatha, Powderwash, and Great Divide areas.

White River Field Office (WRFO). The WRFO manages a large portion of the Piceance Basin. The Energy Conservation and Policy Act identified Colorado's Piceance Basin as one of five subbasins in the continental United States with large reserves of hydrocarbon potential. The Piceance Basin contains considerable natural gas resources; the majority are attributed to the highly productive Mesaverde Gas Play. The Rangely field is the largest oil field in Colorado. The ultimate recovery of oil from this area is expected to be close to one billion barrels. The Piceance Basin contains one of the richest oil shale resources in the world, with 1.5 trillion barrels of oil in place. The bulk of this resource lies within the WRFO's boundaries. Currently, there are over 2,080 producing federal oil and gas wells within the WRFO's boundaries. The three active oil shale research design and demonstration leases in Colorado are within the WRFO's boundaries.

Colorado River Valley Field Office (CRVFO). The CRVFO's boundaries contain approximately 2,910 producing federal oil and gas wells. The CRVFO processes the most APDs in Colorado. Most oil and gas development within the CRVFO's boundaries (about 80 percent) is on private land and minerals, where the BLM has no jurisdiction. About 200,000 acres of the 773,000 acres of federal minerals within CRVFO's jurisdiction is leased for oil and gas. The CRVFO does not expect much new land to be leased over the next 20 years, but it expects continued development in the areas that are already leased.

Grand Junction Field Office (GJFO). Approximately 513,913 acres are leased for oil and gas within the GJFO's boundaries. The majority of acres open to oil and gas leasing are already leased, with the highest production areas north and east of Grand Junction. There are currently approximately 340 producing federal oil and gas wells.

Gunnison Field Office (GFO). GFO does not currently have any fluid mineral leases.

Uncompahgre Field Office (UFO). Within the UFO's boundaries, mineral development typically occurs in sedimentary strata associated with the Mancos shale and within coal seams in rock formations of the Mesa Verde Group. These fluid mineral resources (primarily natural gas) are found in the same general locations as coal resources in the North Fork of the Gunnison River in Delta and Gunnison Counties. Development of fluid mineral resources is also present in the west end of Montrose County. Overall, a low level of fluid mineral development has occurred in the UFO's boundaries in the past 5 years, with an average of one to two APDs per year. This number rose to six in 2018; it is expected to grow.

Tres Rios Field Office (TRFO). The TRFO manages about 2.1 million acres of federal mineral estate and has tribal trust responsibilities for the mineral resources of the Southern Ute and Ute Mountain Indian

¹⁰ Tight sand and shale formations are the geologic strata from which oil and natural gas can be most efficiently extracted by means of hydraulic fracturing. Other methods are not economically feasible means of recovering these resources.

Reservations. There are approximately 280 producing existing federal oil and gas wells. The existing oil and gas operations also include about 1,000 coal-bed methane wells and 70 carbon dioxide wells in the northern San Juan and Paradox geologic basins of southwestern Colorado and northwestern New Mexico.

Canyons of the Ancients National Monument (CANM). About 77 percent of CANM, which is part of the Paradox Basin, is leased for oil and gas. Production comes primarily from the McElmo Dome field (containing carbon dioxide reserves) and the overlying Island Butte II, Cutthroat, and Canyon units (producing natural gas, condensate, and oil).

Big Game Hunting

Another important use on BLM-administered lands in Colorado, in addition to mineral development, is hunting. Hunting is a popular recreational activity and is important for those who rely on hunting for subsistence use. Pursuing big game is the most popular form of hunting in Colorado for both residents of the state and those traveling from other locations. Colorado residents comprise a majority of days spent hunting in the state (at 69.8 percent), with the remainder accounted for by out-of-state parties who travel to Colorado for hunting opportunities. The average nonresident big game hunter spends more money per day than in-state residents (CPW 2017b). Big game hunting supports jobs through direct spending on guides and outfitters and indirectly through spending on equipment manufacturing, retail, transportation, and other supportive industries. **Table 3-76** displays the total economic contributions of big game hunting in Colorado, which accounts for 6,304 jobs and \$219.6 million in labor income.

Table 3-76. Total Economic Contributions of Big Game Hunting in Colorado (2017)

Source	Output (\$millions)	Labor Income (\$millions)	State/Local Taxes (\$millions)	Federal Taxes (\$millions)	Jobs
Resident	374.3	124.5	21.3	29.1	2,999
Nonresident	228.2	95.1	13.0	21.3	3,305
Total	602.4	219.6	34.4	50.4	6,304

Source: CPW 2017b

* The totals in the table may not sum due to rounding.

Table 3-77 displays the total economic contributions by county in the primary socioeconomic analysis area. These data are not specific to BLM-administered lands; instead, they include contributions associated with hunting on all lands in the noted counties. **Figure 3-15, Appendix D, Hunting Economic Output, and Table M-8, Appendix M, Total Hunting Economic Contributions by County,** show the total economic contribution from hunting across all 64 counties in Colorado. **Table 3-78** shows the economic contributions of wildlife watching by region in Colorado, in addition to hunting.

Table 3-77. Total Hunting Economic Contributions for Primary Socioeconomic Analysis Area

County	Output (\$1,000)	Labor Income (\$1,000)	State and Local Taxes (\$1,000)	Federal Taxes (\$1,000)	Jobs
Delta	6,225	1,944	641	455	129
Eagle	14,109	5,786	986	1,334	144
Fremont	2,593	915	257	206	81
Garfield	15,249	6,700	1,369	1,457	217
Gunnison	8,442	3,096	825	730	155
Mesa	26,868	8,380	1,712	2,035	392

County	Output (\$1,000)	Labor Income (\$1,000)	State and Local Taxes (\$1,000)	Federal Taxes (\$1,000)	Jobs
Moffat	11,942	4,271	807	1,037	312
Montrose	8,299	2,682	771	646	175
Park	3,364	1,138	403	279	76
Rio Blanco	9,433	4,741	1,229	708	172
Routt	13,264	5,540	1,157	1,306	219
Saguache	3,963	2,253	432	302	131
San Miguel	2,832	1,170	273	254	35

Source: CPW 2017b

Table 3-78. Total Economic Contributions of Hunting and Wildlife Watching by Region in Colorado

Use	Northwest	North Central	Metro	Northeast	Southeast	South Central	Southwest	State
Economic Output (\$millions)								
Hunting	\$136	\$221	\$166	\$20	\$24	\$93	\$55	\$843
Wildlife Watching	\$161	\$762	\$682	\$23	\$55	\$277	\$86	\$2,436
Salaries & Wages (\$millions)								
Hunting	\$50	\$65	\$53	\$8	\$8	\$28	\$22	\$280
Wildlife Watching	\$49	\$184	\$191	\$7	\$17	\$72	\$28	\$637
GDP Contribution (\$millions)								
Hunting	\$77	\$113	\$90	\$11	\$12	\$46	\$31	\$457
Wildlife Watching	\$88	\$310	\$320	\$10	\$28	\$121	\$45	\$1,071
State & Local Taxes (\$millions)								
Hunting	\$9	\$11	\$8	\$2	\$2	\$6	\$5	\$44
Wildlife Watching	\$11	\$33	\$31	\$2	\$5	\$14	\$7	\$111
Federal Taxes (\$millions)								
Hunting	\$12	\$16	\$13	\$2	\$2	\$6	\$5	\$66
Wildlife Watching	\$12	\$44	\$47	\$2	\$4	\$16	\$6	\$154
Jobs								
Hunting	1,488	1,885	1,238	368	443	1,213	869	7,937
Wildlife Watching	1,283	3,936	4,313	191	569	1,916	825	13,243

Source: CPW 2017b

Social Conditions

There are several social and geographic groups throughout the primary socioeconomic analysis area and Colorado that can be affected by management of BLM-managed lands in varying ways. Residents, visitors, commercial users, traditional or subsistence users, Tribes, and interest-based or place-based groups have distinct sets of attitudes, beliefs, values, opinions, and perceptions about BLM-managed public resources and the effects of various management policies and actions. These views reflect different cultural and economic linkages that people have with BLM-managed lands. Communities of shared interest are organizations and groups of individuals who have common interests in the use and management of BLM-managed public resources; many organizations or groups of individuals may belong to or share values with more than one communities of interest. Different types of communities of interest have distinct sets of attitudes, beliefs, values, opinions, and perceptions about BLM-managed public resources and the effects of various

management policies and actions. These views reflect different cultural and economic linkages that people have to BLM-managed lands.

Tribes are federally recognized sovereign nations who value BLM-administered lands for its cultural and spiritual significance. Tribes value protection of cultural resources and maintaining access to traditional cultural sites, which could include areas of past occupation and areas where traditional practices have occurred. Subsistence resources is often important to Tribes through the traditional, cultural, spiritual, and health and wellbeing values it provides tribal members. See **Section 3.4.1**, Native American Religious Concerns, for more details. Other groups and individuals with interests in archaeology and history also value cultural resources, though these should not be conflated with the unique relationships and responsibilities upheld by the BLM with Tribal Nations.

Habitat and resource conservation communities of interest are organizations and groups of individuals who have a number of conservation objectives, but most believe broadly that protecting at-risk species and maintaining habitats and ecosystems, such as sage grouse habitats, are fundamental values that should be a high priority in public policy (Brown et al. 2015). These communities often value conservation of wildlife, habitats, and ecosystems to ensure future generations have the opportunities to enjoy the natural resources. Persons and organizations concerned with protecting paleontological, cultural, and historic sites also generally fit into this category of resource conservation communities.

Recreation communities of shared interest are organizations and individuals who value the region for its recreational opportunities. These communities of shared interest could seek protection of areas with high recreational values, such as areas with opportunities for big game hunting. However, these views on preserving habitats and ecosystems for recreational use can conflict with the views of habitat and resource conservation communities because of the disparate reasoning behind the value of protecting lands and resources. These conflicting views create challenges for developing land use policies (Thomas and Reed 2019). See **Section 3.4.5**, Recreation, for more information on recreation use.

Mineral development and production communities of shared interest are organizations and individuals who believe mineral development is a vital component of the national, state, and local economies—creating jobs, generating income, and contributing tax and royalty payments to all levels of government. Throughout the West, many of these stakeholders also believe mineral development and production are socially important because they have been part of the social fabric of some communities for years, and because they support the social systems of local communities by providing private sector livelihoods and revenues to government. See **Section 3.2.1**, Geology and Fluid Minerals, for more details on mineral development in the planning area.

Intertwined with the above communities of shared interest are local residents throughout the counties in the primary socioeconomic analysis area and Colorado. Some residents seek to preserve the historical way of life in the community. These residents are concerned about changes in the character of the community. However, there could be different views on the character of the community. For example, some residents might welcome the opportunities that oil and gas development provides, such as increased economic contributions through employment, earnings, and business opportunities. On the other hand, some residents might value preserving the natural resources in the surrounding public lands for the enjoyment of future generations, and they might see oil and gas development as in opposition of this goal.

Environmental Consequences

The following discussion is focused on the issues identified for analysis and describes how the alternatives might impact current conditions that were described in the previous section. The economic data presented in this discussion include annual averages for the most recent reporting periods. These include the widespread economic effects of the recession brought about by the 2020 global COVID-19 pandemic, which have impacted local and regional economies through short-term reductions in employment and industry output. Additionally, there has been an increase in employees working remotely, or working from home, due to the COVID-19 pandemic, which has contributed to a large rise in housing prices in certain locations. The effects of the COVID-19 pandemic may be ongoing and may not be evenly distributed across industries or locations.

Issue 1: What is the economic impact associated with potentially decreased levels of oil and gas development?

Analytical Methods and Assumptions

Oil and gas development could be impacted by the alternatives in several ways. First, the reduction in lands open to leasing could have a local and regional economic impact due to a reduction in oil and gas production and revenue and a reduction in drilling and completion expenditures. The local governments could also be impacted due to reduced tax revenues and fewer dollars flowing through to the local economies. Additionally, the disturbance density threshold policy under some of the alternatives could impact private landowners or private mineral owners by limiting oil and gas development on split estate lands or making oil and gas development more costly. The following discussion outlines the methodology for calculating the impacts from changes in production, drilling and completion expenditure, and tax revenue, under the alternatives. The results of the impact analysis are expanded to the 64-county planning area (the state of Colorado) rather than just the primary socioeconomic analysis area.

Production and Expenditure Impacts

The impacts of oil and gas development under Alternative A, the No Action Alternative, were modeled using the Impact Analysis for Planning Model (IMPLAN), an input-output model that measures the indirect and induced impacts from a one-time direct change to the economy due to increases or decreases in expenditures, employment, or income. The outputs calculated from IMPLAN include gross regional economic output, employment, or labor income. Indirect impacts occur from changes to gross regional economic output, employment, or labor income due to changes in expenditures in other industries to support the oil and gas industry (for example, changes in supply purchases made by oil and gas operators). Induced impacts occur from changes to gross regional economic output, employment, or labor income due to changes in other industries from changes in personal and household income of oil and gas operators (for example, changes in purchases at local stores for personal groceries).

The direct impacts were calculated from projected revenue per well and expenditures from drilling and well completion costs per well. These impacts per well were then multiplied by the projected number of wells in the reasonably foreseeable future scenario to calculate the total direct impacts from oil and gas development in Colorado.

Projected revenue from 2025 to 2050 was calculated using projected annual wellhead prices, from the 2022 Annual Energy Outlook (AEO) scenarios published by the US Energy Information Administration (EIA) (EIA 2022c), and projected annual production for wells existing in 2025 and wells developed from 2025 to 2050 from BLM Regional Modeling Study Scenario B. Annual production was calculated from the BLM Regional Modeling Study Scenario B by applying the annual production growth factor from the reference case, the high oil and gas supply case, or the low oil and gas supply case from 2022 AEO Lower 48 Onshore Rocky

Mountain Regional oil and gas tables, depending on which case most closely corresponded to the oil and gas market in each state (BLM 2022i, EIA 2022c). **Table 3-79** shows the projected production for existing and new oil and gas wells in 2025 and 2050 in the state of Colorado and the combined primary socioeconomic analysis area for each alternative. **Table M-9, Appendix M, Projected Gas Production by Alternative** (MMSCF per year), and **Table M-10, Appendix M, Projected Oil Production by Alternative** (Mbbbl per year), show the projected oil and gas production data broken out by each county in the primary socioeconomic analysis area as well as by each field office in Colorado for each alternative. Projected oil and gas production under Alternative A represents the forecast under a no-action scenario and assumes that the current conditions continue. Under Alternatives B, C, and D, there would be varying levels of stipulations and restrictions on oil and gas development. These stipulations and restrictions could deter operators from leasing, drilling, and producing oil and gas on BLM-administered lands. Instead, operators could choose to develop oil and gas on non-federal lands or they could choose to reduce production altogether. Either one of these decisions would likely lead to less oil and gas production. This means that oil and gas production from federal minerals is expected to be lower under Alternatives B, C, and D than under Alternative A due to the increase in areas closed to oil and gas development or open with stipulations on oil and gas development.

Table 3-79. Projected Oil and Gas Production for All Alternatives

Combined Region	Alternative	Total Gas Production (MMSCF per year)		Total Oil Production (Mbbbl per year)	
		2025	2050	2025	2050
Colorado	Alternative A	414,309	513,667	18,001	21,662
	Alternative B/C	408,552	510,374	17,980	21,652
	Alternative D	408,453	510,323	17,980	21,652
Primary Socioeconomic Analysis Area	Alternative A	346,990	429,129	3,287	2,593
	Alternative B/C	341,293	425,890	3,277	2,587
	Alternative D	341,221	425,850	3,277	2,587

Sources: BLM 2022i

*Existing wells were assumed to decline in production based on a typical production curve for each well type. Total production includes production from wells that were drilled to replace the retiring wells.

Total expenditures from drilling and completion costs are calculated by multiplying the projected number of wells by the estimated percentage of type of well and the drilling and completion costs by well type. Annual well counts were calculated based on annual spud rates approved in the RMP for each Field Office; the spud rates are constant for each year and only occur until the last year of the RMP for the applicable Field Office. Drilling and completion costs were gathered from each field office based on the best available information. **Table 3-80** shows the number of projected existing wells in 2025 and the projected total wells in 2044 (after 2044, all existing RMPs are expected to have an approved revised plan in place) in the state of Colorado and the combined primary socioeconomic analysis area for each alternative (see **Table M-11, Appendix M, Total Number of Projected Oil and Gas Wells by Alternative**, for the data on well counts in 2025 and 2044 broken out by each counties in the primary socioeconomic analysis area as well as by each field office in Colorado for each alternative). **Table 3-81** shows the estimated percentage of well type in each field office.

Table 3-80. Number of Projected Oil and Gas Wells by Alternative

Combined Region	Existing Oil and Gas Wells in 2025	Total Oil and Gas Wells in 2044		
		Alternative A	Alternative B/C	Alternative D
Colorado	13,031	16,038	15,744	15,740
Primary Socioeconomic Analysis Area	9,789	11,437	11,150	11,147

Sources: BLM 2022i

*Existing wells were assumed to decline in production based on a typical production curve for each well type. Total projected wells include wells that were drilled to replace the retiring wells.

Table 3-81. Percentage of Types of Wells in Each Field Office (2022)

Field Office	Directional	Horizontal	Vertical
Royal Gorge	4 percent	54 percent	41 percent
Colorado River Valley	90 percent	1 percent	9 percent
Little Snake	11 percent	4 percent	85 percent
Tres Rios	28 percent	15 percent	57 percent
Grand Junction	43 percent	5 percent	51 percent
White River	41 percent	0 percent	58 percent

Sources: BLM 2022h

This analysis assumes that the percentages of well types do not change from current percentages. There might be changes in percentages of well types due to the inclusion of additional CSU, NSO, and TL stipulations. For example, horizontal and directional wells might increase to gain access to minerals under surface lands that are no longer open to leasing. If these proportions change, the total weighted costs and expenditures for well development would increase (because directional and horizontal drilling tends to be more costly than vertical drilling). The change in projected well types is not currently known, so these impacts are discussed qualitatively.

Tax Revenue Impacts

Changes in mineral development would also impact the tax revenue received by the county. The impact to tax revenue from royalties is calculated from the projected production revenue and the royalty rate (16.67 percent for new leases). The impacts to the revenue from Severance Tax is calculated from the severance tax rate.

Environmental Consequences

Impacts Common to All Alternatives

The data collected to calculate projected revenue and well development costs for this impacts analysis are based on historical data prior to the passing of the IRA. Revenue and production from new oil and gas leases is expected to change as a result of the changes from the implementation of the IRA, such as the increases in royalty rates and rental rates. For example, the increase in rates might further lead developers to choose to operate on non-federal lands, rather than federal lands. Such impacts would occur under all alternatives. However, the magnitude of these potential changes is not yet known.

Alternative A

Under Alternative A, there would be no change to acres closed to leasing. Mineral development would be expected to continue similar to current and historical trends.

Table 3-82 and **Table 3-83** show the average annual number of jobs, labor income, and total net economic output that could result from projected oil and gas development from 2025 to 2050, under Alternative A, for the entire planning area combined (all counties in Colorado) and the primary socioeconomic analysis area combined, respectively. Oil and gas revenue and well development are expected to have the highest economic contributions from 2030 to 2034 and the lowest contributions from 2045 to 2050. This is because the timelines for the RMPs throughout Colorado end from 2032 to 2044, with the majority of the RMPs ending in 2035, and the analysis does not consider new well development after the end of the current RMPs. Trends in oil and gas development after 2044 would be analyzed in support of future RMP revisions and are beyond the scope of this socioeconomic analysis. The 2030 to 2034 time period has the highest projected economic contributions, on average, from oil and gas revenue and well development because it the last few years of production and development in the expected life of the RMPs end. On average, from 2030 to 2034, oil and gas revenue and well development in the state of Colorado is expected to result in about 19,579 jobs, \$2.9 billion in labor income, and nearly \$6.7 billion in net economic output per year. From 2045 to 2050, oil and gas revenue and well development is expected to result in nearly 17,100 jobs, about \$2.5 billion in labor income, and \$5.8 billion in net economic output per year. Most of the direct economic contribution impacts on employment and economic output from oil and gas revenue and well development would occur in the primary socioeconomic analysis area, however the total impacts in the primary socioeconomic analysis area are less than half of the total impacts in the state of Colorado. From 2030 to 2034, on average, oil and gas production and development could support over 7,100 total jobs, \$500 million in labor income, and \$2.5 billion in net economic output per year in the primary socioeconomic analysis area. From 2045 to 2050, oil and gas revenue and development could result in nearly 5,300 jobs, about \$380 million in labor income, and \$1.8 billion in net economic output.

Table 3-82. Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative A

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,822	5,530	9,276	17,628
	2030-2034	3,135	6,141	10,303	19,579
	2035-2039	2,952	5,784	9,703	18,439
	2040-2044	2,925	5,731	9,615	18,271
	2045-2050	2,737	5,362	8,995	17,094
Labor Income (2023\$ Millions)	2025-2029	1,421	636	564	2,621
	2030-2034	1,578	707	626	2,911
	2035-2039	1,486	666	590	2,742
	2040-2044	1,473	660	585	2,717
	2045-2050	1,378	617	547	2,542
Net economic output (2023\$ Millions)	2025-2029	2,953	1,321	1,750	6,024
	2030-2034	3,280	1,468	1,943	6,691
	2035-2039	3,089	1,382	1,830	6,301
	2040-2044	3,061	1,370	1,813	6,244
	2045-2050	2,864	1,281	1,697	5,842

Source: IMPLAN model 2023

Table 3-83. Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative A

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,284	2,804	1,350	6,439
	2030-2034	2,535	3,112	1,498	7,146
	2035-2039	2,119	2,601	1,252	5,972
	2040-2044	1,930	2,369	1,140	5,440
	2045-2050	1,867	2,292	1,103	5,262
Labor Income (2023\$ Millions)	2025-2029	217	185	64	466
	2030-2034	241	205	72	518
	2035-2039	202	171	60	433
	2040-2044	184	156	54	394
	2045-2050	178	151	53	381
Net economic output (2023\$ Millions)	2025-2029	1,495	542	220	2,256
	2030-2034	1,659	601	244	2,504
	2035-2039	1,386	503	204	2,093
	2040-2044	1,263	458	186	1,906
	2045-2050	1,221	443	179	1,844

Source: IMPLAN model 2023

Under Alternative A, there would be no change to tax revenues. The exact projected tax revenue depends on the severance tax rate, which is dependent on the size of the operations and can range from 2 to 5 percent (Colorado Legislative Council Staff 2023). The severance tax revenue under Alternative A could range from about \$41 million (from 2025 to 2029, with 2 percent rate) to nearly \$130 million (from 2045 to 2050, with 5 percent rate), on average. The revenue from royalties, on average, is projected to be about \$343 million from 2025 to 2029 and \$433 million from 2045 to 2050 (see Table 3-84).

Table 3-84. Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative A, 2025-2050 (\$000)

Average Year Range	Royalty Revenue	Severance Tax Revenue (with 2 percent rate)	Severance Tax Revenue (with 5 percent rate)
2025-2029	\$343,277	\$41,185	\$102,963
2030-2034	\$393,539	\$47,215	\$118,038
2035-2039	\$418,620	\$50,224	\$125,561
2040-2044	\$427,745	\$51,319	\$128,298
2045-2050	\$433,240	\$51,978	\$129,946

Source: BLM 2022i, H.R. 5376 2022, Colorado Legislative Council Staff 2023

Alternative B

Under Alternative B, the acres closed to leasing would be the same as under Alternative A. However, the areas open to leasing subject to NSO, CSU, and TL would be 172,000, 4,775,000, and 1,339,000 acres more than under Alternative A, respectively. Additionally, under Alternative B, there would be a surface disturbance density limitation of 1/640. The change in acres subject to NSO, CSU, and TL stipulations and the disturbance density limitation increase constraints on federal lands for oil and gas developers, which might lead to increased incentives to develop wells on adjacent non-federal lands or reduced well development altogether. If fewer oil and gas operators choose to develop wells on federal lands, that might result in less production on federal lands and reduced mineral royalties. If there is a reduction in overall oil

and gas production and well development due to the increased stipulations, then there might be a reduction in regional net economic output, labor income, and employment, as compared to Alternative A.

Table 3-85 and **Table 3-86** show the potential economic contributions that may result, under Alternative B, from projected oil and gas development from 2025 to 2050 for the entire planning area combined (all counties in Colorado) and the primary socioeconomic analysis area combined, respectively. Oil and gas operators could decide to reduce well development and production due to the stipulations and surface disturbance density limitation, under Alternative B, which could result in a reduction in economic contributions of over 600 jobs, about \$98 million in labor income, and \$226 million in net economic output annually throughout Colorado, from 2030 to 2034, compared with Alternative A. In the primary socioeconomic analysis area, the reduction in economic contributions based on a reduction in well development could range from a loss of 41 to 484 jobs, \$3 million to \$35 million in labor income, and \$15 million to \$169 million in net economic output, compared with Alternative A, for the 2045 to 2050 and 2030 to 2034 time period, respectively.

Table 3-85. Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative B

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,730	5,349	8,974	17,054
	2030-2034	3,029	5,934	9,956	18,919
	2035-2039	2,913	5,707	9,574	18,194
	2040-2044	2,916	5,713	9,584	18,213
	2045-2050	2,735	5,359	8,991	17,085
Labor Income (\$ Millions)	2025-2029	1,375	616	546	2,536
	2030-2034	1,525	683	605	2,813
	2035-2039	1,466	657	582	2,705
	2040-2044	1,468	658	583	2,708
	2045-2050	1,377	617	547	2,541
Net economic output (\$ Millions)	2025-2029	2,857	1,278	1,693	5,828
	2030-2034	3,169	1,418	1,878	6,465
	2035-2039	3,048	1,364	1,806	6,217
	2040-2044	3,051	1,365	1,808	6,224
	2045-2050	2,862	1,281	1,696	5,839

Source: IMPLAN model 2023

Table 3-86. Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative B

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,138	2,625	1,263	6,027
	2030-2034	2,364	2,902	1,397	6,662
	2035-2039	2,052	2,519	1,212	5,783
	2040-2044	1,908	2,343	1,128	5,379
	2045-2050	1,852	2,274	1,094	5,221
Labor Income (2023\$ Millions)	2025-2029	203	173	60	437
	2030-2034	225	191	67	483
	2035-2039	195	166	58	419
	2040-2044	182	154	54	390
	2045-2050	176	150	52	378

Metric	Average Year Range	Direct	Indirect	Induced	Total
Net economic output (2023\$ Millions)	2025-2029	1,399	507	206	2,112
	2030-2034	1,547	561	227	2,335
	2035-2039	1,343	487	197	2,027
	2040-2044	1,249	453	183	1,885
	2045-2050	1,212	439	178	1,829

Source: IMPLAN model 2023

Under Alternative B, the increase in land subject to stipulations might increase the need for more horizontal and directional drilling, rather than vertical drilling to access federal minerals that are under land with stipulations. This change in proportion of horizontal and directional drilling might increase the cost and expenditures for drilling and well completion, which would result in a bigger direct impact to the local and regional economy. This in turn would result in higher net economic output, more jobs, and higher labor income. The magnitude of impact on the economy would depend on the proportional change of drilling types. It is not clear whether the increase in economic output from increased costs would offset the decrease in economic output from less production and well development.

Under Alternative B, the reduction in oil and gas production revenue due to fewer developed wells on federal lands resulting from more acres with stipulations, could result in a reduction in tax revenues compared to under Alternative A. **Table 3-87** shows the estimated average tax revenue for Colorado under Alternative B. Under Alternative B, the reduction in oil and gas production, compared with Alternative A, could lead to a reduction in royalty revenue ranging from about \$229,000 per year in 2045-2050 to \$5.9 million per year in 2030-2034, on average. Revenue from severance tax depends on the percent rate, but under Alternative B, it could decrease by a range of about \$27,000 per year (from 2045 to 2050, with 2 percent rate) to about \$1.8 million (from 2030 to 2034, with 5 percent rate), on average, compared with Alternative A.

Table 3-87. Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative B, 2025-2050 (\$000)

Average Year Range	Royalty Revenue	Severance Tax Revenue (with 2 percent rate)	Severance Tax Revenue (with 5 percent rate)
2025-2029	\$339,743	\$40,761	\$101,903
2030-2034	\$387,661	\$46,510	\$116,275
2035-2039	\$414,743	\$49,759	\$124,398
2040-2044	\$426,485	\$51,168	\$127,920
2045-2050	\$433,011	\$51,951	\$129,877

Source: BLM 2022i, H.R. 5376 2022, Colorado Legislative Council Staff 2023

Alternative C

Under Alternative C, the acres closed to leasing would be the same as under Alternative A and Alternative B, and the area open to leasing subject to NSO, CSU, and TL would be the same as under Alternative B. Under Alternative C, there would be a surface disturbance density limitation of 1/640, which is the same as under Alternative B. The impacts on well development, the regional economy, and royalty revenue from increased areas subject to stipulations and surface disturbance density limitations would be the same as under Alternative B. Under Alternative C, there would be a three percent disturbance threshold that would not be present under Alternatives A and B. This disturbance threshold could further limit the development of oil and gas on federal lands, however, the impact on economic contributions from the three percent

disturbance threshold is likely to be minimal because it is assumed that operators would still develop on lands not subject to the threshold (e.g., private lands).

Table 3-88 and **Table 3-89** show the potential economic contributions that may result, under Alternative C, from projected oil and gas development from 2025 to 2050 for the entire planning area combined (all counties in Colorado) and the primary socioeconomic analysis area combined, respectively. The economic contributions from jobs, income, and economic output is the same as under Alternative B.

Table 3-88. Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative C

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,730	5,349	8,974	17,054
	2030-2034	3,029	5,934	9,956	18,919
	2035-2039	2,913	5,707	9,574	18,194
	2040-2044	2,916	5,713	9,584	18,213
	2045-2050	2,735	5,359	8,991	17,085
Labor Income (\$ Millions)	2025-2029	1,375	616	546	2,536
	2030-2034	1,525	683	605	2,813
	2035-2039	1,466	657	582	2,705
	2040-2044	1,468	658	583	2,708
	2045-2050	1,377	617	547	2,541
Net economic output (\$ Millions)	2025-2029	2,857	1,278	1,693	5,828
	2030-2034	3,169	1,418	1,878	6,465
	2035-2039	3,048	1,364	1,806	6,217
	2040-2044	3,051	1,365	1,808	6,224
	2045-2050	2,862	1,281	1,696	5,839

Source: IMPLAN model 2023

Table 3-89. Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative C

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,138	2,625	1,263	6,027
	2030-2034	2,364	2,902	1,397	6,662
	2035-2039	2,052	2,519	1,212	5,783
	2040-2044	1,908	2,343	1,128	5,379
	2045-2050	1,852	2,274	1,094	5,221
Labor Income (2023\$ Millions)	2025-2029	203	173	60	437
	2030-2034	225	191	67	483
	2035-2039	195	166	58	419
	2040-2044	182	154	54	390
	2045-2050	176	150	52	378
Net economic output (2023\$ Millions)	2025-2029	1,399	507	206	2,112
	2030-2034	1,547	561	227	2,335
	2035-2039	1,343	487	197	2,027
	2040-2044	1,249	453	183	1,885
	2045-2050	1,212	439	178	1,829

Source: IMPLAN model 2023

Under Alternative C, the impact on tax revenues resulting from more acres with stipulations would be the same as under Alternative B (see **Table 3-90**).

Table 3-90. Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative C, 2025-2050 (\$000)

Average Year Range	Royalty Revenue	Severance Tax Revenue (with 2 percent rate)	Severance Tax Revenue (with 5 percent rate)
2025-2029	\$339,743	\$40,761	\$101,903
2030-2034	\$387,661	\$46,510	\$116,275
2035-2039	\$414,743	\$49,759	\$124,398
2040-2044	\$426,485	\$51,168	\$127,920
2045-2050	\$433,011	\$51,951	\$129,877

Source: BLM 2022i, H.R. 5376 2022, Colorado Legislative Council Staff 2023

The quantified impacts on economic contributions, analyzed and discussed above, from production revenue, well development costs and tax revenue may not capture all of the economic impacts, as they are limited to an examination of federal mineral development. The 3-percent density disturbance threshold, under Alternative C, may have further economic impacts on split estate lands, for example. While the impacts on split estate lands is difficult to quantify, the impacts can be qualitatively discussed. For split estate lands with federal mineral owners and non-federal surface landowners, sub-surface mineral rights development would be subject to additional requirements, including potential for issuance of a Surface Owner Damages Bond to compensate for losses. These protections would likely mitigate the impacts that might occur on private property from oil and gas development. For split estate lands with non-federal mineral owners and BLM-administered surface land, the 3-percent density disturbance threshold or the mosaic of development densities that BLM may consider could result in restrictions on use of the surface lands that increase the cost for private mineral owners to access their minerals. Under this scenario, oil and gas developers may need to use directional or horizontal drilling to access the minerals—which are more costly than vertical wells—and in some cases, these drilling techniques could be cost prohibitive, leading oil and gas developers to choose other locations for their operations. This could lead to economic impacts on private mineral rights holders if the density disturbance threshold leads to less interest in oil and gas development on their subsurface estate.

Alternative D

Under Alternative D, the acres closed to leasing would be 4,031,000 acres more than under Alternative A. The area open to leasing subject to CSU would be 748,000 acres more than under Alternative A, but the area open to leasing subject to NSO and TL would be 829,000 and 2,485,000 acres less than under Alternative A, respectively. Overall, there would be 1,465,000 more acres that are closed to leasing or open to leasing subject to stipulations, under Alternative D compared to Alternative A. The change in acres closed and subject to stipulations would result in similar impacts on oil and gas development as under Alternative B; however, the magnitude of those impacts would likely be greater. Under Alternative D, there would be a density threshold of three percent, and this threshold would consider disturbance on all lands, including BLM-administered land, private land, and state land. This density threshold is the most limiting out of all the alternatives, which may result in further reductions in oil and gas development on federal and non-federal lands.

Table 3-91 and **Table 3-92** show the potential economic contributions that may result, under Alternative D, from projected oil and gas development from 2025 to 2050 for the entire planning area combined (all counties in Colorado) and the primary socioeconomic analysis area combined, respectively. Oil and gas operators could decide to reduce well development and production due to the stipulations and surface disturbance density limitation, under Alternative D, which could result in a reduction in economic contributions of about 674 jobs, \$100 million in labor income, and \$230 million in net economic output annually throughout Colorado, from 2030 to 2034, compared with Alternative A. In the primary socioeconomic analysis area the reduction in economic contributions could range from a loss of 42 to 488 jobs, \$3 million to \$36 million in labor income, and \$15 million to \$171 million in net economic output, compared with Alternative A, for the 2045 to 2050 and 2030 to 2034 time period, respectively.

Table 3-91. Average Annual Economic Contributions from Projected Oil and Gas Revenue and Well Development for the State of Colorado Combined, Under Alternative D

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,729	5,346	8,968	17,042
	2030-2034	3,027	5,930	9,948	18,905
	2035-2039	2,912	5,705	9,571	18,188
	2040-2044	2,916	5,712	9,583	18,211
	2045-2050	2,735	5,359	8,990	17,084
Labor Income (\$ Millions)	2025-2029	1,374	615	545	2,534
	2030-2034	1,524	683	605	2,811
	2035-2039	1,466	657	582	2,705
	2040-2044	1,468	657	583	2,708
	2045-2050	1,377	617	547	2,540
Net economic output (\$ Millions)	2025-2029	2,855	1,277	1,691	5,824
	2030-2034	3,167	1,417	1,876	6,461
	2035-2039	3,047	1,363	1,805	6,215
	2040-2044	3,051	1,365	1,807	6,223
	2045-2050	2,862	1,281	1,696	5,838

Source: IMPLAN model 2023

Table 3-92. Average Annual Economic Contributions from projected Oil and Gas Revenue and Well Development for the Primary Analysis Area Combined, Under Alternative D

Metric	Average Year Range	Direct	Indirect	Induced	Total
Employment	2025-2029	2,137	2,624	1,263	6,023
	2030-2034	2,362	2,900	1,396	6,658
	2035-2039	2,051	2,518	1,212	5,781
	2040-2044	1,908	2,342	1,127	5,378
	2045-2050	1,852	2,274	1,094	5,220
Labor Income (2023\$ Millions)	2025-2029	203	173	60	436
	2030-2034	225	191	67	482
	2035-2039	195	166	58	419
	2040-2044	182	154	54	390
	2045-2050	176	150	52	378

Metric	Average Year Range	Direct	Indirect	Induced	Total
Net economic output (2023\$ Millions)	2025-2029	1,398	507	205	2,111
	2030-2034	1,546	560	227	2,333
	2035-2039	1,342	487	197	2,026
	2040-2044	1,249	453	183	1,885
	2045-2050	1,212	439	178	1,829

Source: IMPLAN model 2023

Under Alternative D, the increase in acres closed to mineral leasing, which could result in a decrease in wells developed on federal lands and a reduction in production revenue, might also result in a reduction in tax revenue, compared to under Alternative A. **Table 3-93** shows the estimated average tax revenue for Colorado under Alternative D. Compared to Alternative A, the reduction in oil and gas production could lead to a reduction in royalty revenue of as much as about \$6 million per year from 2030-2034, on average. This difference of royalty revenue under Alternative B compared with Alternative A would likely drop to a difference of about \$250 thousand per year from 2045-2050, as production per well is expected to diminish. Revenue from severance tax could reduce, under Alternative B, by about \$31 thousand per year (from 2045 to 2050, with 2 percent rate) to \$1.8 million (from 2030 to 2034, with 5 percent rate), on average.

Table 3-93. Average Annual Projected Tax Revenue for the State of Colorado Combined, Under Alternative D, 2025-2050 (\$000)

Average Year Range	Royalty Revenue	Severance Tax Revenue (with 2 percent rate)	Severance Tax Revenue (with 5 percent rate)
2025-2029	\$339,672	\$40,753	\$101,881
2030-2034	\$387,531	\$46,494	\$116,236
2035-2039	\$414,643	\$49,747	\$124,368
2040-2044	\$426,442	\$51,163	\$127,907
2045-2050	\$432,983	\$51,948	\$129,869

Source: BLM 2022i, H.R. 5376 2022, Colorado Legislative Council Staff 2023

The economic contributions analyzed and discussed above may not capture all of the economic impacts, as they are limited to an examination of federal mineral development. The 3-percent density disturbance threshold, under Alternative D, may have further economic impacts on split estate lands, similar to under Alternative C, and could economically impact private landowners or private mineral estate owners.

Cumulative Impacts

Under all alternatives, the Greater and Gunnison sage-grouse planning efforts could result in decisions that contribute to cumulative impacts by placing more constraints on mineral development in areas where sage-grouse habitats overlap with big game HPH.

Alternative A would have no direct or indirect impacts on oil and gas development, so cumulative impacts of the alternative when combined with impacts of past, present, and reasonably foreseeable future actions would be similar to trends described for the existing environment.

Under all action alternatives, past, present, and reasonably foreseeable future actions may contribute to cumulative impacts on oil and gas development to the extent that these actions contribute to surface disturbance and are considered as part of the surface disturbance limitations and the disturbance threshold. These actions may include energy and other mineral development, lands, realty, and cadastral survey, livestock grazing and agriculture, road construction, vegetation and fire and fuels management. The

magnitude in which these projects would contribute to cumulative impacts would depend on the project and would require a site-specific analysis and discussion.

Issue 2: How will protection of big game HPH influence management of energy resources and social and economic values?

Analytical Methods and Assumptions

For the purposes of this analysis, the nature and type of effects from protection of big game HPH on social, environmental and economic considerations are analyzed in terms of how management actions would affect fluid mineral development and production on federal lands allocated to the protection of big game HPH. The effects described here are qualitative assertions based on best available information and professional judgement.

Environmental Consequences

Community Effects

Under all action alternatives, depending on the degree to which stipulations affected the accessibility of leased federal fluid mineral estate, economic effects from the reduction in oil and gas development would be likely and would be spread throughout the planning area, with the biggest impacts likely occurring in the primary socioeconomic analysis area. The effects on local labor force engaged in oil production, as well as for oil and gas well drilling and completion and other support industries, would be felt most acutely by those workers currently employed in the mineral development industry, those currently unemployed who might otherwise have gained employment in the industry and, potentially, those who might have relocated on a temporary or permanent basis to the planning area.

Federal policy and regulations such as increasing stipulations on federal lands for oil and gas development can directly impact private businesses' revenue and decision making. For example, increases in restrictions to oil and gas development on BLM-administered lands could lead to private businesses choosing to conduct their business in other counties or states. This impact on private industry could lead to reductions in jobs, income, population, tax revenue, and economic resources, especially in areas that are dependent on oil and gas industry and are often more susceptible to changes in economic conditions. Businesses already face more costs due to regulatory changes. After Senate Bill 19-181 passed in Colorado, there was a reduction in employment in the energy industry, which could have been partially due to the regulations increasing costs for businesses (Newburn 2022). Under all alternatives, there could be additional costs to businesses from regulations.

There are also potential indirect effects on the local economy as a result of reduced employment from reduced oil and gas development, including lack of spending on hotels, restaurants, and equipment purchases. These effects on reduced spending in other industries might result in fewer jobs in those industries, which might cause spillover effects to other industries.

Increases in unemployment often cause economic instability in rural communities, and the stress of financial uncertainty and instability can negatively affect the well-being of residents. During periods of economic downturns from reduced mineral development, increased rates of depression have been reported. In addition, demand for public services, including public assistance programs, alcohol and drug treatment, and law enforcement, has also been observed to increase during economic downturns following slowed activity and lower employment in mineral extraction industries (Shandro et al. 2011). Collectively, these factors can adversely affect community cohesion and the quality of life in affected communities (Klasic et al. 2022). It

should be noted, however, that job losses in some industries may be offset by job gains in other industries, although this tradeoff may occur outside of the local area economy.

Decreased oil and gas development might also result in decreased tax revenue and tax collections (for example, less severance tax), which would result in impacts to local governments as well as the programs and public services that rely on the tax revenue for funding (for example, flood control or water supply projects administered by the Colorado Water Conservation Board as well as educational institutions).

The potential for localized impacts on quality-of-life indicators due to loss in oil and gas development-related revenues and employment could also occur depending upon the level of anticipated reduction. BLM management actions that change development levels or have population growth-inducing effects could change the social setting and nonmarket contributions for communities and groups of interest. Those who prioritize resource conservation could also experience beneficial effects on values such as open space, viewshed, and recreational opportunities. In contrast, values important for mineral estate owners and those who prioritize resource use could be adversely affected by reduced mineral development. These impacts would largely occur in counties with a large number of acres of BLM-administered surface and/or subsurface mineral estate overlapping with big game priority habitat, as discussed above. The 13 counties in the primary socioeconomic area, with the highest potential for impacts due to the large acreages or percentage of land that overlaps big game priority habitat and BLM-administered land, are: Delta, Eagle, Fremont, Garfield, Gunnison, Mesa, Moffat, Montrose, Park, Rio Blanco, Routt, Saguache, and San Miguel Counties.

Recreational Uses

Recreation is a component of many lifestyles in the study area and is an important element of the overall quality of life for many residents. The BLM manages a wide range of dispersed and casual use recreation, such as camping, hiking, and hunting (subject to state regulation). In 2021, recreation on BLM-administered lands throughout the state of Colorado supported almost 11,000 jobs and \$1.4 billion in economic output (BLM 2022f).

Under Alternative A, the continued closures and restrictions on surface occupancy and use in some areas could result in benefits to recreational access and public enjoyment of recreational opportunities in those areas. However, under Alternative A, the limited restrictions on oil and gas development would result in continued impacts on big game, which would continue to limit the availability of big game for hunting. This would impact both the number of licenses, as Colorado Parks and Wildlife determines the number of licenses to issue based on big game populations, as well as hunting successes. Alternative A would have similar impacts on wildlife viewing.

Under the action alternatives, depending upon the extent of closures (under Alternative D) and degree to which stipulations are applied to the development of fluid minerals, recreational uses would receive benefits from enhanced access in the relative absence of oil and gas development. There would be reduced impacts on big game habitat and availability under the action alternatives as compared with Alternative A, which might increase the number of big game hunting licenses and hunting successes. Additionally, the reduced impacts on big game habitat would increase the opportunities and enhance user experience for wildlife viewing and related recreational activities.

Cumulative Impacts

Under all alternatives, there could be cumulative impacts on the local communities from past, present, and reasonably foreseeable future actions, if these actions further limit oil and gas development and recreation opportunities. However, these impacts would be site specific and depend on the project. The Greater and

Gunnison sage-grouse planning efforts could contribute to cumulative impacts if they result in decisions that further constrain mineral development in areas where sage-grouse habitats overlap with big game HPH, which could put more strain on the local economies.

Issue 3: How will BLM's management decisions affect the values people and communities enjoy from public lands in the planning area?

Analytical Methods and Assumptions

For the purposes of this analysis, the nature and type of effects from management decisions on values of public lands are analyzed in terms of how management actions would affect oil and gas development and production on federal lands allocated to the protection of big game HPH. The effects described here are qualitative assertions based on best available information and professional judgement.

Environmental Consequences

The value of goods traded in a market can be obtained from information on the quantity sold and its market price. For some goods supported by natural resources however, markets do not exist for some resources, such as recreation opportunities and environmental services. Measuring their value is important, since without estimates, these resources may be implicitly undervalued, and decisions regarding their use may not accurately reflect their true value to society. Because these recreation and environmental values are not traded in markets, they can be characterized as non-market values.

Both market and nonmarket values can be discussed in the framework of ecosystem services. These represent goods and services that an ecosystem provides for human use. Impacts on ecosystem services from mineral development activities would include potential impacts on provisioning services¹¹ of minerals and water; regulating services, such as maintenance of water and air quality; supporting services of habitat for wildlife; and information services related to aesthetic values and recreation opportunities. Regarding agricultural values, for example, the potential decrease in availability or increasing costs of nitrogen-based fertilizers derived as a byproduct of oil and gas production activities¹² could affect the economic viability of certain agricultural commodities, with impacts to agricultural producers, although the nature and extent of such effects is difficult to quantify given that they would extend to communities and economies beyond those identified as primary areas within the socioeconomic study area.

Under all alternatives, depending on how much stipulations affected the degree to which leased federal fluid mineral estate could be accessed, effects on the market and non-market value of public lands from the reduction in oil and gas development would be likely and would be spread throughout the planning area, with the biggest impacts likely occurring in the primary socioeconomic analysis area.

Research has found that while both market and non-market benefits of oil and gas development are geographically widespread, many of the non-market costs are concentrated in the areas of drilling, creating disproportionate effects that may drive much of the controversy over the use of particular extraction methods such as hydraulic fracturing (Loomis and Haelele 2017). Drilling and hydraulic fracturing have been shown to impact human health, air pollution, water quality, noise and visual resources, and wildlife habitat

¹¹ Provisioning services are the products directly obtained from ecosystems for basic human needs (for example, food, water, minerals, shelter, and fuel).

¹² One of the by-products of oil refining is petroleum coke, also known as 'coke' or 'petcoke'. With over 80 percent carbon, petroleum coke is essential to the manufacture of fertilizer, where it undergoes a gasification process to create ammonia and urea ammonium nitrate. This is then used to create nitrogen fertilizers. In addition, natural gas is used as feedstock to make nitrogenous fertilizers and a range of chemical products including ammonia, hydrogen, and methanol.

fragmentation, which lead to reduced nonmarket values (Loomis Haefele 2017, Johnston et al. 2020, Yale School of Public Health 2022). There is a large body of literature that have shown links between proximity to oil and gas drilling and impacts on human health, including negative pregnancy outcomes, hospitalizations, asthma, poor mental health or stress, higher blood pressure, and cancer (Yale School of Public Health 2022, Johnston et al. 2023, Richards 2023, McKenzie et al. 2016). Perceptions of mineral resources impacts on quality of life are highly subjective. A recent study in Colorado (Malin et al. 2019) indicates that divergent views regarding perceptions of quality of life and the perceived impacts of oil and gas production are driven by political ideology and party affiliation. Mineral development can also affect different aspects of the economy in both adverse and beneficial ways. A study in Colorado found home prices were reduced by approximately 35 percent when highly intensive drilling (or, around 16 wells) occurred within a mile of the house (Boslett et al. 2019). In a study done on nonurban areas across the US, it was found that incomes were 11 percent higher in counties with shale development than their non-shale counterparts and “boom” counties had incomes that were 29 percent higher (Maniloff and Mastromonaco 2017).

Cumulative Impacts

Under all alternatives, there could be cumulative impacts on non-market benefits from past, present, and reasonably foreseeable future actions, if these actions further limit oil and gas development. However, these impacts would be site specific and depend on the project. The Greater and Gunnison sage-grouse planning efforts could contribute to cumulative impacts if they result in decisions that further constrain mineral development in areas where sage-grouse habitats overlap with big game HPH, which could provide more non-market benefits associated with wildlife preservation.

3.4.4 Environmental Justice

Issue 1: Do any of the alternatives disproportionately and adversely impact minority, low income, or tribal populations?

Environmental justice (EJ) refers to the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies (CEQ 1997). Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires federal agencies to determine if proposed actions would have disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority, low-income, and tribal populations. Executive Order 14096, Revitalizing Our Nation’s Commitment to Environmental Justice for All, was enacted on April 21, 2023, to complement Executive Order 12989. Until further guidance is issued on how to implement Executive Order 14096, the BLM continues to implement Executive Order 12898.

Analytical Methods and Assumptions

Analysis Methods

The analysis of impacts on minority, low income, or tribal populations from the alternatives being considered will:

- Describe—in general—the laws, regulations, and BLM policies and how the BLM considers the potential for impacting minority, low income, or tribal populations
- Describe the nature and types of potential impacts on minority, low income, or tribal populations that could result from the development of an oil and gas lease, including the subsequent exploration, development, production, abandonment, and reclamation phases of any permitted development
- Describe the potential impacts and protections for minority, low income, or tribal populations associated with the different types of constraints under consideration.

- Compare the alternatives in general terms regarding the potential for impacts on minority, low income, or tribal populations based on the level of constraints proposed under each alternative.

In September 2022, BLM published IM2022-059 to update the best practices recommended for completion of EJ analyses and provide clarity on the policy for minimum requirement to elevate environmental justice at the BLM, with a primary focus on environmental compliance review under the NEPA, including scoping, outreach, and analysis. Additionally, new CEQ guidance has been developed to advance environmental justice objectives (CEQ 2022). The BLM recognizes that the diversity of communities, projects, and processes requires the flexibility to adopt multiple approaches or select more sensitive or context-specific approaches. The BLM incorporates EJ efforts into the planning process by identifying potential areas where minority populations, low-income communities, and Tribes may be disproportionately affected by impacts from the proposed action(s). The BLM also incorporates EJ efforts in documenting findings and recommended solutions (BLM 2005). For example, reduced royalties from oil and gas production can impact public services for EJ populations. Additionally, communities of EJ concern located near high oil and gas development activity can experience higher levels of air pollution, impacts on visual resources and soundscapes, and lower levels of water quality than communities in other locations.

To identify communities of potential EJ concern within the planning area, the BLM conducted an EJ screen of the counties in Colorado. The screen consisted of using US Census Bureau data¹³ to determine whether the populations in each county met at least one of the following criteria:

- A minority¹⁴ community of concern is present if the percentage of the population identified as belonging to a minority group in a study area is 1) equal to or greater than 50 percent of the population or 2) meets the “meaningfully greater” threshold (CEQ 1997). Meaningfully greater is calculated by comparing the minority group population percentage with 110 percent of the reference area minority population (BLM 2022j).
- A low-income community of concern is present if the population, in the study area, experiencing income levels at or below 200 percent of the federal poverty threshold is 1) equal to or greater than 50 percent of the population or 2) greater than or equal to the population, in the reference area, experiencing income levels at or below 200 percent of the federal poverty threshold (BLM 2022j).
- The BLM IM2022-059 does not specify a threshold to use when screening for tribal populations. Tribal populations are included in the minority community of concern, as described above, however, because there could be impacts on subsistence use resources and tribal populations tend to value subsistence resources in the planning area more than the general population, a more sensitive threshold is used in this screening of tribal communities of concern. A tribal community of concern is present in this analysis if the percentage of the population identified as belonging to a tribal community is equal to or greater than the percentage of the population that identified as belonging to a tribal community in the reference area. The population identified as belonging to a tribal community was defined as the population who identified as Native American along or in combination

¹³ Data was collected directly from US Census Bureau in order to gather the most recent data. The Environmental Protection Agency also calculates and reports data on minority and low-income populations based on data from the US Census Bureau; however, due to timing of the reports published by the Environmental Protection, the data that is used often lags behind the data on the US Census Bureau by one year.

¹⁴ Total minority population is defined as the total population minus that portion that is listed in US Census Bureau data as white, of non-Hispanic origin. This method includes all individuals who identify as a racial or ethnic minority, or both, without double counting these populations.

with one or more other races as reported by the U.S. Census Bureau. Federally recognized Tribes are considered EJ populations in and of themselves.

- The BLM also looked for EJ populations that are not place-based in Colorado but use resources on BLM-administered lands such as subsistence hunters that may cross over state lines.

Assumptions

The analysis of impacts on minority, low income, or tribal populations is based on the following assumptions:

- The EJ area of analysis is the entire state of Colorado, at the county level.
- The reference population is the State of Colorado.
- Census data used to indicate a low-income population are the ACS 5-year estimates, Table S1701.
- Census data used to identify a minority EJ population are the ACS 5-year estimates, Table DP05.

Scope of the Analysis

The scope of the analysis is limited to the considerations of the effects of new or changed oil and gas management decisions designed to maintain, conserve, and protect big game corridors and HPH. The geographic scope is the entire planning area. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

Low-Income and Minority Populations

The majority of analysis area counties qualified for further consideration as EJ populations. **Table 3-94** identifies the percentage of the population considered low-income and the percentage of minorities in the population for each county in the primary socioeconomic analysis area. Qualifying metrics for EJ populations are in bold font in the table below. **Figures 3-16 and 3-17, Appendix D**, show all counties in Colorado shaded based on the percentage of the population identified as low-income and minority, respectively. **Table N-1, Appendix N**, Populations for EJ Consideration, contains data on minority and low-income population percentages for all 64 counties in Colorado. Additional, supplemental environmental and demographic indicators in Colorado from the EPA EJScreen are shown in **Table N-2, Appendix N**, EPA EJScreen Environmental and Socioeconomic Indicators Data.

Table 3-94. Populations for EJ Consideration

EJ Indicators (Race/Ethnicity and Income Status) as a Percentage of Total Population^{1,2}						
Geography	Total Minority Population (total %/ "meaningfully greater" threshold %²)	Hispanic or Latino Population	Native American Population	African American Population	Low- Income Population	Meets One or More EJ Threshold³
State and Planning Area Overall						
Colorado	33.2/36.5	21.9	0.5	3.9	23.6	—
Counties in the Primary Socioeconomic Analysis Area						
Delta	20.0	15.4	0.5	0.8	37.1	Yes
Eagle	35.1	29.4	0.1	0.9	23.8	Yes
Fremont	21.7	13.6	0.9	4.3	34.7	Yes
Garfield	33.7	29.2	0.3	0.5	24.5	Yes

EJ Indicators (Race/Ethnicity and Income Status) as a Percentage of Total Population^{1,2}						
Geography	Total Minority Population (total %/ "meaningfully greater" threshold %²)	Hispanic or Latino Population	Native American Population	African American Population	Low- Income Population	Meets One or More EJ Threshold³
Gunnison	14.4	9.7	0.5	0.5	30.6	Yes
Mesa	19.8	15	0.6	0.7	30.2	Yes
Moffat	20.9	16.3	1.3	0.3	35.2	Yes
Montrose	24.8	20.8	0.7	0.2	29.0	Yes
Park	12.0	6.6	0.5	0.3	18.2	Yes
Rio Blanco	17.0	10.7	1.2	0.3	32.3	Yes
Routt	14.9	7	0.1	0.3	20.0	X
Saguache	41.7	36	1.3	1.2	42.6	Yes
San Miguel	14.9	11.2	1	0.2	28.7	Yes

Sources: US Census Bureau 2021a, 2021b

¹ The Environmental Protection Agency calculates and reports data on minority and low-income populations based on data from the US Census Bureau American Community Survey 5-Year Estimates Data Profiles; however, at the time the data was collected for this report, the Environmental Protection Agency has not yet published the latest version of EJ data (from the 2021 American Community Survey 5-Year Estimates Data Profiles), so data taken directly from the US Census Bureau's website was used to calculate the percentages above.

² Bold values indicate the counties that were identified as EJ communities of concern based on each indicator.

³ Total minority population is calculated based on the total population minus those identifying as white, of non-Hispanic descent.

⁴ EJ consideration based on comparison with the state values

See **Section 3.4.1**, Native American Religious Concerns, for discussion of Tribes that have affiliation with BLM-administered lands in Colorado. Native American Tribes in the area have potential for disproportionate adverse impacts due to traditional cultural use of resources in the area, specifically big game for traditional hunting purposes. Across the United States, members of Native American Tribes regularly hunt big game inside and outside of tribal reservation lands. Beyond subsistence of hunting and the sale of hunting tags and guide services on tribal lands, big game management and hunting can hold great importance for these groups. According to an ethnographic overview of Tribes associated with Canyon of the Ancients National Monument, among the Utes hunting is a fundamentally important part of traditional Ute lifeways and deer was a primary game animal. The Utes make clothing and crafts from buckskin, sheepskin, and elk hides (Steinbrecher and Hopkins 2019). According to a news article published by the Southern Ute Drum, since 2003, the Southern Ute Indian Tribe has hosted eight different Pueblos as well as the Hopi Tribe for cultural hunts on Southern Ute lands (Shockley 2017).

Numerous court cases have affirmed off-reservation traditional hunting and fishing rights retained by Indigenous groups through treaties made with the U.S. government (Minnesota vs. Mille Lacs Band of Chippewa Indians 1999, U.S. vs Tribes of Colville Indian 2010). In 1873, the Brunot Agreement between the Utes and the U.S. government removed 3.7 million acres from the Ute Reservation in western Colorado. An important provision reserved for the Utes the right to "hunt upon said land so long as the game lasts and the Indians are at peace with the white people." (Southern Ute Indian Tribe 2022). The Southern Ute Tribe has dedicated hunting license allocations pulled from the general pot for the Brunot Agreement area to hunt big horn sheep, mountain goat, and moose. Although some individual tribal members may apply to the state's general hunting lottery, the Tribe manages the hunting of elk and deer on tribal lands under its own licensing system. The Tribe could request hunting allocation of these species in the Brunot area but has

not¹⁵. The Ute Mountain Ute Tribe sued the State of Colorado in 1978 and successfully negotiated for use of the historical hunting rights outside of the modern reservation boundary for subsistence, religious, or ceremonial purposes under the Brunot Agreement, and renegotiated expanded rights again in 2013 (Forest Service 2021).

Traditional, religious, and ceremonial purposes for hunting remain important enough to modern Tribes as to be provided for in official tribal governing documents. Hunting and fishing rights affirmed by treaties, legislation, and court cases can have value separate from traditional purposes as well. It has been argued that hunting and fishing rights delineated by treaties with the U.S. government includes implied rights to protection of the populations and habitats of these wildlife (Leonard 2014). Exercising hunting rights may also be perceived by tribal members as important to maintaining tribal rights (Correll 2008).

Environmental Consequences

Impacts Common to All Alternatives

Under all alternatives, the potential for impacts on visual setting, noise, human physical and mental health, quality of life, water quality, and air pollution would continue to occur in the planning area for EJ communities of concern adjacent to oil and gas development (see **Sections 3.2.2**, Air Quality, **3.2.4**, Noise and Acoustic Environment, and **3.4.7**, Visual Resources). These impacts could adversely and disproportionately impact EJ communities of concern, because EJ populations often live closer to oil and gas development and drilling than non-EJ populations and proximity to oil and gas development has been linked with increased adverse impacts on social conditions (Yale School of Public Health 2022, Johnston et al. 2023, Richards 2023, McKenzie et al. 2016). Stipulations such as NSO, CSU, and TL which reduce the level of development for protection of big game habitat could result in a related reduction of impacts to communities from development activities.

In addition, under all alternatives, permitted activities and disturbance as well as changes to habitat conditions would continue to affect big game habitat and availability of big game for hunting in locations with traditional importance for Native American Tribes as well as other individuals who may utilize hunting to support subsistence use, such as minority and low-income individuals.

As detailed in **Section 3.3.1**, Big Game Species and Habitat, direct and indirect habitat losses and fragmentation have the potential to occur from widespread development, including energy development. The greater the area that is open to leasing and development, the more likely impacts, such as habitat fragmentation and avoidance, are to occur with the potential for resulting impacts on big game populations and hunting success. Restricting surface-disturbing activities from fluid mineral development would, therefore, reduce impacts on big game species and big game HPH in the decision area. Areas managed under NSO, CSU, and TL stipulations would limit surface disturbance and associated impacts, such as habitat removal, fragmentation, and human disturbance, where they are applied.

Alternative A

Under Alternative A, there would be no change to land open to leasing subject to stipulations. Impacts from new oil and gas development would likely continue to adversely affect neighboring communities. These adverse impacts include quality of life, visual and noise effects from well drilling and operations, human health and air quality effects, and access to cultural, historical, and subsistence resources. These impacts on social conditions and nonmarket values could lead to adverse and disproportionate impacts on EJ communities of

¹⁵ Personal communication between CPW and BLM staff on Dec. 22, 2022.

concern, especially low-income communities of concern who tend to live closer to oil and gas development (McKenzie et al. 2016).

Human health impacts may result from air pollution and degradation in air quality associated with oil and gas development. Oil and gas leaks can also adversely affect air and water quality in the surrounding communities (Johnston et al. 2020). Although these health impacts would affect all populations in the communities equally, EJ communities of concern, especially low-income populations, tend to live closer to oil and gas developments, which means that these EJ populations would likely be disproportionately impacted by the continued development (McKenzie et al. 2016). All of the counties in the primary socioeconomic analysis area, except for Park County and Routt County, have higher low-income populations than the state average, which means that these low-income EJ populations could be disproportionately impacted by the continued health and air quality impacts from nearby oil and gas developments.

Subsistence is an important use of BLM-administered lands for Tribes, minority populations, and low-income populations in Colorado. Under Alternative A, with continued well development, big game habitat may be reduced, which could decrease availability of big game for subsistence. Decreased subsistence resource availability would adversely affect sociocultural systems due to the importance of subsistence in these communities' cultural identity, social organization, social cohesion, transmission of cultural values, and community and individual well-being. Decreases in subsistence resource availability would reduce opportunities for engaging in subsistence activities potentially increasing social problems. Due to the particular importance to Tribes and low-income populations of subsistence hunting, EJ populations would be disproportionately impacted from reduced access to big game habitats. Many counties in the primary socioeconomic analysis area have higher tribal population percentages than the state average and could be disproportionately impacted from reductions in subsistence use, especially Moffat County, Rio Blanco County, and Saguache County, which have tribal populations over one percent of the total population in the counties. Additionally, the poorest residents would bear disproportionate effects of reductions in access to big game for subsistence, due to the limited resources that are often available to low-income individuals. Moffat and Saguache Counties have some of the largest percentages of populations that identify as tribal, minority, and/or low-income in the primary socioeconomic analysis area, so the EJ communities of concern in these two counties are likely to have disproportionate, adverse impacts from reductions in subsistence use, compared with other counties in the primary socioeconomic analysis area and in Colorado that have lower percentages of EJ populations. Due to the integral role of subsistence hunting, it is a key consideration in the EJ impacts analysis.

Alternative B

Under Alternative B, there would be no change to acres closed to leasing, compared with Alternative A, but the areas open to leasing subject to NSO, CSU, and TL would be 172,000, 4,775,000, and 1,339,000 acres more than under Alternative A, respectively. Additionally, under Alternative B, there would be a surface disturbance density limitation of 1/640. The increase in the acreage of NSO, CSU, and TL stipulations and the surface disturbance density limitation under Alternative B could reduce the number of wells developed, which could reduce the impacts to the surrounding communities from well development and oil and gas operations, such as quality of life, noise and visual values, human health and air quality, and access to cultural, historical, and subsistence resources. These impacts on social conditions would likely be more substantial in counties with higher low-income populations, such as Delta, Fremont, Moffat, and Saguache Counties, because low-income households tend to live closer to oil and gas developments.

Under Alternative B, restrictions on mineral development would reduce the potential for impacts on big game habitat and availability. This could result in an increase in access to products and improve habitat for subsistence use, compared to under Alternative A. Subsistence use is more common in minority, tribal, and low-income populations, so an increase in access to subsistence resources would likely directly benefit EJ communities of concern more than other populations. Subsistence harvests are part of the social, cultural, and economic fabric for some of these communities. Adverse effects to subsistence hunting would affect social standing in the community, transmission of cultural traditions between generation, and food security for individual households and the community as a whole. The increase in access to big game for subsistence use will likely be more impactful in Moffat, Rio Blanco and Saguache Counties, where higher percentages of the populations identify as being part of a Tribe than other counties in Colorado.

If the management decisions under Alternative B were to result in reduced federal mineral development, then there could be a reduction in social cohesion and an increase in potential conflicts across user groups. This could result in adverse and disproportionate impacts on EJ communities of concern, especially low-income populations and minority populations that traditionally have been and are likely to continue to be dependent on mineral development (for example, Rio Blanco County).

Alternative C

Under Alternative C, the acres closed, acres open to leasing subject to NSO, CSU, and TL, and the surface disturbance density limitation of 1/640 would all be the same as under Alternative B. However, in addition, there would be a three percent disturbance threshold that would not be present under Alternatives A and B. Under Alternative C, the impacts on EJ communities of concern from reduced adverse quality of life, visual, noise, and health effects would likely be similar to those described under Alternative B. The impacts on subsistence use due to increased availability of big game habitats would also likely be similar to under Alternative B. However, the three percent disturbance threshold could further limit the development of oil and gas on federal lands, which could support greater increases in human health impacts and subsistence use. EJ populations, especially those in Delta, Fremont, Moffat, Rio Blanco, and Saguache Counties due to the large percentages of EJ populations, would likely benefit more than other populations due to their proximity to oil and gas developments and the importance of subsistence use to their cultural heritage, traditions, well-being, and livelihoods.

Alternative D

Under Alternative D, the acres closed to leasing would be 4,031,000 acres more than under Alternative A. The area open to leasing subject to CSU would be 748,000 acres more than under Alternative A, but the area open to leasing subject to NSO and TL would be 829,000 and 2,485,000 acres less than under Alternative A, respectively. Overall, there would be 1,465,000 more acres that are closed to leasing or open to leasing subject to stipulations, under Alternative D compared to Alternative A. Additionally, there would be a disturbance threshold of three percent, and this threshold would consider disturbance on all lands, including BLM-administered land, private land, and state land.

The disturbance threshold under Alternative D is the most limiting out of all the alternatives. As a result of the disturbance threshold and the increase in acres closed to leasing, more operators might decide to forgo oil and gas development on federal mineral estate compared to the rest of the alternatives. Potential reductions in oil and gas production and development, under Alternative D could have greater impacts on the surrounding EJ populations stemming from reductions in visual and noise disturbance. Air and water pollution would likely be of lower intensity and duration than those described under Alternative A. These impacts would likely benefit EJ communities of concern, especially those in Delta, Fremont, Moffat, and

Saguache Counties with high percentages of low-income populations, more than other populations due their proximity to oil and gas development activities.

Under Alternative D, the reduction in social cohesion and an increase in potential conflicts across user groups. This could result in adverse and disproportionate impacts on EJ communities of concern, especially low-income populations and minority populations that have traditionally been and are likely to continue to be dependent on mineral development (for example, Rio Blanco County).

Under Alternative D, the additional land closed to leasing and density threshold would likely reduce impacts on big game habitat and availability. This would result in fewer adverse impacts on EJ communities of concern through reduced impacts on subsistence use, compared to Alternative A. The increase in subsistence use could strengthen community well-being, way-of-life, and traditional and cultural use for local EJ populations, especially those in Moffat, Rio Blanco, and Saguache Counties with relatively higher percentages of tribal populations.

Cumulative Impacts

Under all alternatives, there could be cumulative impacts on the EJ populations in the surrounding communities from past, present, and reasonably foreseeable future actions, if these actions further limit oil and gas development. However, these impacts would be site specific and depend on the project. The Greater and Gunnison sage-grouse planning efforts could contribute to cumulative impacts if they result in decisions that further constrain mineral development in areas where sage-grouse habitats overlap with big game HPH, which could reduce health impacts from oil and gas production and development, but it also could reduce federal revenue from oil and gas. These impacts could lead to disproportionate effects on EJ communities of concern, depending on the sites and where the communities are located.

3.4.5 Recreation

Issue 1: How would changing the eligibility of lands for oil and gas leasing change recreation opportunities and experiences?

Analytical Methods and Assumptions

The analytical methods will address recreation management areas (RMAs) and designated trails. The analytical methods will also address dispersed recreation on non-RMA lands. Developed and dispersed recreation opportunities and experiences are affected by oil and gas exploration and development, including infrastructure and roadways. The analytical methods will:

- Identify geographic areas where recreation opportunities and experiences would be affected by changes in the availability of lands for oil and gas leasing
- Describe how changes in the availability of lands for oil and gas leasing would affect recreation opportunities and experiences

The following are analytical assumptions:

- Current recreation and demand in the decision area will continue and likely increase. Technological advancements may also introduce new types of recreation, season of use, numbers of users, as well as changes in expectations, and satisfaction of outcomes.
- The potential for interactions between all types of users will increase with increasing use.
- Demand for most types of recreation will increase, regardless of whether the activity is allowed, while demand for some types of recreation will decline or remain the same.
- Revenue generated from recreation will continue to increase in the future.

- Operators will undergo the NEPA process and use the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (commonly referred to as The Gold Book; US DOI and USDA 2007) to conduct environmentally responsible oil and gas operations on federal lands and on private surface over federal minerals.

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area includes all BLM-administered lands and approximately 4.6 million acres of local government and state lands. The BLM would also manage authorizations tied to the Federal mineral estate, which could impact recreation opportunities on split-estate lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

BLM-administered lands provide a variety of recreation opportunities, including hiking, hunting, horseback riding, mountain biking, rock climbing, wildlife viewing, camping, fishing, river-based activities, and motorized recreation. The BLM primarily manages dispersed recreation in Colorado, rather than developing facility-dependent recreation attractions.

Recreation Management Areas

RMA's are the BLM's land use planning-level tool for managing recreational use of BLM-administered lands, such as hiking, biking, camping, hunting, skiing, and snowshoeing, with summer activities occurring in much greater volume with greater impacts than winter activities. BLM-administered lands are identified for recreation as a SRMA, ERMA, or non-designated public lands.

SRMA's recognize unique and distinctive recreation values; those values are managed to enhance a targeted set of activities, experiences, benefits, and recreation setting characteristics, which become the priority management focus. ERMA's recognize existing recreational use, demand, or program investments in recreation and visitor services. They are managed commensurate with other resources and resource uses to sustain the ERMA's principal recreational activities and associated qualities and conditions.

An RMA may be subdivided into recreation management zones (RMZs) to further delineate specific recreation opportunities (for example, a focus on mountain bike use). SRMA's may be subdivided into RMZs with discrete objectives, while ERMA's generally cannot. SRMA and RMZ objectives must define the specific recreation opportunities (that is, activities, experiences, and benefits derived from those experiences), which become the focus of recreation and visitor services management.

In the decision area, the BLM's SRMA's total 1,299,000 acres, and ERMA's total 431,000 acres (BLM GIS 2022). **Figure 3-18, Appendix D, Recreation**, shows these areas. **Table 3-95**, below, identifies the RMA's within the decision area, along with the percent overlap for each RMA and total visits over a recent 5-year period. **Table 3-96**, below, identifies important big game habitat in RMA's.

Table 3-95. Number of Visits to RMA's Overlapping with Big Game HPH

RMA's in Decision Area	Sum of Acres	Overlap of RMA's with Big Game HPH	Total Visits Over 5 Years (2017 – 2022) ¹
ERMA			
Barrel Springs	25,000	52%	5,429
Bocco Mtn ERMA	1,000	100%	43,554
Burn Canyon	9,000	100%	948
Eagle River ERMA	3,000	67%	96,305
East Creek ERMA	2,000	100%	30,340

3. Affected Environment and Environmental Consequences (Recreation)

RMA s in Decision Area	Sum of Acres	Overlap of RMA s with Big Game HPH	Total Visits Over 5 Years (2017 – 2022) ¹
Gateway	78,000	77%	441
Grand Valley Ranges	1,000	0%	0
Gunnison River Bluffs	1,000	0%	21,776
Gypsum Hills ERMA	19,000	37%	51,979
Headwaters ERMA	14,000	43%	18,874
Horse Mountain - Zone I	5,000	20%	75,522
Hunting Ground ERMA	23,000	30%	55,534
Kinikin Hills	11,000	82%	12,399
New Castle ERMA	5,000	100%	81,452
Nine Mile Hill ERMA	10,000	100%	33,511
North Desert	108,000	41%	820,719
Paradox Valley	45,000	100%	10,582
Sawmill Mesa/Wagon Park ERMA	53,000	98%	102,794
Silt Mesa ERMA	3,000	100%	33,069
Thompson Creek ERMA	9,000	56%	28,140
SRMA			
Alpine Triangle Recreation Area	117,000	94%	1,931,890
Arkansas Headwaters Recreation Area	115,000	97%	34,681
Bangs SRMA	48,000	79%	1,280,712
Cactus Park SRMA	27,000	96%	51,014
Cedar Mountain SRMA	1,000	100%	50,321
Cochetopa Canyon SRMA	3,000	100%	5,513
Cortez SRMA/ RMZ	7,000	100%	264,543
Dolores River Canyon	16,000	94%	123,840
Dolores River Special Recreation Management Area	34,000	97%	263,690
Dry Creek, Zone 1	2,000	100%	25,090
Dry Creek, Zone 2	1,000	100%	15,916
Dry Creek, Zone 3	31,000	90%	222,441
Dry Creek, Zone 4	1,000	100%	43,676
Dry Creek, Zone 5	8,000	88%	20,909
Durango SRMA/RMZ	1,000	100%	731,845
Emerald Mountain SRMA	4,000	100%	92,066
Escalante Canyon SRMA	3,000	100%	48,120
Flat Top-Peach Valley	10,000	10%	57,401
Gold Belt Recreation Area	177,000	89%	3,763,874
Grand Valley OHV	10,000	0%	711,754
Gunnison River SRMA	4,000	75%	576,138
Hardscrabble – East Eagle	10,000	90%	273,726
Hartman Rocks SRMA	15,000	87%	415,566
Jumbo Mountain, Zone 1	0	0%	61,531
Jumbo Mountain, Zone 2	1,000	100%	14,383
Juniper Mountain SRMA	2,000	100%	4,615
King Mountain SRMA	13,000	54%	185,954
Little Yampa Canyon SRMA	28,000	100%	82,984
MCNCA - Black Ridge Canyons East	14,000	100%	90,813
MCNCA - Black Ridge Canyons West	48,000	96%	9,565
MCNCA - Colorado River	10,000	70%	177,986

3. Affected Environment and Environmental Consequences (Recreation)

RMA in Decision Area	Sum of Acres	Overlap of RMAs with Big Game HPH	Total Visits Over 5 Years (2017 – 2022) ¹
MCNCA - Rabbit Valley Motorized	8,000	0%	207,684
MCNCA - Rattlesnake/Mee Canyons Access	13,000	85%	57,994
MCNCA - The High North	9,000	44%	20,594
MCNCA - Urban/Wilderness Interface	2,000	50%	217,527
MCNCA SRMA	118,000	70%	215
North Delta	4,000	25%	12
North Forks	13,000	46%	161,449
North Fruita Desert	12,000	67%	112,424
North Sand Hills SRMA	1,000	100%	48,882
Penitente Canyon Recreation Area	6,000	100%	19,046
Red Hill SRMA	3,000	100%	307,050
Ridgway Trails, Zone 1	0	0%	85,306
Ridgway Trails, Zone 2	1,000	100%	72,515
Rio Grande Corridor Recreation Area	4,000	25%	4,700
Roubideau, Zone 1	3,000	100%	4,250
Roubideau, Zone 2	14,000	93%	0
Roubideau, Zone 3	4,000	50%	5,583
Roubideau, Zone 4	4,000	100%	858
San Miguel River, Zone 1	19,000	89%	317,629
San Miguel River, Zone 2	8,000	63%	8,277
San Miguel River, Zone 3	1,000	100%	1,434
San Miguel River, Zone 4	2,000	100%	288
Serviceberry SRMA	12,000	100%	11,714
Silverton Special Recreation Management Area	40,000	10%	44,945
Spring Creek, Zone 1	1,000	100%	74,600
Spring Creek, Zone 2	3,000	67%	15,539
Spring Creek, Zone 3	1,000	100%	2,472
Strawberry SRMA	8,000	63%	41,131
The Crown SRMA	9,000	78%	144,257
Upper Colorado River SRMA	30,000	90%	515,613
Wolford SRMA	26,000	81%	107,647
Zapata Falls Recreation Area	3,000	100%	821,706

Source: BLM GIS 2023, BLM RMIS 2023

¹ Visitation data for sites/zones were combined for some RMAs

Table 3-96. RMAs in Big Game Habitat

Species	Habitat	Size (Acres)
ERMA		
Elk	Severe Winter Range	164,000
Elk	Winter Concentration Area	67,000
Elk	Migration and Movement Corridors	5,000
Elk	Production Area	5,000
Mule Deer	Severe Winter Range	211,000
Mule Deer	Winter Concentration Area	92,000

Species	Habitat	Size (Acres)
Mule Deer	Migration and Movement Corridors	12,000
Pronghorn Antelope	Winter Concentration Area	11,000
Pronghorn Antelope	Migration and Movement Corridors	1,000
Bighorn Sheep	Migration and Movement Corridors	4,000
Bighorn Sheep	Production Area	9,000
Bighorn Sheep	Winter Range	43,000
SRMA		
Elk	Severe Winter Range	431,000
Elk	Winter Concentration Area	200,000
Elk	Migration Corridor	140,000
Elk	Production Area	60,000
Mule Deer	Severe Winter Range	491,000
Mule Deer	Winter Concentration Area	293,000
Mule Deer	Migration and Movement Corridors	101,000
Pronghorn Antelope	Winter Concentration Area	23,000
Pronghorn Antelope	Migration and Movement Corridors	9,000
Bighorn Sheep	Migration and Movement Corridors	78,000
Bighorn Sheep	Production Area	160,000
Bighorn Sheep	Winter Range	466,000

Source: BLM GIS 2022

Note: High priority habitat and big game migration and movement corridors overlap in many instances, causing acres to be higher than the total acres in the decision area.

Non-Recreation Management Areas

Public lands that are not designated as RMAs (undesignated lands) are managed to meet basic recreation and visitor services and resource stewardship needs. The recreation and visitor services are managed to allow recreation uses that are not in conflict with the primary uses of these lands. Recreation is not emphasized on non-designated lands; however, recreation may occur, except on those lands closed to public use.

Trails

The National Trails System promotes the enjoyment and appreciation of trails while encouraging greater public access. Trails in the National Trails System include national historic trails, national scenic trails, and national recreation trails. The BLM administers and protects these trails as part of its National Conservation Lands. In the decision area, the BLM manages 105 miles of the Old Spanish National Historic Trail and 6 miles of the Continental Divide National Scenic Trail (BLM GIS 2022). These trails are shown in **Figure 3--18, Appendix D**, Recreation.

The National Park Service and the BLM jointly manage the Old Spanish National Historic Trail. Remnant traces of the trail remain where visitors can witness evidence of the route's important impact on the West. Throughout New Mexico, Utah, and Colorado, expanses of packed and eroded ground still mark the trail where hundreds of mules and their muleteers once traversed the country on their way to California. The trail's main use was as an extensive trade route between the markets of Los Angeles and Santa Fe (NPS 2022b).

The Continental Divide National Scenic Trail crosses through some of the nation’s most treasured scenic terrain. It stretches across 3,100 miles between the borders of Mexico and Canada and follows the Rocky Mountains, including the peaks of Colorado (Forest Service 2022).

Recreation Setting Characteristics

The BLM uses recreation setting characteristics (RSCs) to provide a comprehensive way to describe a geographic location’s distinct environmental character, i.e. recreation qualities and conditions. RSCs can be categorized as physical (qualities of the landscape), social (qualities associated with use) and operational (conditions created by management controls over recreation use). The planning area’s physical and operational RSC are inventoried using GIS and **Table 3-97** displays information per setting in the decision area overall. A description of these characteristics is found in **Table 3-97**. **Table 3-97** depicts the physical and operational components or qualities associated with the planning area. There are also social components or qualities associated with use. Use patterns vary greatly across the decision area and by season. The planning area is comprised mostly of front, middle, and back country, while primitive (Wilderness Study Areas, wilderness, National Monuments, and National Conservation Areas) and rural characteristics exist in some areas.

Table 3-97. Recreation Setting Characteristics in the Decision Area

Recreation Analysis Area	Recreation Setting Characteristic
Physical Component (Qualities of the Landscape)	
Planning Area (State of Colorado)	Urban (Within ½ mile of streets and roads within municipalities and along highways.)
	Rural (Within ½ mile of paved/primary roads and highways.)
	Front Country (Within ½ mile of low-clearance or passenger vehicle routes (e.g., unpaved county roads, private land routes.)
	Middle Country (Within ½ mile of four-wheel-drive, ATV, and motorcycle routes.)
	Back Country (Within ½ mile of mechanized and Class 1, 2 & 3 e-bikes trails/routes.)
	Primitive (More than ½ mile from either mechanized or motorized trails and routes.)
	Remoteness
	Naturalness
Visitor Services	Urban (Within ½ mile of streets and roads within municipalities and along highways.)
Operational Components (Operational conditions to manage recreation use)	
Planning Area (State of Colorado)	Decision Area
	Type of Access
	Visitor Services
	Management Controls

*Classifications were derived from BLMs Recreation and Visitor Services Planning Handbook H-8320-I

Recreational Activities

BLM Colorado focuses recreation on the visitors’ freedom to choose where to go and what to do. More than a quarter of BLM-administered lands in Colorado are managed specifically for recreation and tourism. About 10.5 million visitors per year visit BLM-administered lands in Colorado to hike, mountain bike, whitewater raft, camp, fish, etc. (BLM 2022k). Hiking is popular at 78 locations (BLM 2022l), and off-highway vehicle use is popular at 33 locations (BLM 2022m).

Recreationists also partake in winter sports on BLM-administered lands. While some winter sports can occur in dispersed areas, there are also areas developed for specific forms of recreation, such as backcountry skiing, snowshoeing, dog sledding, and ice climbing. These areas include Emerald Mountain Recreation Area,

Silverton Mountain Ski Area, Cedar Mountain Special Recreation Area, Molas Pass/Silverton Winter Trails, Eureka, Lake City Ice Park, Mike’s Mile, Hartman Rocks Recreation Area, Zapata Falls SRMA, and Dominguez-Escalante National Conservation Area (BLM 2022n).

Outdoor recreation includes a diverse set of activities that participants pursue in Colorado. Of particular interest are fishing, hunting, and wildlife watching. Colorado’s 8.4 million acres of BLM-administered lands saw 545,107 hunting visits, 326,049 wildlife-watching visits, and 164,120 fishing visits in 2016 (The Pew Charitable Trusts 2018). All anglers and hunters on BLM-administered lands must have the required state license(s). BLM-administered lands are open for fishing unless there are temporary closures warranted by specific conditions.

More than 8 million acres of BLM-administered lands in Colorado are open to hunting. BLM-administered land is open to hunting as long as there is legal access to hunt it. Outfitting is legal on BLM-administered land as long as the outfitter is permitted through the local BLM office and also licensed by the state. The BLM issues special recreation permits to outfitters on a case-by-case basis to manage visitor use and to protect resources. The BLM typically limits the number of big game outfitters permitted in a specific area to reduce conflicts, but these outfitter permits do not affect public access. Motorized vehicles must remain on existing or designated roads. This includes retrieving downed game. Rules for motorized travel vary by BLM office (BLM 2022o).

Driving for pleasure ranks very high on the scale of activities that Colorado residents and visitors enjoy as they travel around the state. Colorado’s 26 scenic and historic byways (Colorado Department of Transportation 2022) offer travelers a chance to experience scenic, historic, recreational, ecological, and cultural value. While scenery and history have traditionally been the reason for byway designation, these byways are also excellent in their wildlife viewing potential. Most byways have been designated to assist local and regional economies of rural areas in their economic development (Koshak 2007).

The National Landscape Conservation System (NLCS) was established in 2000. This system of lands includes national monuments and national conservation areas managed by the BLM. These lands offer visitors opportunities for hunting, solitude, wildlife viewing, fishing, history exploration, scientific research and a wide range of traditional uses (BLM 2023d). There is one national monument and one national conservation area in the decision area (**Table 3-98**).

Table 3-98. National Monuments and National Conservation Areas in the Decision Area

NLCS Unit	Size (Acres)
Canyons of the Ancients National Monument	180,000
Gunnison Gorge National Conservation Area	64,000
Total	244,000

Source: BLM GIS 2023

Reasonably Foreseeable Trends and Planned Actions

Big game species, such as bighorn sheep, pronghorn, elk, moose, and mule deer, are important to natural systems, sporting enthusiasts, and local economies; however, some species and local populations have suffered declines in recent decades. While disease, competition, and predation contribute to these dwindling numbers, habitat loss and fragmentation stemming from residential, recreational, and industrial development,

compounded by the long-term effects of climate change, also present risks to these species (Colorado Department of Natural Resources 2021).

Management and research have shown that winter range's quality and quantity is one of the primary limiting factors for big game population performance. CPW has observed multiple severe winter events over the past several decades that have had significant impacts on big game populations. Human recreation and development, which continue to occur at high levels in Colorado, increasingly overlap, fragment, and impact big game winter range habitats (Cooley et al. 2020). See **Section 3.3.1**, Big Game Species and Habitat for additional discussion of the impacts from winter events on big game populations.

The threats associated with a growing human population include habitat loss, degradation, and fragmentation caused by increasing residential and commercial development, recreational activities, and road density. There is a finite amount of available land to accommodate a growing human population, housing needs, and increasing visitors and recreation while also maintaining healthy and sustainable big game habitats and populations (Cooley et al. 2020).

According to Colorado Parks and Wildlife's 2019 Statewide Comprehensive Outdoor Recreation Plan, approximately 92 percent of Coloradans recreate at least every few weeks to four (or more) times per week. Projected available recreation acres per capita are expected to decline from around 5.5 acres to less than 3.5 acres by 2050, as the number of people recreating increases (CPW 2018). This loss of space will not only increase potential conflicts between recreationists but also with Colorado's wildlife populations and habitat. Recreation has direct and indirect impacts on wildlife and habitat by causing wildlife disturbance, habitat loss, habitat degradation, and habitat fragmentation (Cooley et al. 2020). The BLM accounts for much of this impact by establishing management prescriptions at the time SRMAs, ERMAs and RMPs are prepared and signed through wildlife closures and SRP stipulations.

Threats to big game HPH include agriculture; commercial and residential development; oil, gas, and mining energy production; habitat alteration and loss; recreation; extreme weather changes both local and over time; and transportation (highways and railroads, and access to oil and gas developments, range facilities, weather stations, and private lands.). Recreation's specific threats to big game HPH involve the following (Cooley et al. 2020):

- Nonmotorized trails (hiking, mountain biking, horseback riding, and skiing and snowshoeing)
- Motorized trails (off-highway vehicle and all-terrain vehicle, motorbike, four-wheel drive, snowmobile, and electric bike)
- Established recreation sites (ski resorts, golf courses, campgrounds, and parks)
- Ecotourism and guided recreation (backcountry skiing, rafting, bike tours, and hiking Colorado's mountains over 14,000 feet)
- Illegal activity (off-trail use, violation of closures, and harassment of wildlife)

Environmental Consequences

Impacts Common to All Alternatives

Under all alternatives, the BLM would not change recreation management in the decision area. The BLM's RMPA proposes changes to fluid mineral leasing stipulations and use restrictions. No new areas would receive closed, limited, or open designations and there would be no changes to existing designations.

Generally, recreation setting characteristics (RSCs) would have no significant changes as a result of the action alternatives. Oil and gas management actions under Alternatives B, C, and D would not result in a significant

change to “urban,” “rural,” “front,” “back,” “middle” or “primitive” characteristic acres in the planning area. No difference in shift of the physical setting characteristics would occur from the action alternatives compared to Alternative A. If oil and gas development increases over the next decade, this development could push characteristics more towards rural or urban setting. The physical (qualities of the landscape) and social (qualities associated with use) components of the landscape of the trails in the planning area are not expected to change as a result of the action alternatives.

Alternative A

Under Alternative A, the BLM would continue to manage approximately 11,218,000 total acres of land as open to fluid mineral leasing and 1,792,000 acres would continue to be closed to fluid mineral leasing. Acres of recreation management areas, National Trails, and NLCS units subject to NSO, CSU, and TL stipulations for oil and gas development under Alternative A are presented in **Table 3-99**. NSO stipulations would have the greatest level of impacts on recreation by restricting surface-disturbing activities, increasing recreational opportunities and experiences over the long-term, while CSU and TL stipulations would change the density and duration of development activities having short-term, localized impacts on recreation. Sights and sounds from oil and gas could take away from the naturalness and solitude of the environment, having an impact visitors’ experiences. Conversely, an increase in oil and gas leasing development would likely promote the construction of new roads that, if open to the public would increase access to recreation.

Table 3-99. Acres Closed and Open to Leasing, Subject to NSO, CSU, and TL Stipulations Under Alternative A

BLM Land Type	Alternative A (Acres)	Percent Total
Closed to Leasing		
Recreation Management Areas	691,000	40
National Trails (Miles)*	22	20
NLCS Units	438,000	75
Total	1,132,002	49
Open to Leasing, Subject to NSO Stipulations		
Recreation Management Areas	302,000	17
National Trails (Miles)*	14	13
NLCS Units	0	0
Open to Leasing, Subject to CSU Stipulations		
Recreation Management Areas	502,000	20
National Trails (Miles)*	15	9
NLCS Units	0	0
Open to Leasing, Subject to TL Stipulations		
Recreation Management Areas	661,000	26
National Trails (Miles)*	44	27
NLCS Units	0	0

Source: BLM GIS 2023

*Miles converted to acres for the total calculation

Alternative B

Under Alternative B, acres open and closed to fluid mineral leasing would be the same as under Alternative A. However, Alternative B would change the way in which the 11,218,000 open acres would be managed by adding an additional acres of NSO, CSU, and TL stipulations to HPH to align with the planning and management decisions of the State of Colorado’s big game HPH management.

Acres of recreation management areas, National Trails, and NLCS units subject to NSO, CSU, and TL stipulations for oil and gas development under Alternative B are presented in **Table 3-100**. By incorporating the stipulations, the overall result would be more restrictive management of oil and gas leasing. Opportunities for recreation would be unaffected by these decisions. Depending on the locations of oil and gas development in areas subject to stipulations relative to recreational use areas, recreation experiences could be maintained in some areas through preservation of the visual and auditory environment.

Table 3-100. Comparison of Acres Open to Leasing, Subject to NSO, CSU, and TL Stipulations Under Alternatives A, B, and C

BLM Land Type	Alternative A (Acres) (%)	Alternatives B and C (Acres) (%)	Change in Acres (%)
Open Subject to NSO Stipulations			
Recreation Management Areas	302,000 (17)	354,000 (20)	17
National Trails (Miles)*	14 (13)	14 (13)	4
NLCS Units	0 (0)	0 (0)	0
Open Subject to CSU Stipulations			
Recreation Management Areas	502,000 (20)	946,000 (30)	47
National Trails (Miles)*	15 (9)	78 (31)	81
NLCS Units	0 (0)	83,000 (27)	100
Open Subject to TL Stipulations			
Recreation Management Areas	661,000 (26)	771,000 (25)	14
National Trails (Miles)*	44 (27)	71 (28)	38
NLCS Units	0 (0)	83,000 (27)	100

Source: BLM GIS 2023

*Miles converted to acres for the total calculation

Alternative C

Under Alternative C, the impacts on recreation would be similar to those discussed under Alternative B. The acres of recreational use areas within the decision area open to fluid mineral leasing subject to NSO, CSU, and TL-stipulations would be the same as under Alternative B (**Table 3-100**). Acres closed to fluid mineral leasing would be the same as under Alternative A. Additionally, Alternative C would include a 3 percent surface disturbance threshold on big game HPH on BLM-administered surface lands in each impacted DAU. This would further reduce oil and gas development, resulting in the potential for enhanced recreational experiences-in the decision area.

Alternative D

Alternative D is the only alternative that would designate additional land as closed to oil and gas leasing. While fewer acres of recreation management areas, National Trails, and NLCS units would be open to fluid mineral leasing subject to NSO, CSU, and TL stipulations, more acres would be closed to oil and gas leasing. (**Table 3-101**). Management would also include the most restrictive application of the 3 percent disturbance threshold for all lands in a DAU, regardless of surface ownership, and applied to new oil and gas leases and related authorizations on BLM-administered lands and federal mineral estate in the decision area. The additional closures and more restrictive management would cause Alternative D to be the alternative most likely to preserve the sights and sounds that enhance to recreational experiences.

Table 3-101. Comparison of Acres Closed and Open to Leasing, Subject to NSO Stipulations Under Alternatives A and D

BLM Land Type	Alternative A (Acres)	Alternative D (Acres) (%)	Change in Acres (%)
Closed to Leasing			
Recreation Management Areas	691,000 (40)	1,351,000 (78)	49
National Trails (Miles)*	22 (20)	64 (58)	67
NLCS Units	438,000 (75)	441,000 (76)	0.7
Total	1,132,002 (49)	1,797,120 (77)	37
Open to Leasing, Subject to NSO Stipulations			
Recreation Management Areas	302,000 (17)	131,000 (8)	57
National Trails (Miles)*	14 (13)	7 (6)	50
NLCS Units	0 (0)	0 (0)	0
Open to Leasing, Subject to CSU Stipulations			
Recreation Management Areas	502,000 (20)	285,000 (29)	43
National Trails (Miles)*	15 (9)	36 (30)	58
NLCS Units	0 (0)	81,000 (27)	100
Open to Leasing, Subject to TL Stipulations			
Recreation Management Areas	661,000 (26)	166,000 (17)	75
National Trails (Miles)*	44 (27)	31 (26)	30
NLCS Units	0 (0)	81,000 (27)	100

Source: BLM GIS 2023

*Miles converted to acres for the total calculation

Cumulative Impacts

Past, present, and reasonably foreseeable future actions, such as oil and gas drilling and development, mineral development, land use authorizations and access, livestock grazing and agriculture, travel and transportation uses including new road construction, vegetation treatments, and fire and fuels management that have affected, and are likely going to continue to affect recreation throughout the cumulative effects analysis area. These actions affect recreation by altering the landscape and reducing areas available for recreation opportunities and experiences. Naturally occurring events, such as wildfires and extreme weather events, can also have effects on recreation in the decision area. These events can transform vegetative communities and landforms, potentially introducing artificial elements, non-native vegetation, and erosion into the natural landscape.

The no action alternative, Alternative A would contribute to cumulative effects by allowing for the most oil and gas development within big game HPH of the alternatives, thus possibly allowing more human-caused disturbances from facility development and transportation.

Compared to Alternative A, Alternatives B and C would reduce the cumulative impacts within the planning area by limiting density and disturbance of the oil and gas development in HPH. By doing so, ground disturbance and other actions that could affect recreation opportunities and experiences would also be limited. However, many of the other disturbances listed above would remain the same.

Alternative D would have the fewest cumulative impacts of all the alternatives from the decision of increasing the areas closed to oil and gas leasing and limiting the effects further. The other disturbances such as existing oil and gas lease and other types of mineral development, non-oil and gas related ROW authorizations, developed recreation sites, livestock grazing, etc. would remain the same as the no action alternative.

3.4.6 Travel and Transportation

Issue 1: How would open and closed fluid mineral leasing areas impact OHV routes and OHV areas with use restrictions?

Analytical Methods and Assumptions

Assumptions

- Transportation access and use will continue to increase in Colorado due to the recent upward trends in motorized recreation opportunities.

Scope of the Analysis

The scope of the transportation analysis is limited to routes and OHV areas that occur in the decision area.

Affected Environment

Background

Travel and transportation management consists of implementing travel and transportation planning decisions, inventorying and mapping routes, signing areas, designating routes, educating and interpreting, enforcing laws, acquiring easements, monitoring, and undertaking other measures necessary for providing access to and across BLM-administered lands for a wide variety of uses. Routes are in place for ROWs, grazing, mineral access, and overall access to public land.

Under 43 CFR §8342.1, all public lands must have an OHV area designation. As part of its travel and transportation management, the BLM must make OHV area designations as open, limited, or closed to motorized travel as defined in 43 CFR §8340.0-5(f), (g) and (h) and based on the criteria established for closed, open, or limited designations established in 43 CFR §8342.1(a-d). OHV area designations are made

at the RMP level. By improving trail and OHV management through land use planning, the BLM minimizes the impacts on wildlife habitat, reduces the introduction and spread of invasive weeds, lessens conflicts among various motorized and nonmotorized recreation users, and prevents damage to cultural resources resulting from the expansion of roads and trails on BLM-administered lands. The OHV travel designations include:

- **Open:** Motorized vehicle travel is permitted year-long anywhere within an area designated as “open” to OHV use. Open designations are areas where all types of vehicle use is permitted at all times, anywhere in the area subject to the operating regulations and vehicle standards set forth in subparts 8341 and 8342 of this title (see 43 CFR 8340.05 and BLM Handbook 8342).
- **Limited:** Motorized vehicle travel within specified areas and/or on designated routes, roads, vehicle ways, or trails is subject to restrictions. The limited designation is used in areas restricted at certain times, in certain areas, and/or to certain vehicular use. These restrictions may be of any type, but can generally be accommodated within the following type of categories: Numbers of vehicles; types of vehicles; time or season of vehicle use; permitted or licensed use only; use on existing roads and trails; use on designated roads and trails; and other restrictions (see 43 CFR 8340.05 and BLM Handbook 8342).
- **Closed:** Designated areas where off-road vehicle use is prohibited. Use of off-road vehicles in closed areas may be allowed for certain reasons; however, such use shall be made only with the approval of the authorized officer (see 43 CFR 8340.05 and BLM Handbook 8342).

After the BLM makes an OHV area designation through the land use planning process, the BLM reviews the modes of travel and determines which modes are permitted or prohibited in the OHV designations. Implementation-level route-by-route designations include identifying whether the specific route is open, limited, or closed to OHVs, and each route open to OHV must show how the designation criteria were addressed to minimize impacts to resources. Routes can also be designated for nonmotorized uses, administrative use, or public safety use. “Mode of travel” refers to the mechanisms used to move across the land. It is broadly defined into three categories: those that use motors, those using some mechanical method, and those reliant only on the movements of the human (or animal) bodies (BLM 2014). Broadly, there are motorized, nonmotorized, and mechanized travel use restrictions. Certain routes may be open to all three modes of travel, while other routes may only be open to one mode. The different modes of travel are located below:

- **Motorized Travel**—Motorized travel includes standard passenger vehicles on maintained roads and OHVs on primitive roads and trails. OHVs can include, but are not limited to off-road motorcycles, all-terrain vehicles (ATVs), jeeps, specialized 4x4 trucks, and snowmobiles.
- **Mechanized Travel**—Mechanized vehicles primarily include mountain bikes and specialized equipment such as mountain skateboards.
- **Nonmechanized Travel**—Nonmechanized modes of travel include walking, cross-country skiing, snowshoeing, horseback riding, pack animal driving, hiking, boating, hang gliding, paragliding, and ballooning.
- **Nonmotorized Travel**—Moving by foot, stock or pack animal, non-motorized boat, ski, or mechanized vehicle such as a bicycle.

OHV Designations in the Decision Area

In the decision area, there are 7,025,000 acres¹⁶ of OHV areas with some form of closed, limited, or open designation. Breaking it down by designation type, there are 798,000 acres of OHV closed area designations; 6,190,000 acres of OHV limited area designations¹⁷; and 37,000 acres of OHV open area designations. Approximately 88.1 percent of the overall acreage of OHV designations in the decision area are classified as OHV limited areas; however, OHV limited area restrictions do not always prohibit motorized travel since motorized travel can be limited to existing or designated routes. Other forms of travel activities present or restricted in OHV limited designations include equestrian use, walking, or bicycle; certain seasonal uses; certain vehicle classes; BLM or administrative use to meet specific land management objectives (BLM 2011a). OHV areas designated as closed in the decision area represent 11.4 percent of overall acreage of OHV designations. These areas prohibit motorized use to protect resources, ensure visitor safety, or reduce conflicts. Less than one percent of overall acres of OHV designations in the decision area are designated as OHV open. Activities permitted in an open area are specified further under CFR 8340.0-5, subparts 8341 and 8342.

OHV designations are implemented at the field office level. **Table 3-102** illustrates the different OHV area classifications by field office.

Table 3-102. OHV Area Designations by Field Office in the Decision Area

	CRVFO	GJFO	GFO	KFO	LSFO	RGFO	SLVFO	TRFO	UFO	WRFO
Closed	38,000	159,000	58,000	8,000	125,000	76,000	0	73,000	88,000	160,000
Limited	530,000	988,000	475,000	340,000	1,192,000	551,000	488,000	430,000	684,000	1,292,000
Open	2,000	10,000	0	0	20,000	12,000	0	0	4,000	0
Total	570,000	1,157,000	533,000	348,000	1,337,000	639,000	488,000	503,000	776,000	1,452,000

Source: BLM GIS 2023

* Totals are rounded to the nearest 1,000.

Modes of Travel in the Decision Area

Once an area is designated as open, limited, or closed to motorized travel, the BLM identifies travel routes and the mode(s) of travel allowed on each route. As described above, certain restrictions, such as seasonal or travel use may occur on limited routes. **Table 3-103** illustrates miles of routes open to motorized and nonmotorized travel in the decision area. In the decision area, most routes open to motorized travel are also open to nonmotorized travel. However, there are some routes (trails) which are designated exclusively for nonmotorized travel. Approximately 63.6 percent of open routes are open to motorized travel, while 30.7 percent of total miles of motorized routes in the decision area are classified as limited travel routes. Existing off-highway vehicle areas are illustrated in **Figure 3-19, Appendix D**.

Table 3-103. BLM Motorized and Nonmotorized Routes in the Decision Area

Route Designation	Motorized		Nonmotorized Only	
	Miles	Percent of All Miles in the Decision Area	Miles	Percent of All Miles in the Decision Area
Road	1,873	16.0	1	0.1
Primitive road	8,508	72.8	36	4.0
Trail	1,311	11.2	873	95.9
Total	11,692	-	910	-
Grand total	12,602			

Source: BLM GIS 2023

¹⁶ Royal Gorge FO data is not present in existing designation acreage.

¹⁷ Seasonal OHV use areas partially overlap existing OHV areas

Existing Travel Management Plans and Seasonal Route Closures

Several RODs and RMPs address travel and transportation management in the decision area. Seasonal closure dates apply to limited route designations and aren't needed for closed motorized travel routes. **Table 3-104** presents seasonal closures on BLM-administered lands and associated acreages, as reported in various BLM land use plans. Most existing seasonal closures are from December 1 through late spring and into early summer. It should be noted that nonmotorized means of travel, such as walking, may still occur in certain closed designations because some field offices actually enforce closures by linear route rather than by area.

Table 3-104. Seasonal Closures in the Decision Area

	Dates	Acres
Closed to all uses*	December 1–July 31	2,000
	December 1–June 30	3,000
	December 1–April 15	5,000
	December 1–April 30	6,000
	March 15–May 15	1,000
	November 1–April 30	0
	Other	10,000
Total		27,000
Closed to motorized	December 15–April 15	0
	March 15–May 15	265,000
	October 1–November 30	3,000
	Other	20,000
Total		288,000
Closed to motorized and mechanized	August 20–April 15	0
	August 20–November 30	0
	December 1–April 15	121,000
	December 1–April 30	74,000
	December 1–May 1	103,000
	December 1–May 31	2,000
	December 15–April 15	2,000
	December 15–June 1	8,000
	January 16–April 15	21,000
	Other	55,000
Total		387,000
Limited to over-snow vehicles	December 15–April 15	32,000
Total		32,000
Grand total		734,000

Source: BLM GIS 2022

* Note that some field offices enforce closures by linear route rather than by area. Closed to all uses indicates that no uses, such as motorized, mechanized, and nonmotorized recreation, are permitted. Totals are rounded to the nearest 1,000.

Reasonably Foreseeable Trends

Colorado transportation and travel trends are expected to increase in the future due to the economic importance of the recreation industry in Colorado (Colorado Office of Economic Development and International Trade 2021). Multiple BLM field offices have indicated that outdoor recreation, particularly nonmotorized and motorized recreation, will continue to increase for the foreseeable future. The continuing increase in OHV recreation opportunities will continue to expand existing transportation access; however, gains will also impact big game species by reducing available habitat. However, recreation opportunities are not the only contributing influence on Colorado's transportation system. Population growth is anticipated

to impact Colorado's transportation network on BLM-administered lands. By 2050, it is expected Colorado will have over 7 million residents, which will represent a dramatic increase since 3.5 million called the state home in 1990 (CIM 2023). An increase in population will increase the demand on existing transportation networks while also increasing the potential for ROW and mineral demand. The increase of ROWs and mineral demand is expected to increase infrastructure-related projects and road infrastructure that may be associated with energy projects or ROWs. As population increases, the transportation network in Colorado will become larger, providing more areas of access.

Environmental Consequences

Impacts Common to All Alternatives

The BLM would not change any travel designations in the decision area under any of the alternatives, as the actions considered focus on changes to fluid mineral leasing stipulations and use restrictions for the protection of HPH. Anticipated future oil and gas development could result in an increase of oil and gas roads, with associated changes to the existing travel network. However, overall access is not expected to change under any alternative, and no adverse effects on travel and transportation are expected to occur. OHV open, limited, and closed designations vary between field offices; with different restrictions, designations, and seasonal uses depending on specific field office plans, as described above in the affected environment section.

3.4.7 Visual Resources

Issue 1: How would changing the eligibility of lands for oil and gas leasing affect visual resources?

Analytical Methods and Assumptions

The analytical methods outline the approach to evaluating impacts on visual values. Visual resources are affected by oil and gas exploration and development, including infrastructure and roadways. The analytical methods will:

- Identify geographic areas where visual values would be affected by changes in the eligibility of lands for oil and gas leasing and the application of development constraints
- Describe how visual values would be affected by changes in the eligibility of lands for oil and gas leasing and the application of development constraints

The following are the analytical assumptions:

- Visual values will become increasingly important to residents of and visitors to the area.
- Residents and visitors to the decision area are sensitive to changes to visual values and to the area's overall scenic quality, which contributes to living conditions and the visitor experience.
- Activities that cause the most visual contrast and are the most noticeable to the viewer will have the greatest impact on scenic quality.
- As the number of acres of disturbance increases, the impacts on visual values will also increase.
- The more protection associated with the management of other resources, the greater the benefit to the visual values of the surrounding viewsheds.
- Best management practices and project design, avoidance, or mitigation can reduce, but not entirely prevent, impacts on visual values.
- The BLM's visual resource management system's visual resource contrast rating process (BLM Manual H-8400 and Handbook H-8410-1) will be used for site-specific actions.
- Operators will use Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (commonly referred to as the Gold Book) to conduct environmentally responsible oil

and gas operations on federal lands and on private surface over federal minerals (US DOI and USDA 2007).

Scope of the Analysis

The geographic scope of the analysis is the decision area. The decision area includes all BLM-administered lands and approximately 4.6 million acres of split-estate private, local government, and state lands. The temporal scope of the analysis is the life of the RMPs that are being amended.

Affected Environment

BLM-administered lands in Colorado are in the Colorado Plateau, Rocky Mountain System, and Great Plains physiographic provinces. The Colorado Plateau straddles the region known as the Four Corners, where Arizona, Utah, Colorado, and New Mexico meet. Ancient volcanic mountains, plateaus and buttes, deeply carved canyons, and amazing ranges in color are the region's defining characteristics. The elevation for the Colorado Plateau starts at about 2,000 feet above sea level, with plateau tops ranging from 5,000 to 7,000 feet and mountaintops reaching nearly 13,000 feet (NPS 2022c).

In Colorado, the Rocky Mountain System can be broken down into the following physiographic provinces: Middle Rocky Mountains, Wyoming Basin, and Southern Rocky Mountains. In the Middle Rocky Mountains province, folded mountains¹⁸ are the dominant type of mountain. Other types of mountains include volcanic mountains¹⁹ and uplifted fault blocks.²⁰ Lying between the Middle Rocky Mountains and the Southern Rocky Mountains, the Wyoming Basin is an elevated depression. Characteristic features of the Wyoming Basin include hogbacks,²¹ cuerdas,²² and numerous basins that are separated by mountains of varying size. The Southern Rocky Mountains are massive mountains that rise over 14,000 feet. Characteristic structures of the Southern Rocky Mountains include anticlinal arches and intermontane basins (NPS 2022d).

The Great Plains is bordered to the west by the Rocky Mountains. The eastern border with the Central Lowlands is less distinct; the separation is characterized by the 20-inch rainfall divide, as well as changes in vegetation and soils. The Great Plains slope downward to the east, with maximum heights in the foothills of the Rocky Mountains at 5,500 feet decreasing to 2,000 feet. The High Plains region in the center of the Great Plains includes eastern Colorado; this region is overlain by alluvial sediments from the Rocky Mountains by east-flowing streams (NPS 2022e).

Visual values are the visible physical features on a landscape (for example, land, water, vegetation, animals, structures, and other features). The objective of visual resource management (VRM) is to manage BLM-administered lands in a manner that will protect the quality of the scenic (visual) values of these lands (BLM 1984).

Visual resource management (VRM) classes are assigned to BLM-administered lands through the BLM resource management planning process. VRM classes are assigned based on scenic quality, sensitivity level,

¹⁸ Folded mountains are created where two or more of the earth's tectonic plates are pushed together.

¹⁹ A volcanic mountain starts out as a crack in the earth, which is called a volcanic vent. Magma erupts out of the ground as lava flows, clouds of ash, and explosions of rock. This material falls back to the earth around the vent and piles up around it. There are different kinds of volcanic mountains.

²⁰ Fault block mountains are distinguished by sheer rock faces. These form when underground pressure forces a whole rock mass to break away from another at a fault.

²¹ A hogback is a ridge of land formed by the outcropping edges of tilted strata. It is a ridge with a sharp summit and steeply sloping sides.

²² A cuesta is a hill or ridge with a steep face on one side and a gentle slope on the other.

and distance zones. There are four classes. Each class has an objective that prescribes the amount of change allowed in the characteristic landscape (BLM 1984). VRM classes and objective are as follows (BLM 1986a):

- Class I: The objective of this class is to preserve the landscape's existing character. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- Class II: The objective of this class is to retain the landscape's existing character. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III: The objective of this class is to partially retain the landscape's existing character. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV: The objective of this class is to allow for management activities that require major modifications of the landscape's existing character. The level of change to the characteristic landscape can be high. Management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

BLM-administered lands in the decision area contain the following (**Figure 3-20, Appendix D, Visual Resource Management**):

- 819,000 acres of VRM Class I
- 2,218,000 acres of VRM Class II
- 4,224,000 acres of VRM Class III
- 1,257,000 acres of VRM Class IV

VRM classes are only applied to BLM-administered lands. Fragmented surface landownership affects the management of visual values; this is because management of visual values on non-BLM-administered lands can be different from management of visual values on BLM-administered lands. For example, management of visual values on non-BLM-administered lands may not take into consideration managing to protect the quality of the scenic (visual) values of the lands. This affects the management and integrity of the broader landscape's character spanning multiple landownerships. In areas with BLM-administered mineral rights, the BLM may offer the same level of surface protection that the BLM provides on Federal surface during consultation with the surface owner.

The visual resource contrast rating system (Handbook H-8431-1) is a systematic process the BLM uses to analyze the potential visual impacts of proposed projects and activities. The degree to which a management activity affects a landscape's visual quality depends on the visual contrast created between a project and the existing landscape (**Figure 3-21, Appendix D, Visual Resource Inventory Scenic Quality**). The contrast can be measured by comparing the project features with the major features in the existing landscape. This assessment process provides a means for determining visual impacts and for identifying measures to mitigate these impacts (BLM 1986b).

Visual values inventory (VRI) classes are the categories the BLM uses to classify the visual character of the landscape and are a way to describe the degree of visual quality in the area. Generally, VRI Class A has the highest scenic quality, while Class C indicates low scenic quality.

Nighttime artificial outdoor light sources occur across the decision area. Sources include, but are not limited to, communities, streetlights, vehicles, developed recreation areas, and existing oil and gas or mineral development. Light pollution is more significant around areas of dense population, such as cities and towns, but not restricted to those areas.

Reasonably Foreseeable Trends and Planned Actions

The visual values throughout the decision area are extremely diverse, including river landscapes, forested mountains, snow-covered mountains, rolling hills, flat valleys, grasslands, and lakes and reservoirs. The scenic quality of the decision area is a very important component of the local and regional economy. Many people live and recreate in the decision area because of the area's special visual features, and travelers from throughout the United States and the world consider the scenery an important part of their visit. Scenery is a valued amenity to local communities within the decision area, contributing to the quality of life, economic value of tourism, recreation, and associated businesses. Visitors to Colorado expect to see high-quality scenic values, which contribute to the state's economy.

Environmental Consequences

The analysis area for visual values is BLM-administered lands in the decision area. Visual impacts associated with development of existing leases would be expected to continue under all alternatives.

Alternative A

Under the No Action Alternative, the current RMPs would not be amended and existing stipulations with waivers, exceptions, and modifications would not change, so there would be no alteration to visual values management. Visual values would continue to be impacted from oil and gas development on BLM-administered land, but would vary depending on VRM class objectives. There would continue to be new leases and permits, but the impacts on visual values would remain at their current level. **Table 3-105** shows the levels of VRM and VRI for Alternative A. VRM Class III currently has the most acres under Alternative A, while Class I has the lowest.

Table 3-105. VRM and VRI Classes in the Decision Area by Alternative

VRM ¹								
Class	Acres Open ^{2,3}				Acres Closed			
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Class I	163,000	351,000	351,000	49,000	678,000	678,000	678,000	790,000
Class II	4,516,000	5,458,000	5,458,000	2,929,000	456,000	456,000	456,000	1207,000
Class III	9,740,000	11,936,000	11,936,000	7,279,000	426,000	426,000	426,000	1831,000
Class IV	2,636,000	3,353,000	3,353,000	1,896,000	62,000	62,000	62,000	532,000

VRI								
Class	Acres Open ²				Acres Closed			
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Class A	2,631,000	3,582,000	3,582,000	1,715,000	235,000	235,000	235,000	804,000
Class B	11,696,000	14,402,000	14,402,000	8,468,000	845,000	845,000	845,000	2687,000

Class	VRI							
	Acres Open ²				Acres Closed			
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Class C	7,921,000	9,022,000	9,022,000	6,981,000	411,000	411,000	411,000	994,000
Not Inventoried	1,846,000	1,961,000	1,961,000	887,000	236,000	236,000	236,000	530,000

Source: BLM GIS 2023

¹Some VRM classes incorrectly overlap, making the total greater than the total BLM-administered land

²Includes Open CSU, Open NSO, Open CSU-TL, Open Standard Stipulations, and Open TL

³Open fluid mineral stipulations overlap

Construction for new oil and gas activities in areas that would remain open under Alternative A would create surface disturbance which would disrupt the form, line, color, and texture of the landscape, including the terrain and vegetation. These changes could come from vehicle use and construction of the pads, developed areas and roads in the areas that remain open to leases. This would diminish the scenic quality in those areas. The BLM would use design features to minimize and mitigate these effects.

The use of vehicles would also create dust and artificial light. Dust would decrease the visual distance and diminish views and scenery from human observation. Artificial lights from vehicles, communities, and those used to illuminate work sites for visibility and safety would also increase sky glow²³ and, in turn, can affect the presence and behavior of animals viewed in the decision area. During operations, lights would also be used to illuminate sites for visibility and safety. The most noticeable operations lights would be at the pads, any airstrips, and barge landings and on taller structures, such as the drill rigs. The intensity and amount of light and glare would vary, depending on, for example, the light source and its orientation, the intensity and angle of sunlight, and the time of day and year. Reflective surfaces on construction equipment and vehicles would create glare and add to the increased skyglow.

Unlike light impacts during construction, the impacts from operations lights would be long term. They would be more visible during nighttime and winter when there are fewer daylight hours. Artificial light would also decrease the visibility of stars normally visible in the decision area.

Alternative B

Table 3-105 shows the VRM and VRI under Alternative B. Because there are no additional closures under Alternative B, impacts under this alternative would be similar to those under Alternative A. However, there would be a difference in the acres under each stipulation. Areas categorized as NSO would have fewer impacts on visual values than areas categorized as CSU, TL, and open. Waivers, exceptions, and modifications could still be implemented on NSO, so there could still be some minor disturbances and changes to visual values. CSU and TL limit the impacts on visual values but would still have larger impact than NSO and thus create a larger possibility of disturbance to the landscape's line, color, and texture. A difference between Alternative B and Alternative A is also the inclusion of the "I in 640" surface disturbance density evaluation; visual impact from oil and gas development in HPH would be greatly decreased by this measure. By keeping disturbance in HPH to 1 disturbance per square mile, the visual quality of the landscape would be maintained overall compared to the No Action Alternative.

²³ Light scattered back to earth by aerosols and clouds

Dust and artificial light would be limited to those areas of new and existing oil and gas development and their impact would be greatly decreased in the rest of the HPH, which would potentially not happen under Alternative A. The individual outputs of each disturbance area would be the same as under Alternative A.

Alternative C

Table 3-105 shows the VRM and VRI under Alternative C. Alternative C would have the same impacts as Alternative B except with the addition of the 3 percent disturbance threshold on top of the “1 in 640” surface disturbance density evaluation. Because the 3 percent disturbance threshold is on a broader landscape scale, the disturbance would potentially be more spread out, thus allowing for the potential for the landscape to be altered by surface disturbances and construction of artificial structures from smaller scale disturbances across a larger area. This would have a greater potential to disturb the form, line, color, and texture of the landscape than the “1 in 640” threshold, but the overall impact on visual values would be less than Alternative A. The “1 in 640” threshold would also apply and would have the same effect as Alternative B.

The effects from dust and artificial light would be the same as under Alternative B, but would have the potential to be more dispersed with the landscape level scale of the 3 percent disturbance threshold.

Alternative D

Table 3-105 shows the VRM and VRI under Alternative D. Alternative D is the only alternative to propose additional closures. This would leave more areas free of oil and gas development, so there would be less of an overall impact on visual values across the decision area from surface disturbances and construction of artificial structures. Along with reduced areas open to new oil and gas leasing, the scope of restrictive stipulations would be decreased. The effects of stipulations would be similar to those described for Alternative B, but at a smaller scale. Fewer oil and gas developments would cause less disturbance to the line, color, and texture of the landscape.

There would be less artificial light and dust created from the developments overall. However, each individual development would create the same amount of disturbance as any developments under the other alternatives.

Cumulative Effects

Past, present, and reasonably foreseeable future actions, such as oil and gas development, other mineral development, land use authorizations and access, livestock grazing, recreation, and vegetation management have affected, and are likely to continue to affect visual values throughout the cumulative effects analysis area. These affect visual values by altering the form, line, color, and texture of the landscape from surface disturbances, construction of artificial structures, and changes to vegetation.

Naturally occurring events, such as wildfire, can also alter the landscape with effects on visual values in the decision area. Many of these actions and events have altered vegetation and landforms and have introduced artificial elements into the natural landscape. Some past developments are being reclaimed, and visual impacts are lessening, but not as fast as new developments are happening.

The no action alternative would contribute to cumulative effects by allowing for more oil and gas development within big game HPH, thus contributing more human caused disturbances from development and transportation.

Alternatives B and C would reduce the cumulative impacts within the planning area by limiting the oil and gas development in HPH. By doing so, the BLM would also be limiting the ground disturbance and other disturbances that would affect form, line, color, and texture. However, the other disturbances listed above would remain the same as the no-action alternative, particularly on non-federal lands.

Alternative D would reduce cumulative impacts more than any of the other alternatives by having more areas closed to oil and gas leasing and limiting the effects further. The other disturbances listed above would remain the same as the no action alternative, particularly on non-federal lands.

3.4.8 Lands, Realty, and Cadastral Survey

Issue 1: How would the alternatives affect land use authorizations on BLM-administered land?

Analytical Methods and Assumptions

The analysis of impacts on land use authorizations under each alternative includes the following steps:

1. Query the BLM's Legacy Rehost 2000 (LR2000) database and conduct a geographic information system (GIS) analysis to determine acres of Mineral Leasing Act ROWs (related to oil and gas facilities) and land use authorizations, ROW exclusion areas, and ROW avoidance areas in the decision area.
2. Conduct a GIS analysis of acres of designated utility corridors in the decision area.
3. Conduct a GIS analysis of acres of designated communication sites in the decision area.
4. Using these data, conduct a quantitative analysis to compare the changes in land use authorizations, utility corridors, and communication sites under each alternative. Conduct a qualitative analysis to describe the impacts on land use and potential lands realty actions from actions under other resource programs, under each alternative.

The analysis of impacts on land use authorizations is based on the following assumptions:

- The BLM anticipates approximately 344 to 877 new Mineral Leasing Act ROW authorizations in Colorado each year, including those outside of the project area, with an average of 542 annually.²⁴ These are off-lease actions for oil and gas-related facilities, such as off-lease pipelines carrying gas or off-lease roads tied to oil and gas activities.
- Management actions will not affect existing ROWs or other valid existing rights.
- The demand for new Mineral Leasing Act ROWs and other land use authorizations will remain stable or increase slightly throughout the life of the RMPs.
- Expanding uses next to BLM-administered lands or on private inholdings within BLM-administered lands, particularly residential and commercial development, increases the demand for ROWs on BLM-administered lands to accommodate those uses.
- Other than oil-and-gas related management decisions, including ROWs, management decisions in the alternatives for this RMPA will not change lands, realty, and cadastral survey program components.

Scope of the Analysis

The geographic scope of the analysis is the decision area. The temporal scope of the analysis is the life of the RMPs that are being amended.

²⁴ Averaged based on Mineral Leasing Act ROWs authorized between 2012 and 2021 (BLM 2022b)

Affected Environment

The decision area encompasses approximately 8.3 million acres of BLM-administered surface lands and 4.6 million acres of split-estate private, local government, and state lands. Lands are administered or owned by multiple federal, state, and local agencies and private landowners. The configuration of landownerships and their proximity to each other is an important factor when considering land tenure adjustments and evaluating ROW applications. The planning area contains lands managed by the BLM, Forest Service, other federal agencies, various state agencies, counties, and private landowners. **Table I-2, Decision Area Lands by County**, in Chapter I shows the acreage and overall percent ownership for each landowner in the planning area (also see **Figure I-1, The Planning and Decision Area, Appendix D**).

Several areas of the decision area have fragmented ownership patterns with “checkerboard,” or alternating blocks of public and private lands, and other mixed federal-private surface and federal mineral estates. This mixed ownership pattern may include small parcels of BLM-administered land, and results from complex ownership histories. In such areas, the BLM has minimal influence over management across the landscape. Mixed ownership, including that within HPH, is most prevalent on the eastern plains, such as in Pueblo County (within the BLM Royal Gorge Field Office’s jurisdiction; BLM GIS 2022).

The BLM’s lands, realty, and cadastral survey actions described in this section are land use authorizations, which consist of ROWs and other leases or permits. Land use authorizations in the decision area include those for roads, electrical transmission lines, water facilities, communication sites, water pipelines, and off-lease oil and gas infrastructure. This section also describes utility corridors, which are a land use planning-level designation to facilitate the orderly placement of linear ROWs.

Rights-of-way

A ROW is the most common form of authorization to permit use of a specific parcel of BLM-administered land by commercial, private, or government entities for a certain project, such as roads, pipelines, electric power lines, communication tower sites, or renewable (wind or solar) energy sites. A ROW authorizes nonexclusive rights and privileges for a specific use of the land for a designated time. The ROW is subject to BLM review and renewal or denial at the end of the authorization period. A ROW is granted for a term appropriate to the life of a project. A ROW authorizes the holder to construct, operate, maintain, and terminate a facility over, under, upon, or through BLM-administered lands. ROW authorizations may be terminated or suspended for noncompliance with their terms or for other resource concerns. ROWs are discretionary, and the BLM considers only ROW applications from qualified individuals, businesses, or government entities.

The BLM has authorized 5,667 ROWs (for communication sites, oil and gas pipelines and facilities, power facilities, power lines, railroads, roads, telephone lines, water facilities and irrigation, and renewable energy) covering approximately 3 million acres (23 percent) of the decision area (BLM GIS 2022; **Figure 3-22, Appendix D, Authorized Right-of-Ways**). Of these, 4,569 ROWs (81 percent of all ROWs) covering approximately 2.2 million acres (17 percent of the decision area) are in HPH (26 percent of all decision area HPH; BLM GIS 2022).

All use, occupancy, or development on BLM-administered lands that is above casual use requires BLM authorization. The BLM processes applications for new ROWs, as well as the amendment, assignment, renewal, relinquishment, or cancellation of existing ROWs. ROWs are not guaranteed for lease holders. The BLM may issue multiple types of authorizations for a project. For example, for an oil and gas project, an

operator may submit a ROW application, if necessary. An oil and gas project may need a ROW for an electric power line, wastewater disposal pipeline, product pipeline, or other authorization type.

ROW Exclusion and Avoidance Areas. Lands may be classified as exclusion or avoidance areas in an RMP. ROW exclusion areas are not available for location of ROWs under most conditions. ROW avoidance areas are defined as those areas on which a ROW should be avoided, if possible. The decision area contains 816,000 acres (6 percent of the decision area) managed as ROW exclusion areas and 1,992,000 acres (15 percent of the decision area) managed as ROW avoidance areas. Of these, within HPH, ROW exclusion areas cover 570,000 acres (almost 7 percent of all decision area HPH), and ROW avoidance areas encompass 1,384,000 acres (16 percent of all decision area HPH) (BLM GIS 2022).

Utility Corridors. Utility corridors are preferred routes that collocate multiple linear ROWs and are generally next to existing highways or county roads. Facilities within these corridors may include gas and water pipelines, power lines, and communication lines, such as telephone or cable. In the decision area, 1.2 million acres of utility corridors are in HPH (BLM GIS 2022). This includes several energy corridors that were designated under Section 368 of the Energy Policy Act of 2005 (Public Law 109-58). Procedures for processing ROW applications within these corridors are in Appendix B, Interagency Agency Operating Procedures, of the 2009 West-wide Energy Corridor Programmatic EIS (US Department of Energy and BLM 2009).

Communication Sites. The BLM issues ROW communication-use leases for communications facilities on BLM-administered lands. Communication sites include broadcast and nonbroadcast uses, including cellular telephone, microwave, paging, television translators, mobile radio, wireless internet service provider, or other communication uses. Most communications sites on BLM-administered lands are at higher elevations and have one or more facilities (such as towers, antennae, or buildings) owned by private or governmental entities. The local BLM field office manages activities at each site under a land use plan and a site-specific management plan (BLM 2022a). The decision area has 323 authorized and 10 pending communication sites (BLM GIS 2022).

Renewable Energy. The BLM also authorizes solar and wind energy projects and facilities via the ROW authorization process. No wind or solar energy land use authorizations exist in HPH in the decision area (BLM GIS 2022). The BLM also processes ROWs for such facilities as transmission lines and roads that cross BLM-administered land to support solar or wind energy projects on non-federal lands in the decision area.

In 2012, the BLM published the Approved RMP Amendments/Record of Decision for Solar Energy Development in Six Southwestern States (Solar Programmatic EIS; BLM 2012). Based on a high-level resource constraints analysis, the BLM identified developable acreage in solar energy zones, variance areas (areas outside solar energy zones where solar energy development may be appropriate, pending further analysis), and exclusion areas for utility-level solar ROWs. One solar energy zone has since been deallocated (BLM 2018), and two solar emphasis areas were created (BLM 2015a). In the decision area, there are approximately 16,000 acres of solar energy zones and emphasis areas (0.1 percent of the decision area), 94,000 acres of solar variance areas (0.7 percent of the decision area), and 8,114,000 acres of solar exclusion areas (62 percent of the decision area; BLM GIS 2022). It should be noted that the BLM is revising the 2012 programmatic EIS (BLM 2012) to reflect changes in technology since then. More areas could be opened to solar energy development because there are fewer technological limitations.

In 2005, the BLM published a record of decision for the Wind Energy Development Programmatic EIS and Associated Land Use Plan Amendments (BLM 2005), which analyzed the development of wind energy

projects in the West. The record of decision amended 52 land use plans in nine states, including Royal Gorge and San Luis Valley in Colorado, to adopt programmatic policies and BMPs for wind energy development (BLM 2005). In all field offices, applications for wind energy development are processed per general ROW applications.

Oil and Gas Leases

The Mineral Leasing Act of 1920, as amended, and the Mineral Leasing Act for Acquired Lands of 1947, as amended, give the BLM responsibility for oil and gas leasing, which is discussed in **Section 3.2.1**, Geology and Fluid Minerals.

Section 302 of the FLPMA gives the BLM the authority to issue, at its discretion, leases, permits, and easements for the use, occupancy, and development of BLM-administered lands. Any use not specifically authorized under other laws or regulations (such as the Mineral Leasing Act of 1920), and not specifically forbidden by law, may be authorized under this section of the FLPMA. Uses that may be authorized include residential, agricultural, industrial, and commercial uses, and uses that cannot be authorized under the primary ROW authorities.

The BLM issues leases and permits for purposes such as construction equipment storage sites, assembly yards, oil rig stacking sites, and well pumps. Leases are generally used for long-term, nonlinear development projects, such as agricultural and commercial development uses or occupancy leases. Permits are generally short-term authorizations (not to exceed 3 years) that have a minimal impact on the land, such as temporary storage areas. The objective of the permits and leases program is to provide for the use of BLM-administered lands by the private sector and state and local governments where the uses conform to land use plans and where they cannot be achieved prudently or feasibly on land other than BLM-administered lands. The BLM administers 2,854 oil and gas leases covering 1,954,000 acres in the decision area (BLM GIS 2022).

Reasonably Foreseeable Trends and Planned Actions

Land use authorizations are increasing. Issues driving the trend to more land use authorizations include growth and urbanization issues, the interface between private landowners, and the demands on BLM-administered land to locate the facilities (for example, access roads, communication sites, mineral development, pipelines, water tanks, and utility corridors) needed to support the fast-growing infrastructure. As communities and mineral developments continue to expand in the planning area, it is likely that requests for the use of BLM-administered land for facilities will increase.

Rights-of-way. From 2012 through 2016, an average of 526 new Mineral Leasing Act ROWs were authorized annually in the decision area (BLM 2022b). From 2017 through 2021, an average of 559 new Mineral Leasing Act ROWs were authorized annually in the decision area (BLM 2022b). Although year-to-year authorizations vary, the 5-year averages show an increase in Mineral Leasing Act ROW authorizations. The number of Mineral Leasing Act ROW applications and authorizations are expected to remain stable or increase slightly.

Utility Corridors. In the last 5 years (August 2017 through August 2022), 164 new utility corridors encompassing 135,000 acres were approved in the decision area (BLM GIS 2022). The rate of utility corridor applications is expected to increase.

Communication Sites. In the last 5 years (August 2017 through August 2022), 70 new communication sites encompassing 11,000 acres were established in the decision area (BLM GIS 2022). The number of communication site applications is expected to increase.

Oil and Gas-Related Leases. In the last 5 years (August 2017 through August 2022), 259 new oil and gas-related leases encompassing 267,000 acres were approved in the decision area (BLM GIS 2022). The number of applications is expected to increase.

Environmental Consequences

The analysis area for lands, realty, and cadastral survey is BLM-administered lands in the decision area. Potential impacts on land uses are the result of land use allocations and lease stipulations that allow or restrict certain land uses. Use restrictions, such as those intended to protect resources or to reduce conflicts with other uses, can preclude the placement of new infrastructure or require special conditions for development. In areas subject to NSO, new activities associated with oil and gas leasing, such as construction of wells and/or pads, would be precluded. Areas identified as NSO are open to oil and gas leasing, but surface occupancy or surface-disturbing activities associated with the lease must be conducted outside the boundaries of the NSO area. Depending on the use, development outside of the NSO area may not be physically or commercially viable. In areas subject to CSU or TLs, additional requirements, such as long-term monitoring, special design features, and special siting requirements, could restrict a future project's location or viability of projects.

Impacts Common to All Alternatives

Under all alternatives, 816,000 acres (6 percent of the decision area) would continue being managed as ROW exclusion areas, and 1,992,000 acres (15 percent of the decision area) would continue being managed as ROW avoidance areas. Of these, ROW exclusion areas cover 570,000 acres (almost 7 percent of all decision area HPH), and ROW avoidance areas encompass 1,384,000 acres (16 percent of all decision area HPH) (BLM GIS 2022). ROW exclusion and avoidance areas would limit the availability of lands for ROWs for new oil and gas-related land use authorizations.

Alternative A

Under Alternative A, land use authorizations would continue to follow the existing approved RMPs, as amended. Permits, leases, and ROWs would continue to be approved for oil and gas activities in the decision area based on planning guidance dependent on RMP jurisdiction. There would continue to be a lack of consistency across the decision area pertaining to oil and gas approvals, BMPs, and related HPH protections and stipulations. Requests for land use authorizations would continue increasing to support demand for development on BLM-administered lands and split-estate mineral resources. As a result, approved land use authorizations would continue to be subject to variable guidance to protect big game HPH. Under Alternative A, the BLM would not have cohesive statewide planning guidance related to the 2020 Colorado report on impacts of energy development on big game (CPW 2020). Oil and gas-related land use authorizations would continue to be approved in HPH.

Alternative B

Under Alternative B, localized disturbances would be co-located and consolidated to maintain and conserve intact HPH. To achieve this objective, the BLM would be required to plan for land use authorizations to occur in more deliberate locations. Compared with Alternative A, management under Alternative B would allow the BLM to better manage permit, lease, and ROW decisions in a manner consistent with the guidelines in the ECMC regulations. However, under Alternative B, land use authorizations would not necessarily be decided by feasibility or commercial viability but proximity to HPH. Limitations, such as a CSU surface density of 1 pad per square mile and 1 linear mile of routes per square mile for oil and gas development, would add complexity to implementation-level land use decision-making. Compared with Alternative A, the impact of management actions under Alternative B on lands, realty, and cadastral survey would be the greater

limitation of available locations for land use authorizations as oil and gas activities are focused outside of HPH. Overall, Alternative B would likely result in fewer oil and gas-related land use authorizations than under Alternative A.

Alternative C

Alternative C includes management decisions similar to Alternative B, but incorporates a 3 percent surface disturbance threshold. Compared with Alternative A, Alternative C would provide the BLM with guidelines to reach land disturbance and impact clustering goals. However, restrictions on development would increase complexity of implementation-level decision-making in a similar way to that described under Alternative B, but with additional limitations. Increased complexity could slow down the process of issuing land use authorizations for oil and gas development. All other management guidance and impacts would be similar to those described under Alternative B, and there would likely be fewer oil and gas-related land use authorizations under Alternative C than under Alternative A.

Alternative D

Compared with Alternative A, Alternative D is the only alternative to propose additional closures to leasing availability. Major constraints on oil and gas leasing would occur to protect HPH, especially in HPH areas with no known, low, or moderate oil and gas development potential. Impacts on lands, realty, and cadastral survey from Alternative D would be similar to Alternative C, but would be more acute due to increased closure of available land and a more restrictive application of the 3 percent surface disturbance threshold. As a result, there would be fewer opportunities for oil and gas-related land use authorizations within the decision area and, therefore, fewer authorizations administered by the BLM.

Cumulative Impacts

Cumulative impacts on lands, realty, and cadastral survey would be the result of past, present, and reasonably foreseeable future actions that restrict the types or locations available for new ROWs, utility corridors, communication sites, and leases. The BLM anticipates that the number of applications for land use authorizations will increase over time. This demand would occur under all alternatives because of existing and ongoing oil and gas activities. Under the action alternatives, increased restrictions, limitations, and stipulations may compound with a larger number of applications and slow down the land use authorization process. In addition to these increased restrictions, the Greater and Gunnison sage-grouse planning efforts and ongoing RMP developments for several BLM districts in Colorado could result in decisions that would further constrain ROW authorizations in certain habitats. However, there is some overlap between sage-grouse and big game priority habitat. Regardless, these enhanced restrictions and stipulations could put greater stress on BLM staffing and workload to accommodate higher rates of applications with less available land. This would be most likely to occur under Alternative D, which is the only alternative that proposes closing additional land to leasing. Under Alternative B, which affords greater flexibility in ROW siting, there would be no co-location requirement for surface disturbances, so the desired outcome of big game habitat protection may not be as effectively achieved over time.

Chapter 4. Consultation, Coordination, and Public Involvement

This chapter describes the public outreach and participation opportunities made available through the development of this Draft RMPA/EIS and consultation and coordination efforts between the BLM and Native American Tribal Governments, federal, state, and local government agencies, and other stakeholders. This chapter also lists the tribal and local governments and agencies that received a copy of the Draft RMPA/EIS, and describes the public involvement and agency consultation and coordination that occurred during the preparation of this Draft RMP/EIS, including Federal Register notices, public and informal meetings, and the project eplanning website (<https://go.usa.gov/xzXxY>).

4.1 PUBLIC ENGAGEMENT

Public involvement for the Draft RMPA/EIS includes the following four phases:

1. Public scoping before beginning NEPA analysis to determine the scope of issues and alternatives to be addressed in the RMPA/EIS
2. Public outreach via newsletters and news releases
3. Coordination with federal, state, local, and tribal governments and cooperating agencies
4. Public review of and comment on the Draft RMPA/EIS, which analyzes likely environmental effects and identifies the BLM's preferred alternative

The public scoping phase (phase 1) of the process has been completed and is described in **Section 4.1.1** (Scoping Process). The public outreach and collaboration phases (2 and 3) are ongoing throughout the RMP/EIS process and are described in **Section 4.2** (Consultation and Coordination) and **Section 4.3** (Cooperating Agencies). Phase 4 started with the 90-day public comment period on the Draft RMPA/EIS on **October 2023 (target)**. This phase is discussed under **Section 4.4** (Distribution and Availability of the Draft RMPA/EIS).

Additionally, the BLM has provided information to the public through various digital media outlets, including the BLM's public website and Twitter. The public can send inquiries to the agency at any time through a publicly available email address, BLM_CO_corridors_planning@blm.gov.

4.1.1 Mailing List / List of Recipients of the Draft RMPA/EIS

The BLM will distribute the Draft RMPA/EIS to a mailing list of those agencies, organizations, Tribes, and individuals that have requested notifications, copies of the draft, or participated in the scoping process. This mailing list includes approximately 422 participants. Most notifications and copies are anticipated to be distributed electronically. Information about how to be added to this mailing list is available on the project website.

Project Web Site

The BLM maintains an ePlanning project website (<https://go.usa.gov/xzXxY>) with information related to the development of the RMPA/EIS. The website includes background documents, maps, information and recordings of public meetings, the scoping report, and contact information for the BLM planning team.

Future Public Engagement

Public participation opportunities will continue to be offered throughout the RMPA/EIS planning process. An important component of this effort is the opportunity for members of the public to review and comment on this Draft RMPA/EIS during a 90-day comment period. The BLM will consider and address substantive comments within the Proposed RMP Amendment/Final EIS. The release of the Proposed RMP Amendment/Final EIS will be followed by a consistency review by the governor of Colorado, and an opportunity for protest. Following resolution of protests and issues raised through the consistency reviews, the BLM will issue a Record of Decision (ROD) and Approved RMP Amendment.

4.1.2 Scoping Process

Formal scoping for the RMPA/EIS started with printing of the Notice of Intent (NOI) in the Federal Register on July 19, 2022, with the publication of the Notice of Intent in the [Federal Register](#). The [NOI](#) initiated the public scoping process for the RMPA/ EIS and contained information about the purpose and need, preliminary planning criteria, proposed alternatives, expected impacts, and information about how to comment. The BLM requested that the public submit comments in response to the NOI by September 2, 2022. The BLM continued to consider any public comments after this period, but those comments are not included in the BLM’s scoping report, which describes the scoping process and summarizes the comments received during the comment period.

Public Scoping Meetings

The BLM sent over 250 notifications to known potentially interested or affected stakeholders, and held five meetings to provide the public with opportunities to become involved, to learn about the project and the planning process, and to offer comments. The scoping meetings included three in-person events (Colorado Springs, Montrose, Grand Junction) with an open house format to encourage participants to discuss concerns and questions with members of the BLM Interdisciplinary Team, and two virtual meetings. A total of 78 individuals participated in the scoping meetings.

At each of these open house-style meetings, the BLM provided a brief overview of the planning process with large poster boards displaying maps, schedule, and other information for discussion with attendees.

The virtual meetings began with a PowerPoint presentation describing the purpose of the RMPA and EIS, the project approach, planning criteria, an ePlanning tutorial, and opportunities for public involvement. Following the presentation, the meetings transitioned to a question-and-answer session, where members of the public could ask questions to the BLM staff. The BLM then gave commenters 5 minutes to provide any verbal public comments. Three comments were submitted in the virtual format. **Table 4-1** provides the dates and times of the public scoping meetings. A list of public meeting attendees is available upon request.

Table 4-1. Public Scoping Meetings in 2022

Meeting Format	Location	Meeting Date	Meeting Time*	Number of Public Attendees
In-person	Colorado Parks and Wildlife (CPW) Regional Office 4255 Sinton Rd. Colorado Springs, CO 80907	August 8, 2022	5:00 p.m. to 7:00 p.m.	2
In-person	Courtyard By Marriott 765 Horizon Dr. Grand Junction, CO 81506	August 11, 2022	5:00 p.m.to 7:00 p.m.	13

Meeting Format	Location	Meeting Date	Meeting Time*	Number of Public Attendees
In-person	Ute Mountain Museum – Chipeta Room 17253 Chipeta Rd. Montrose, CO 81401	August 12, 2022	6:00 p.m. to 8:00 p.m.	9
Virtual	Zoom meeting¹	August 3, 2022	1:00 p.m. to 3:00 p.m.	48
Virtual	Zoom meeting²	August 4, 2022	6:00 p.m. to 8:00 p.m.	31

* All times are mountain daylight time.

¹ The recording of the August 3, 2022, meeting is available for download.

² The recording of the August 4, 2022, meeting is available for download.

Scoping Comments Received

The BLM received 108 unique written submissions containing 519 separate comments during the public scoping period. The BLM also received 489 form submissions. The comments received during the public scoping process were analyzed, and a scoping summary report was completed in December 2022 (BLM 2022a). Detailed information about the comments received and about the public outreach process can be found in the Big Game Corridors RMPA and EIS Scoping Report, finalized in December 2022 (BLM 2022). Refer to the eplanning website for more information about the scoping process and to view the Final Scoping Summary Report.

The issues identified during public scoping and outreach helped refine the list of planning issues, included in **Section 1.6.2** (Issue Identification) which guided the development of alternative management strategies for the RMPA.

4.2 CONSULTATION AND COORDINATION

Federal laws require the BLM to consult with certain federal and state agencies and entities and Native American tribes (40 CFR 1502.25) during the decision-making process. The BLM is also directed to integrate NEPA requirements with other environmental review and consultation requirements to reduce paperwork and delays (40 CFR 1500.4-5).

4.2.1 Federally Recognized Tribes

Federally recognized tribes have a unique relationship with the Federal Government in that they are sovereign nations and retain inherent powers of self-government. They interact with the United States on a government-to-government level. The BLM Colorado State Office initiated consultation with 39 Tribes that are identified as having interests or Traditional Cultural Properties in the RMPA planning area. The BLM formally initiated consultation with all Tribes on June 9, 2022. The Northern Cheyenne, Pueblo of Acoma, Pawnee Nation, Oglala Sioux, Southern Ute, and San Felipe Tribes accepted formal consultation to-date. The planning team is regularly involved in coordination with the Southern Ute. A follow up letter was sent May 18, 2023 to all Tribes to allow for those conversations to inform development of alternatives and issues for analysis. The BLM also invited all Tribes to be cooperating agencies for the RMPA/EIS.

Consultation is that required by NEPA, the National Historic Preservation Act, and the American Indian Religious Freedom Act, among other laws and policies. The BLM is required to initiate and conduct government-to-government consultation with affected tribes as sovereign nations. When it becomes apparent that the nature and/or the location of an activity could affect tribal issues or concerns, the BLM is responsible for initiating appropriate consultation with potentially affected Indian tribes, as soon as possible,

once the general outlines of the land use plan or the proposed project-specific land use decision have been determined. Government-to-government consultation will continue throughout the RMPA process to ensure that the concerns of tribal groups are considered in development of the RMPA.

The BLM has consulted with 39 Tribes and will provide them notification of the Draft RMPA/EIS concurrently with its release to the public:

- Apache Tribe of Oklahoma
- Cheyenne & Arapaho Tribes of Oklahoma
- Comanche Nation, Oklahoma
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe
- Jicarilla Apache Nation
- Kiowa Tribe
- Navajo Nation
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Ohkay Owingeh
- Pawnee Nation
- Pueblo de Cochiti
- Pueblo of Acoma
- Pueblo of Isleta
- Pueblo of Jemez
- Pueblo of Laguna
- Pueblo of Nambe
- Pueblo of Picuris
- Pueblo of Pojoaque
- Pueblo of San Felipe
- Pueblo of San Ildefonso
- Pueblo of Sandia
- Pueblo of Santa Ana
- Pueblo of Santa Clara
- Pueblo of Taos
- Pueblo of Tesuque
- Pueblo of Ysleta del Sur
- Pueblo of Zia
- Pueblo of Zuni
- Rosebud Sioux Tribe
- Santo Domingo Pueblo
- Southern Ute Indian Tribe
- Standing Rock Sioux
- The Hopi Tribe

- Ute Indian Tribe of the Uintah & Ouray Reservation
- Ute Mountain Ute Tribe

4.2.2 Compliance with Federal, State, and Local Laws and Regulations

National Historic Preservation Act Compliance

The Draft RMPA/EIS was provided to the State Historic Preservation Officer (SHPO) concurrently with its release to the public. The BLM sent a letter on July 6, 2022 requesting SHPO review of the project information and inviting cooperating agency status. SHPO declined cooperating agency status but accepted consultation with the BLM, responding that the proposed changes to land use plans comprise a federal undertaking subject to compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations, 36 CFR 800. The BLM continues to consult the SHPO according to the State Protocol Agreement Between the Colorado State Director of the BLM and the Colorado State Historic Preservation Officer Regarding the Manner in Which the BLM Will Meet Its Responsibilities Under the NHPA and the 2012 National Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (BLM State Protocol) for the subject undertaking. On April 5, 2023, the BLM invited SHPO to discuss the RMPA/EIS and discussions continue at Quarterly Protocol Meetings.

Endangered Species Act Compliance

To comply with Section 7(c) of the Endangered Species Act of 1973, the BLM coordinated with the US Fish and Wildlife Service early in the planning process as a cooperating agency. The US Fish and Wildlife Service provided input on planning issues, data collection and review, and alternatives development. The BLM will consult with US Fish and Wildlife Service to develop the draft Biological Assessment after it reviews public comments on the Draft RMPA/EIS.

Resource Advisory Councils

A resource advisory council (RAC) is a committee established by the Secretary of the Interior to provide advice or recommendations to BLM management (BLM Land Use Planning Handbook H-1601-1; BLM 2005a). A resource advisory council is generally composed of 15 members of the public representing different areas of expertise. The Colorado Southwest RAC, Northwest RAC, and Rocky Mountain RAC include members appointed to represent constituent BLM-administered land users and provide input on public management issues.

A coordinated effort to involve the RACs early on and throughout a planning effort ensures that the BLM will obtain and incorporate local input and advice at every stage. The BLM presented project information to the three RACs, including Southwest RAC on Sept 7, 2022 and Dec 8, 2022; Northwest RAC on September 14, 2022, and the Rocky Mountain RAC on August 16, 2022. Letters about the project have also been sent to individual RAC members. Additional engagement is anticipated throughout the remainder of the project.

4.3 COOPERATING AGENCIES

The FLPMA and NEPA provide direction regarding the coordination and cooperation of Federal agencies with other agencies and local and state governments and tribes. The FLPMA specifically emphasizes the need to ensure coordination and seek consistency of the BLM's actions with the plans and policies of other relevant jurisdictions. The Council on Environmental Quality's regulations for implementing NEPA provide for involvement of cooperating agencies in the NEPA process. Cooperating agency status provides a formal framework for governmental units (including local, State, Federal, and tribal) to engage in active collaboration with a lead Federal agency during the NEPA process.

The BLM invites agency cooperation early in the RMPA process using the process outlined in 43 CFR 1501.6. A cooperating agency is any federal, state, or local government agency or Indian tribe that enters into a formal agreement with the lead federal agency to help develop an environmental analysis. More specifically, cooperating agencies “work with the BLM, sharing knowledge and resources, to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks” (BLM Land Use Planning Handbook H-1601-1; BLM 2005a). The primary role of cooperating agencies during the planning process is to provide input on issues for which they have a special expertise or jurisdiction.

The BLM invited a total of 64 Colorado counties as well as state, federal, and tribal representatives to participate as cooperating agencies for the Big Game Habitat Conservation RMPA/EIS. Thirty-eight government organizations are participating in the RMPA as cooperating agencies, all of which have signed memoranda of understanding with the BLM that identifies the roles and responsibilities of the BLM and the cooperating agency in the planning process. (Table 4-2, Cooperating Agency Participation).

Table 4-2. Cooperating Agency Participation

Agency/Entity
Counties
Arapahoe County
Arapahoe County Planning, Oil and Gas Specialist
Archuleta County
Chaffee County
Delta County
Dolores County
Eagle County
El Paso County
Garfield County
Gilpin County
Gunnison County
Hinsdale County
Huerfano County
Jackson County
La Plata County
Las Animas
Mesa County
Moffat County
Montezuma County
Montrose County
Ouray County
Pitkin County
Rio Grande County
Routt County
Saguache County
Teller County
State Agencies
Colorado Department of Natural Resources and associated divisions like Colorado Energy and Carbon Management Commission and Colorado Parks and Wildlife
Colorado Department of Transportation (CDOT)
Colorado Department of Agriculture

Agency/Entity
Federal Agencies
Bureau of Reclamation
US Department of Agriculture – Natural Resources Conservation Service – Colorado
US Fish and Wildlife Service
US Department of Agriculture – US Forest Service

Since August 23, 2022, the BLM has conducted seven meetings with cooperating agencies. Cooperating agencies were also encouraged to attend the scoping open houses and provide comments during the scoping period (**Section 4**). These agencies have been engaged throughout the planning process, including during alternatives development. The BLM held office hours for cooperators on the draft/working range of alternatives in March of 2023.

Working through a semi-regular engagement process, the cooperators have provided expertise on much of the subject matter the BLM is addressing in the Draft RMPA/EIS, as well as advice based on experience with other planning efforts. The cooperators have provided feedback on public outreach sessions, data sources and analytical methods, and components of the draft alternatives. They have provided oral and written feedback and ideas throughout the process of developing the Draft RMPA/EIS. The BLM continues efforts with cooperators to ensure numerous opportunities are provided to express their opinions about content and process, and to make suggestions about how the BLM might improve the plan. During preparation of the final RMPA/EIS, the BLM anticipates updating this section following cooperator feedback on the draft RMPA/EIS, and review of any outstanding concerns expressed from cooperators.

A subset of cooperating agencies comprise a technical team of experts, including Colorado Parks and Wildlife, Colorado Department of Transportation, Colorado Department of Natural Resources, and the U.S. Fish and Wildlife Service. This technical team started October of 2022 with subsequent bi-weekly meetings. The technical team provided a venue to discuss approaches to methodology to assist the BLM's preparation of the Draft RMPA/EIS. The team focused, respectively, on the following topics: methods for density and disturbance, data sources for analyses, habitat conditions, and technical terminology for the EIS.

4.4 COORDINATION AND CONSISTENCY

BLM planning regulations (43 CFR 1610) require that BLM RMPs be consistent with officially approved or adopted resource-related plans of other federal, state, local, and tribal governments, to the extent that those plans are consistent with federal laws and regulations applicable to public lands. Plans formulated by federal, state, local, and tribal governments that relate to federal lands and resources have been reviewed and considered as the RMPA/EIS has been developed. These plans are listed in **Chapter I, Section 1.8**.

The BLM is aware that specific state laws and local plans may be relevant to aspects of public land management. However, the BLM is bound by federal law, and there may be inconsistencies that cannot be reconciled.

With respect to officially approved state and local policies and programs (as opposed to plans), the consistency provision only applies to the maximum extent practical. While county and state planning processes are required to be as integrated and consistent with BLM's plans as practical, the BLM's planning process must adhere to federal laws and regulations.

The BLM sent an additional letter in June 2023 to counties who did not accept cooperating status for this effort to provide another opportunity to coordinate with the BLM regarding local plans.

4.5 DISTRIBUTION AND AVAILABILITY OF THE DRAFT RMPA/EIS

The BLM provided a copy (paper or thumb drive) of the Draft RMPA/EIS to tribal and local governments and agencies. A limited number of copies were printed. Individuals and organizations may download the documents from the RMPA Web site, review a paper copy at the BLM State Office, or request a thumb drive.

Members of the public have the opportunity to comment on this Draft RMPA/EIS during the 90-day public comment period. The Notice of Availability announces the opening of a 90-day comment period for the Draft RMPA/EIS beginning with the date following the Environmental Protection Agency’s (EPA) publication of its Notice of Availability (NOA) in the *Federal Register*.

The Draft RMP Amendment/EIS is available for review on the BLM ePlanning project website at <https://go.usa.gov/xzXxY>. Notification of the Draft RMPA/EIS has also been provided to cooperating agencies and tribal representatives. Written may be submitted by any of the following methods

- Website: <https://go.usa.gov/xzXxY>
- Mail: BLM Colorado State Office, Attn: Big Game Corridor Amendment/EIS, Denver Federal Center Building 40, Lakewood, CO 80225

Documents pertinent to this proposal may be examined online at <https://go.usa.gov/xzXxY> and at the [BLM Colorado State Office, Denver Federal Center, Building 1A, Lakewood, CO](#).

Four in-person public meetings and two virtual public meetings (open houses) will be held during a two-week period during the public comment period on the Draft RMPA/EIS. One meeting will be held in each of the following locations: TBD. These public meetings will be structured in an open house format with BLM specialists available to provide information on the Draft RMPA/EIS, including the range of alternatives, impact analysis, and specific resources of concern, or on the planning process.

The Proposed RMPA/Final EIS will respond to all substantive comments on the Draft RMPA/EIS received during the 90-day comment period. The record of decision will then be issued by the BLM after the release of the Proposed RMPA/Final EIS, the Governor’s Consistency Review, and any resolution of protests received on the Proposed RMPA/Final EIS.

4.6 LIST OF PREPARERS

This Draft RMPA/EIS was prepared by an interdisciplinary team of staff from the BLM and its contractor, Environmental Management and Planning Solutions, Inc. (EMPSi), with its local supporting subcontractors Ramboll–Environ and West, Inc. **Table 4-3** (RMP/EIS Preparers) is a list of people that prepared or contributed to the development of the Draft RMPA and EIS. As discussed in **Section 4.2**, staff from numerous federal, state, and local agencies, industry, and nonprofit organizations also contributed to developing the Draft RMPA.

Table 4-3. RMP/EIS Preparers

Name	Role/Responsibility
BLM Colorado	
Ashley Phillips	Project Manager
Bruce Krickbaum	Branch Chief for Recreation and Planning
Shawn Wiser	Wildlife Biologist
Kemba Anderson	Geology and Fluid Minerals
Dan Ben-Horin	Special Designations

Name	Role/Responsibility
Ben Billings	Vegetation
Malia Burton	Lands and Realty
Jeff Christenson	Travel and Transportation
Natalie Clark	Cultural and Paleontological Resources and Native American Religious Concerns
Forrest Cook	Air Resources and Climate
Christopher Domschke	Vegetation
Kristin Elowe	Geology and Fluid Minerals
Tim Finger	Recreation
Hannah Fortney	GIS Specialist
Greg Goodwin	GIS Specialist
Annette Treat	Lands and Realty
James Miller	Air Resources and Climate
Ed Rumbold	Soil and Riparian Resources
Robin Sell	Wildlife
Amy Stillings	Socioeconomics
Lisa Strunk	Environmental Justice
Carmia Woolley	Geology and Fluid Minerals
Gwenan Poirier	Fire
EMPSi: Environmental Management and Planning Solutions, Inc.	
Meredith Linhoff	Project Manager
Kevin Rice	Project Manager (former)
Liza Schill	Deputy Project Manager, Visual Resources
Angie Adams	Lands and Realty
Lily Benson	Recreation
Amy Cordle	Air Quality and Climate
Francis Craig	Energy and Minerals
Noelle Crowley	Soil Resources and Riparian
Kevin Doyle	Cultural and Paleontological Resources, Native American Concerns
Zoe Ghali	Socioeconomics and Environmental Justice
Derek Holmgren	Recreation, Visual Resources
David Jaeger	Lands and Realty
Perry Lown	Cultural and Paleontological Resources, Native American Concerns
Clayton McGee	Travel and Transportation, Noise and Acoustic Environment, Air and Climate, Comment Analysis
Chelsea Ontiveros	GIS Specialist
Rachel Redding	Wildlife Biologist
Shannon Regan	Wildlife Biologist
Camila Reiswig	Socioeconomics and Environmental Justice
Marcia Rickey, GISP	GIS Specialist
Josh Schnabel	Socioeconomics and Environmental Justice
Andy Spellmeyer	Vegetation, 508 Compliance
Andrew Wilkins	Soil Resources and Riparian
Kim Murdoch	Technical Editing
Cindy Schad	Formatting
Ramboll-Environ	
Ross Beardsley, PhD	Air Quality, Climate
John Grant	Air Quality, Climate
Tejas Shah	Air Quality, Climate
Krish Vijayaraghavan	Air Quality, Climate

This page intentionally left blank.

Chapter 5. References

- Almzam, W., and W. Alfaghi. 2021. Noise Evaluation in Oil and Gas Fields and Associated Risk Assessment. 10.21203/rs.3.rs-161975/v1
- Baker, B. W., H. R. Peinetti, M. B. Coughenour, and T. L. Johnson. 2012. "Competition favors elk over beaver in a riparian willow ecosystem." *Ecosphere* 3(11): 95. Internet website: <http://dx.doi.org/10.1890/ES12-00058.1>.
- Barber, J. R., K. M. Fristrup, C. L. Brown, A. R. Hardy, L. M. Angeloni, and K. R. Crooks. 2009. The costs of chronic noise exposure for terrestrial organisms. *Trends in Ecology and Evolution* 25 (3): 180- 189.
- Blair, B. D., S. Brindley, E. Dinkeloo, L. McKenzie, J. Adgate. 2018. "Residential noise from nearby oil and gas well construction and drilling." *Journal of Exposure Science and Environmental Epidemiology* 28: 538–547.
- BEA (US Department of Commerce, Bureau of Economic Analysis). 2022a. CAINCI County and MSA Personal Income Summary: Personal Income, Population, Per Capita Personal Income. Internet website: <https://apps.bea.gov/itable/>.
- _____. 2022b. Regional Economic Accounts for Colorado and Selected Counties in Colorado, as reported in Headwaters Economic Profile System. Internet website: <https://headwaterseconomics.org/tools/economic-profile-system>.
- _____. 2022c. CAINC5N Personal Income by Major Components and Earnings by NAICS Industry. Internet website: <https://apps.bea.gov/itable/>.
- Blickley, J. L., and G. L. Patricelli. 2012. "Potential acoustic masking of greater sage-grouse display components by chronic industrial noise." *Ornithological Monographs* 74: 23-35.
- Blickley, J. L., K. R. Word, A. H. Krakauer, J. L. Phillips, S. N. Sells, C. C. Taff, J. C. Wingfield, et al. 2012. "Experimental chronic noise is related to elevated fecal corticosteroid metabolites in lekking male Greater Sage-Grouse (*Centrocercus urophasianus*)." *PLoS ONE* 7(11): e50462. DOI:10.1371/journal.pone.0050462
- BLM (United States Department of the Interior, Bureau of Land Management). 1984. Manual 8400—Visual Resource Management. Rel. 8-24 BLM, Washington, DC. April 5, 1984.
- _____. 1986a. Handbook H-8410-1—Visual Resource Inventory. Rel. 8-28, BLM, Washington, DC. January 17, 1986.
- _____. 1986b. Handbook H-8431—Visual Resource Contrast Rating. Rel. 8-30. BLM, Washington, DC. January 17, 1986.
- _____. 2004. BLM Manual 8100, Foundations for Managing Cultural Resources. Washington, DC. Internet website: <https://www.blm.gov/sites/blm.gov/files/Manual%20-%20Foundations%20for%20Managing%20Cultural%20Resources.pdf>.

-
- _____. 2005. Record of Decision for the Wind Energy Development Programmatic EIS and Associated Land Use Plan Amendments. Washington, DC. June. Internet website: <https://windeis.anl.gov/documents/docs/WindPEISROD.pdf>.
- _____. 2007. Record of Decision. Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. BLM, Nevada State Office, Reno, Nevada. June.
- _____. 2011a. 1626 Travel and Transportation Manual (Public). Rel. 1-1731. Form 1221-2.
- _____. 2011b. Little Snake ROD and ARMP. US Department of the Interior. Colorado State Office, Little Snake Field Office. Craig, Colorado.
- _____. 2012. Approved RMP Amendments/Record of Decision for Solar Energy Development in Six Southwestern States. Washington, DC. October. Internet website: https://blmsolar.anl.gov/documents/docs/peis/Solar_PEIS_ROD.pdf.
- _____. 2013. Tres Rios Field Office Proposed RMP and Final Environmental Impact Statement. Volume 1 - Final EIS. Chapter 3 Affected Environment. Internet website: <https://eplanning.blm.gov/eplanning-ui/project/65211/570>.
- _____. 2014a. Colorado River Valley Field Office Approved Resource Management Plan and Planning Documents. Final EIS. Chapter 3 Affected Environment. Internet website: <https://eplanning.blm.gov/eplanning-ui/project/68506/570>.
- _____. 2014b. Kremmling Field Office Proposed Resource Management Plan and Final Environmental Impact Statement. Chapter 3 Affected Environment. Internet website: <https://eplanning.blm.gov/eplanning-ui/project/48543/570>
- _____. 2015a. Grand Junction Field Office Approved Resource Management Plan. Grand Junction, CO. Internet website: https://eplanning.blm.gov/public_projects/lup/55944/67731/73684/4_GJFO_Approved_RMP.pdf.
- _____. 2015b. Northwest Colorado Greater Sage-Grouse Proposed LUPA/Final EIS. June 2015. Northwest Colorado District, Grand Junction, CO.
- _____. 2015c. White River Field Office 2015 Oil and Gas Development Proposed RMPA/FEIS. Chapter 3 Affected Environment. Internet website: <https://eplanning.blm.gov/eplanning-ui/project/65266/570>.
- _____. 2016 (United States Department of the Interior, Bureau of Land Management). Instruction Memorandum 2016-124, Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands. Washington, DC. Internet website: <https://www.blm.gov/policy/im-2016-124>.
- _____. 2018a. Permanent Instruction Memorandum (PIM) 2018-014 Directional Drilling into Federal Mineral Estate from Well Pads on Non-Federal Locations. June 12, 2018. Internet website: <https://www.blm.gov/policy/pim-2018-014>.

-
- _____. 2018b. Fourmile East Solar Energy Zone Deallocation RMP Amendment. Monte Vista, CO. Internet website: https://eplanning.blm.gov/public_projects/nepa/76102/162131/197822/DOI-BLM-CO-F030-2017-0005_EA_final.pdf.
- _____. 2019. Uncompahgre Field Office Proposed RMP / Final EIS. Volume I. Chapter Affected Environment. Internet website: <https://eplanning.blm.gov/eplanning-ui/project/62103/570>.
- _____. 2021. 2021 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends from Coal, Oil, and Gas Exploration and Development on the Federal Mineral Estate. Internet website: <https://www.blm.gov/content/ghg/>.
- _____. 2022a. Lands, Realty, and Cadastral Survey – Rights-of-Way – Communications Sites. Internet website: <https://www.blm.gov/programs/lands-and-realty/communication-sites>.
- _____. 2022b. Legacy Rehost 2000 (LR2000) database. Database queried by J. Jardine, BLM, Colorado State Office, Lakewood, CO, October 2022, and emailed from A. Phillips, BLM, Colorado State Office, Lakewood, CO, to K. Rice, EMPSi, Boulder, CO, on October 19, 2022.
- _____. 2022c. Preparation Plan for Statewide Amendment to Resource Management Places/Environmental Impact Statement Regarding Big Game Conservation. Bureau of Land Management Colorado State Office. Lakewood, Colorado. May 2022.
- _____. 2022d. BLM Colorado Native Plants Program. Internet website: <https://www.blm.gov/programs/natural-resources/native-plant-communities/about-native-plants/colorado>.
- _____. 2022e. Frequently Asked Questions about the Federal Coal Leasing Program. Internet website: https://eplanning.blm.gov/public_projects/nepa/64842/78268/88489/CoalFAQ.pdf
- _____. 2022f. BLM Colorado 2022. Economic Contributions from BLM-Managed Lands FY21. Online: <https://www.blm.gov/about/data/socioeconomic-impact-report-2022>.
- _____. 2022g. 2019 Briefing Book. Bureau of Land Management. Internet website: https://www.blm.gov/sites/blm.gov/files/Briefing%20Book%202019_Final.pdf.
- _____. 2022h. Data on Federal Oil and Gas Wells from the Automated Fluid Minerals Support System Reports (AFMSS).
- _____. 2022i. Data on Colorado Regional Oil and Gas Future and Existing Activity for Scenario B. Unpublished.
- _____. 2022j. Addressing Environmental Justice in NEPA Documents: Frequently Asked Questions. U.S. Department of the Interior, Bureau of Land Management, Socioeconomics Program, Washington, DC.
- _____. 2022k. Colorado Recreation Activities. Internet website: <https://www.blm.gov/programs/recreation/recreation-activities/colorado>.
- _____. 2022l. Visit Us Search Results – Hiking. Internet website: https://www.blm.gov/visit/search?field_location=100035&field_activities=100005&search_api_fulltext=.

- _____. 2022m. Visit Us Search Results – OHV. Internet website: https://www.blm.gov/visit/search?field_location=100035&field_activities=100000&search_api_fulltext=.
- _____. 2022n. Ten Places to Winter Recreate on BLM-managed Public Lands. Internet website: <https://www.blm.gov/blog/2019-02-08/ten-places-winter-recreate-blm-managed-public-lands>.
- _____. 2022o. Access Tips for Hunting on BLM Lands. Internet website: <https://www.blm.gov/press-release/access-tips-hunting-blm-lands>.
- _____. 2022p. BLM. Seasonal Closures. Internet website: <https://www.blm.gov/programs/recreation/recreation-activities/colorado/closures>.
- _____. 2022q. 2021 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends from Coal, Oil, and Gas Exploration and Development on the Federal Mineral Estate. Internet website: <https://www.blm.gov/content/ghg/2021/>.
- _____. 2022r. National Policy for the Right-of-Way Authorizations Necessary for Site Characterization, Capture, Transportation, Injection, and Permanent Geologic Sequestration of Carbon Dioxide in Connection with Carbon Sequestration Projects. Instruction Memorandum IM 2022-041. June 8, 2022. Internet website: <https://www.blm.gov/policy/im-2022-041>.
- _____. 2023a. BLM Colorado’s air quality monitoring network website. Internet website: <https://www.colowhiteriverairquality.net/index.html>.
- _____. 2023b. BLM Colorado’s Air Resources webpage with access to CARMMS and oil and gas related annual reports and CARPP. Internet website: <https://www.blm.gov/programs/natural-resources/soil-air-water/air/colorado>.
- _____. 2023c. About Helium. Internet website: <https://www.blm.gov/programs/energy-and-minerals/helium/about-helium>.
- _____. 2023d. National Conservation Lands. Internet website: <https://www.blm.gov/programs/national-conservation-lands>.
- BLM GIS (United States Department of the Interior, Bureau of Land Management Geographic Information System). 2020. National Western US Greater Sage-Grouse Habitat Management Areas. Internet website: <https://gbp-blm-egis.hub.arcgis.com/datasets/BLM-EGIS::blm-natl-westernus-grsg-rod-habitat-mgmt-areas-february-2020/about>.
- _____. 2022. GIS data used in the Big Game Corridor alternatives, affected environment, and impact analysis. Denver, Colorado.
- _____. 2023. BLM GIS. GIS data used in the Big Game Corridor alternatives, affected environment, and impact analysis. Denver, Colorado.
- BLS (US Department of Labor, Bureau of Labor Statistics). 2023. Local Area Unemployment Statistics, Washington, DC. Internet website: <https://www.bls.gov/data/home.htm>.
- Boslett, A., T. Guilfoos, and C. Lang. 2019. Valuation of the external costs of unconventional oil and gas development--The critical importance of mineral rights ownership. *Journal of the Association of Environmental and Resource Economists* (6):531–561.

- Brown, G., K. de Bie, and D. Weber. 2015. "Identifying public land stakeholder perspectives for implementing place-based land management." *Landscape and Urban Planning*, Volume 139, Pages 1-15, ISSN 0169-2046. Internet website: <https://doi.org/10.1016/j.landurbplan.2015.03.003>.
- Burton, T. A., E. R. Cowley, and S. J. Smith. 2008. *Monitoring Stream Channels and Riparian Vegetation – Multiple Indicators*. Version 5.0. US Department of the Interior. Bureau of Land Management. Idaho State Office. Boise, ID.
- Carsey, K., G. Kittel, K. Decker, D. J. Cooper, and D. Culver. 2003. *Field Guide to the Wetland and Riparian Plant Associations of Colorado*. Colorado Natural Heritage Program, Fort Collins, Colorado.
- CDO (Colorado Division of Wildlife). 2009. *Colorado Bighorn Sheep Management Plan 2009-2019*. Special Report No. 81. Eds. J. L. George, R. Kahn, M. W. Miller, & B. Watkins.
- CDPHE (Colorado Department of Public Health and Environment). 2021. *2021 GHG Emissions Inventory Report*. September 2021. Internet website: <https://cdphe.colorado.gov/air-pollution/climate-change#inventory>.
- _____. 2022a. Colorado Department of Public Health and Environment. *Annual Air Quality Data Reports*. Internet website: https://www.colorado.gov/airquality/tech_doc_repository.aspx#annual_reports.
- _____. 2022b. Colorado Department of Public Health and Environment. *Air Quality Control Commissions. Regulations 3 (effective 05/15/2021) and 7 (effective 01/30/2022) for oil and gas*. Internet website: <https://cdphe.colorado.gov/aqcc-regulations>.
- CEQ (Council on Environmental Quality). 1997. *Environmental Justice Guidance under the National Environmental Policy Act*. Internet website: <https://www.epa.gov/environmentaljustice/ceq-environmental-justice-guidance-under-national-environmental-policy-act>.
- _____. 2022. *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. Internet website: <https://www.federalregister.gov/documents/2023/01/09/2023-00158/national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas-emissions-and-climate>
- Chapman, S. S., G. E. Griffith, J. M. Omernik, A. B. Price, J. Freeouf, and D. L. Schrupp. 2006. *Ecoregions of Colorado (color poster with map, descriptive text, summary tables, and photographs)*: Reston, Virginia. Internet website: https://gaftp.epa.gov/EPADDataCommons/ORD/Ecoregions/co/co_eco_lg.pdf.
- Childress, A., E. Gordon, T. Jedd, R. Klein, J. Lukas, and R. McKeown. 2015. *Colorado Climate Change Vulnerability Study*. Eric Gordon and Dennis Ojima, editors. Internet website: https://www.colorado.edu/sites/default/files/2021-09/co_vulnerability_report_2015_final.pdf.
- CNHP (Colorado Natural Heritage Program). 2015. *Climate Change Vulnerability Assessment for Colorado Bureau of Land Management*. K. Decker, L. Grunau, J. Handwerk, and J. Siemers, editors. Colorado State University, Fort Collins, Colorado.
- CNWA (Colorado Noxious Weed Act). 2009. *Title 35 Agriculture Article 5.5. Colorado Noxious Weed Act*. Internet website: <https://ag.colorado.gov/conservation/noxious-weeds/publications>.

- Coates, P. S., B. G. Prochazka, M. A. Ricca, K. B. Gustafson, P. Ziegler, and M. L. Casazza. 2017. "Pinyon and juniper encroachment into sagebrush ecosystems impacts distribution and survival of greater sage-grouse." *Rangeland Ecology & Management* 70(1): 25–38.
- COGA (Colorado Oil and Gas Association). 2020. Fact Sheet - The Colorado Molecule. Published 06/24/2020. Internet website: <https://www.coga.org/factsheets/colorado-molecule>.
- ECMC (Colorado Energy and Carbon Management Commission). 2008. Aesthetic and Noise Control Regulations. Internet website: <https://cogcc.state.co.us/orders/orders/1r/99.html>.
- Colorado Department of Natural Resources. 2021. Opportunities to Improve Sensitive Habitat and Movement Route Connectivity for Colorado's Big Game Species. In cooperation with Colorado Department of Transportation, Denver, Colorado. September 27, 2021.
- Colorado Department of Local Affairs, State Demography Office. 2022. Population Totals for Colorado Counties, Historical Census, Population Estimates, Population Forecasts. Internet website: <https://demography.dola.colorado.gov/assets/html/county.html>.
- Colorado Department of Transportation. 2022. Colorado Scenic & Historic Byways. Internet website: <https://www.codot.gov/travel/colorado-byways>.
- Colorado Energy Office. 2021. Colorado's GHG Pollution Reduction Roadmap. Internet website: <https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap>
- Colorado Legislative Council Staff. 2023. Economic & Revenue Forecast. March 2023. Internet website: <https://leg.colorado.gov/sites/default/files/images/march2023forecast.pdf#page=33>.
- Colorado Office of Economic Development and International Trade. 2021. Updated economic data from US BEA on impact of outdoor recreation industry shows industry gains, losses and overall economic impact. Internet website: <https://oedit.colorado.gov/press-release/updated-economic-data-from-us-bea-on-impact-of-outdoor-recreation-industry-shows>.
- Colorado State University. 2022. Colorado's Forests in a Changing Climate. <https://csfs.colostate.edu/colorados-forests-changing-climate/#1475778413728-cdbd6c3f-a7c7> CWVCB and DNR (Colorado Water Conservation Board and Department of Natural Resources). 2013. Colorado Drought Mitigation and Response Plan.
- Cooley, C. P., A. Holland, M. Cowardin, M. Flenner, T. Balzer, J. Stiver, E. Slezak, et al. 2020. Status Report: Big Game Winter Range and Migration Corridors. Colorado Parks and Wildlife, Denver, Colorado.
- Cooper, K. C. 1987. Seasonal movements and habitat use of migratory elk in Mount Rainier National Park. Master's Thesis. Oregon State University. Corvallis, Oregon.
- CPW (Colorado Parks and Wildlife). 2005. Gunnison Sage-Grouse Rangewide Conservation Plan. Internet website: <https://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/GunnisonSageGrouse/ConsPlan/3ConservAssess.pdf>.
- _____. 2014. Big Game 2014: Pronghorn provide unique hunting challenge. Internet website: <https://cpw.state.co.us/Lists/News%20Releases/DispForm.aspx?ID=361>

-
- _____. 2017a. The Story of Colorado’s Mule Deer. Past...present...future? Internet website: <https://cpw.state.co.us/Documents/MuleDeer/ColoradosMuleDeerStory.pdf>.
- _____. 2017b. The 2017 Economic Contributions of Outdoor Recreation in Colorado. Internet website: https://cpw.state.co.us/Documents/Trails/SCORP/2017EconomicContributions_SCORP.pdf.
- _____. 2018. The 2019–2023 Colorado Statewide Comprehensive Outdoor Recreation Plan. Internet website: <https://cpw.state.co.us/Documents/Trails/SCORP/Final-Plan/2019-SCORP-Report.pdf>.
- _____. 2020a. Status of Colorado’s Deer, Elk, and Moose Populations. February 2020. Denver, Colorado.
- _____. 2020b Status Report: Big Game Winter Range and Migration Corridors. Denver, CO. Internet website: <https://cpw.state.co.us/Documents/Hunting/BigGame/2020BigGameWinterRangeandMigrationCorridorsReport.pdf>.
- _____. 2022a. GIS Species Activity Mapping Definitions. Internet website: <https://cpw.state.co.us/learn/Maps/CPW-Public-GIS-Species-Activities-Definitions.pdf>.
- _____. 2022b. Colorado Big Game Action Plan for Implementation of Department of Interior Secretarial Order 3362: Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors. 2021-2022. Denver, Colorado.
- _____. 2022c. Scoping comment letter “RE: Colorado Parks Et Wildlife Scoping Comments for BLM's Statewide Big Game Resource Management Plan Amendment Process (DOI-BLM-00-0000-2022-0003-RMP-EIS).” Denver, Colorado.
- _____. 2022d. Elk: 2021 Post-Hunt Population and Sex Ratio Estimates. Internet website: <https://cpw.state.co.us/Documents/Hunting/BigGame/Statistics/Elk/2021ElkPopulationEstimates.pdf>.
- _____. 2022e. Pronghorn: 2021 Post-hunt Population and Sex Ratio Estimates. Internet website: <https://cpw.state.co.us/Documents/Hunting/BigGame/Statistics/Pronghorn/2021PronghornPopulationEstimates.pdf>.
- _____. 2022f. Alpine species. Internet website: <https://cpw.state.co.us/conservation/Pages/CON-Alpine-Species.aspx>.
- _____. 2022g. Aquatic Habitats. Internet website: <https://cpw.state.co.us/conservation/Pages/CON-Aquatic.aspx>.
- _____. 2022h. Aquatic Nuisance Species. Internet website: <https://cpw.state.co.us/aboutus/Pages/ISP-ANS.aspx>.
- _____. 2022i. Draft Colorado Wolf Restoration and Management Plan. Internet website: <https://cpw.state.co.us/Documents/Wolves/DRAFT-CO-Wolf-Plan.pdf>.
- Correll, D. 2008. Colorado Tribe, armed with old treaty, expands hunting. Los Angeles Times. Internet website: <https://www.latimes.com/archives/blogs/la-unleashed/story/2008-11-03/colorado-tribe-armed-with-old-treaty-expands-hunting>.

- CSU (Colorado State University). 2023a. Interagency Monitoring of Protected Visual Environments (IMPROVE) website. Data updated and site accessed September 2022. Internet website: <http://vista.cira.colostate.edu/Improve/improve-data/>
- _____. 2023b. Colorado State University. Federal Land Manager Environmental Database. Air Quality Related Values (AQRV) Express Tools. Internet website: https://www.colorado.gov/airquality/tech_doc_repository.aspx#annual_reports
- Ditmer, M. A., G. Wittemyer, S. W. Breck, and K. R. Crooks. 2022. Defining ecological and socially suitable habitat for the reintroduction of an apex predator. *Global Ecology and Conservation* 38:p.e02192.
- Dodge, V. J., V. T. Eviner, and J. H. Cushman. 2020. “Context-dependent effects of a reintroduced ungulate on soil properties are driven by soil texture, moisture, and herbivore activity.” *Ecology and Evolution* 10: 10858–10871. Internet website: <https://doi.org/10.1002/ece3.6743>.
- Dzialak, M., S. L. Webb, S. M. Harju, J. B. Winstead, J. J. Wondzell, J. P. Mudd, and L. D. Hayden-Wing. 2011. “The spatial pattern of demographic performance as a component of sustainable landscape management and planning.” *Landscape Ecology* 26: 775–790.
- EIA (United States Energy Information Administration). 2018. U.S. Energy Information Administration. Today in Energy article. April 6th, 2018. Internet website: [https://www.eia.gov/todayinenergy/detail.php?id=35672#:~:text=About%20%25%20of%20fossil%20fuels,U.S.%20Energy%20Information%20Administration%20\(EIA\)](https://www.eia.gov/todayinenergy/detail.php?id=35672#:~:text=About%20%25%20of%20fossil%20fuels,U.S.%20Energy%20Information%20Administration%20(EIA))
- _____. 2022. Annual Energy Outlook 2022. Internet website: https://www.eia.gov/outlooks/aeo/IIIF_carbonfee/#:~:text=The%20AEO2022%20Reference%20case%20includes,and%20%25%20above%202020%20levels
- EPA (US Environmental Protection Agency). 2015. U.S. Environmental Protection Agency. Final Rule for National Ambient Air Quality Standards for Ozone. Federal Register Document: 80 FR 65291. Effective Date: 12/28/2015. Internet website: <https://www.federalregister.gov/documents/2015/10/26/2015-26594/national-ambient-air-quality-standards-for-ozone>
- _____. 2016. What Climate Change Means for Colorado. EPA 430-F-16-008. Internet website: <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-co.pdf>.
- _____. 2022. Why are Wetlands Important? Internet website: <https://www.epa.gov/wetlands/why-are-wetlands-important>.
- _____. 2023a. U.S. Environmental Protection Agency. Air Data website: Air Quality Data Collected at Outdoor Monitors Across the US. Accessed September 2022. Internet website: <https://www.epa.gov/outdoor-air-quality-data>
- _____. 2023b. U.S. Environmental Protection Agency. National Emissions Inventory. 2020 and 2017 NEI data. Internet website: <https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei>.

- EPA GIS (Environmental Protection Agency Geographic Information Systems). 2022. Ecoregions of Colorado. Internet website: <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8>.
- Forest Service (US Department of Agriculture, Forest Service). 2021. Final San Juan National Forest Land and Resource Management Plan, March 2021 update. San Juan National Forest, Colorado. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5434480.pdf
- Forest Service (US Department of Agriculture, Forest Service). 2022. Continental Divide National Scenic Trail. Internet website: <https://www.fs.usda.gov/managing-land/trails/cdt>.
- Francis, C. D., and J. R. Barber. 2013. “A framework for understanding noise impacts on wildlife: An urgent conservation priority.” *Frontiers in Ecology and the Environment* 11: 305–313 (DOI: 10.1890/120183).
- Frid, A., and L. Dill. 2002. “Human-caused disturbance stimuli as a form of predation risk.” *Conservation Ecology* 6(1): 11. Internet website: <http://www.ecologyandsociety.org/vol6/iss1/art11/inline.html>.
- GAO (US Government Accountability Office). 2021. Report to Congressional Requesters. Oil and Gas Leasing. BLM Should Update Its Guidance and Review Its Fees. November 2021. GAO-22-103968. Internet website: <https://www.gao.gov/assets/gao-22-103968.pdf>.
- Garfield County Public Health Department. 2021. Garfield County 2020 Air Quality Monitoring Report. Prepared by Air Resource Specialists. June 30. Internet website: <https://www.garfield-county.com/air-quality/filesgcco/sites/33/garfield-county-air-quality-monitoring-2020-annual-report.pdf>.
- George, S. L., and K. R. Crooks. 2006. “Recreation and large mammal activity in an urban nature reserve.” *Biological Conservation* 133: 107–117.
- Gigliotti, L. C., Atwood, M. P., Cole, E. K., Courtemanch, A., Dewey, S., Gude, J. A., Hurley, M., Kauffman, M., Kroetz, K., Leonard, B., MacNulty, D. R., Maichak, E., McWhirter, D., Mong, T. W., Proffitt, K., Scurlock, B., Stahler, D. R., & Middleton, A. D. (2023). Multi-level thresholds of residential and agricultural land use for elk avoidance across the Greater Yellowstone Ecosystem. *Journal of Applied Ecology*, 60, 1089– 1099. Internet website: <https://doi.org/10.1111/1365-2664.14401>.
- Gilbert, M. M. and A. D. Chalfoun. 2011. Energy development affects populations of sagebrush songbirds in Wyoming. *The Journal of Wildlife Management* 75: 816-824.
- Gibson, R. M., and J. W. Bradbury. 1986. “Male and female mating strategies on Sage-Grouse leks.” In: *Ecological Aspects of Social Evolution: Birds and Mammals* (D. I. Rubenstein and R. W. Wrangham, editors). Princeton University Press, New Jersey. Pp. 379-398.
- Gratson, M. W. 1993. “Sexual selection for increased male courtship and acoustic signals and against large male size at sharp-tailed grouse leks.” *Evolution* 47:691-696.
- Great Plains Conservation Network Prairie Dog Working Group. 2022. BLACK-FOOTED FERRET REINTRODUCTION SITE RAPID ASSESSMENT TOOL. Internet website: <https://plainsconservation.org/wp-content/uploads/2022/04/BFF-Reintroduction-Analysis-3-21-2022.pdf>.

- Green, A. W., C. L. Aldridge, and M. S. O'Donnell. 2017. Investigating impacts of oil and gas development on greater sage-grouse. *Journal of Wildlife Management* 81(1): 46–57.
- Halbritter, H., 2011. Data Analysis Unit PH-30. Colorado Parks and Wildlife Commission. Denver, CO.
- Hanser, S. E., P. A. Deibert, J. C. Tull, N. B. Carr, C. L. Aldridge, T. C. Bargsten, T. J. Christiansen, et al. 2018. Greater sage-grouse science (2015–17)—Synthesis and potential management implications: U.S. Geological Survey Open-File Report 2018–1017, 46 p., <https://doi.org/10.3133/ofr20181017>.
- Hebblewhite, M. 2008. A literature review of the effects of energy development on ungulates: Implications for central and eastern Montana. Report prepared for Montana Fish, Wildlife and Parks, Miles City, MT.
- Holland, A. and J. Broderick. 2013. Desert Bighorn Sheep Addendum to the Colorado Bighorn Sheep Management Plan 2009 – 2019. Approved by Colorado Parks and Wildlife Commission November 14, 2013. Available online: <https://cpw.state.co.us/Documents/WildlifeSpecies/Mammals/DesertBighornSheepAddendum.pdf>.
- Holloran, M. J. 2005. “Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming.” Doctoral dissertation. University of Wyoming, Laramie.
- Horn, J. C., 2016. Brunot Agreement. Colorado Encyclopedia. Internet website: <https://coloradoencyclopedia.org/article/brunot-agreement>.
- H.R. 5376. 2022. Inflation Reduction Act of 2022. 117th Congress. Internet Website: <https://www.congress.gov/bill/117th-congress/house-bill/5376/text>.
- IEA (International Energy Agency). 2021. 2021 World Energy Outlook (WEO). December 2021. Internet website: <https://www.iea.org/reports/world-energy-outlook-2021>.
- IMPLAN model. 2023. 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com
- Ingelfinger F. and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. *Western North American Naturalist* 64: 385–395.
- IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland.
- _____. 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, In press, doi:10.1017/9781009157896.

- Irwin, L. L., J. G. Cook, R. A. Riggs, and J. M. Skovlin. 1994. Effects of Long-term Grazing by Big Game and Livestock in the Blue Mountains Forest Ecosystems. General Technical Report PNW-GTR-325. US Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon.
- IWDW (Intermountain West Data Warehouse). 2021. 2014 Modeling Platform with future 2028 projections. Internet website: <https://views.cira.colostate.edu/iwdw/>.
- IWG (Interagency Working Group). 2021. Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide, Interim Estimates under Executive Order 13990. February. Internet website: <https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs>.
- Johnson, H. E., J. R. Shushinsky, A. Holland, E. J. Bergman, T. Balzer, J. Garner, and S. E. Reed. 2017. “Increases in residential and energy development are associated with reductions in recruitment for a large ungulate.” *Global Change Biology* 23: 578–591.
- Johnston, J. E., A. J. L. Quist, S. Navarro, S. F. Farzan, B. Shamasunder. 2023. Cardiovascular health and proximity to urban oil drilling in Los Angeles, California. *Journal of Exposure Science & Environmental Epidemiology*. Internet website: <https://www.nature.com/articles/s41370-023-00589-z#:~:text=Prior%20studies%20have%20found%20evidence,from%20these%20exposures%20%5B41%5D>.
- Johnston, J. E., K. Chau, M. Franklin, L. Cushing. 2020. Environmental Justice Dimensions of Oil and Gas Flaring in South Texas: Disproportionate Exposure among Hispanic communities. *Environ. Sci. Technol.* 2020, 54, 10, 6289–6298. Internet website: <https://pubs.acs.org/doi/abs/10.1021/acs.est.0c00410>.
- Jones, S. K., Collins, S. L., Blair, J. M., Smith, M. D., and Knapp, A. K. 2016. Altered rainfall patterns increase forb abundance and richness in native tallgrass prairie. *Scientific reports* 6(1): 1–10.
- Klasic, M., M. Schomburg, G. Arnold, A. York, M. Baum, M. Cherin, S. Ciff, P. Kavousi, A. Tillet Miller, D. Shajari, Y. Wang, and L. Sialcita. 2022. Boom, bust, action! How communities can cope with boom-bust cycles in unconventional oil and gas development. *Review of Policy Research* 39: 541–569.
- Koshak, J. 2007. Scenic Byways and Watchable Wildlife – Natural Partners. Internet website: <https://www.codot.gov/travel/colorado-byways/assets/ww-byways-project-report-2007-final.pdf>.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2016. Effects of Recreation on Animals Revealed as Widespread through a Global Systematic Review. *PLoS One* 11: 12.
- Lendrum, P. E., C. R. J. Anderson, R. A. Long, J. G. Kie, and R. T. Bowyer. 2012. Habitat selection by mule deer during migration: effects of landscape structure and natural-gas development. *Ecosphere* 3: 82.
- Leonard, W. A. 2014. Habitat and Harvest: The Modern Scope of Tribal Treaty Rights to Hunt and Fish. *American Indian Law Journal* 3(1), Article 7. <https://digitalcommons.law.seattleu.edu/aij/vol3/iss1/7/>.
- Loomis, J. and M. Haefele. 2017. Quantifying Market and Non-market Benefits and Costs of Hydraulic Fracturing in the United States: A Summary of the Literature. *Ecological Economics* 138: 160–167.

- Lustig, T. D. 2003. Where Would You Like the Holes Drilled into Your Crucial Winter Range? Transactions of the 67th North American Wildlife and Natural Resources Conference 67: 317-327.
- Lyon, P., and J. Sovell. 2000. A Natural Heritage Assessment, San Miguel and Western Montrose Counties, Colorado. Prepared for San Miguel County by Colorado Natural Heritage Program, Fort Collins, Colorado.
- Madson, C. 2005. Deer on the Anticline. Wyoming Wildlife. March 2005.
- Malin, S. A., Mayer, A., Crooks, J. L., McKenzie, L., Peel, J. L., and J. L. Adgate, 2019. Putting on partisan glasses: Political identity, quality of life, and oil and gas production in Colorado. *Energy Policy* 129: 738–748.
- Maniloff, P. and R. Mastromonaco. 2017. The local employment impacts of fracking: A national study. *Resource and Energy Economics* 49: 62–85.
- McLaren, M. F., Smith, M., Timmer, J. M., White, C. M., Pavlacky Jr., D. C., Sparks, R. A. 2021. Integrated Monitoring in Bird Conservation Regions (IMBCR): 2020 Field Season Report. Bird Conservancy of the Rockies. Brighton, Colorado, USA.
- McKenzie, L. M., W. B. Allshouse, T. Burke, B. D. Blair, J. L. Adgate. 2016. Population Size, Growth, and Environmental Justice Near Oil and Gas Wells in Colorado. *Environ. Sci. Technol.* 2016, 50, 21, 11471–11480. Internet website: <https://pubs.acs.org/doi/abs/10.1021/acs.est.6b04391>
- Minnesota vs. Mille Lacs Band of Chippewa Indians. 1999. 526 U.S. 172. Internet website: <https://tile.loc.gov/storage-services/service/ll/usrep/usrep526/usrep526172/usrep526172.pdf>.
- Montgomery, R.A., Roloff, G.J. and Millspaugh, J.J. (2013), Variation in elk response to roads by season, sex, and road type. *The Journal of Wildlife Management*, 77: 313-325. <https://doi.org/10.1002/jwmg.462>
- Murphy, D. A., and W. R. Porath. 1969. "Forest soils and game nutrition." Proceedings of the Annual Conference of the Southeastern Association of the Game and Fish Commissioner, US Fish and Wildlife Agency. 23: 18–25. Internet website: <https://seafwa.org/sites/default/files/journal-articles/MURPHY-18.pdf>.
- _____. 2010. Carbon Dioxide Enhanced Oil Recovery. US Department of Energy. March 2010. Internet website: https://www.netl.doe.gov/sites/default/files/netl-file/co2_eor_primer.pdf.
- NatureServe. 2022. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available <https://explorer.natureserve.org/>.
- Naugle, D. E., K. E. Doherty, B. L. Walker, M. J. Holloran, and H. E. Copeland. 2011. Energy development and greater sage-grouse. *Studies in Avian Biology* 38: 505-516.
- Naylor, L. M., M. J. Wisdom, and R. G. Anthony. 2009. "Behavioral responses of North America elk to recreational activity." *The Journal of Wildlife Management* 73: 328–338.

- NEEF (National Environmental Education Foundation). 2022. Climate Change, Migratory Birds, and the Future of America's Flyways. Internet website: <https://www.neefusa.org/nature/plants-and-animals/climate-change-migratory-birds-and-future-america-s-flyways>.
- Newburn, R. M. 2022. Colorado SB-181. Internet website: <https://www.newburnlaw.com/colorado-sb-181>
- NOAA (National Oceanic and Atmospheric Administration). 2022. State Climate Summaries-Colorado. Internet website: <https://statesummaries.ncics.org/downloads/Colorado-StateClimateSummary2022.pdf>.
- Northrup, J. M., C. R. Anderson, and G. Wittemyer. 2015. Quantifying spatial habitat loss from hydrocarbon development through assessing habitat selection patterns of mule deer. *Global Change Biology* 21: 3961–3970.
- NPS. 2023. National Park Service. Critical Loads for Resource Protection. Internet website: [https://www.nps.gov/subjects/air/critical-loads.htm#:~:text=A%20%E2%80%9Ccritical%20load%E2%80%9D%20is%20the,\(wet%20and%20dry\)%20deposition.](https://www.nps.gov/subjects/air/critical-loads.htm#:~:text=A%20%E2%80%9Ccritical%20load%E2%80%9D%20is%20the,(wet%20and%20dry)%20deposition.)
- NRCS (United States Department of Agriculture, Natural Resources Conservation Service). 2022a. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. US Department of Agriculture Handbook 296. Washington, D.C.
- _____. 2022b. The 12 Orders of Soil Taxonomy. Internet website: <https://www.nrcs.usda.gov/resources/education-and-teaching-materials/the-twelve-orders-of-soil-taxonomy>
- NPS (National Park Service) 1997. *National Register Bulletin 15*, How to Apply the National Register Criteria for Evaluation. Prepared by the US Department of the Interior, National Park Service. Washington DC. Internet Website: <https://www.nrc.gov/docs/ML1912/ML19120A529.pdf>.
- _____. 2004. The Elk of Grand Teton and Southern Yellowstone National Parks. Elk Habitats. Research Report GRTE-N-1. January 20, 2004. Internet website: https://www.nps.gov/parkhistory/online_books/fauna8/fauna4a.htm.
- _____. 2022ba Old Spanish National Historic Trail, New Mexico, Colorado, Utah, Arizona, Nevada, California. Internet website: https://www.nps.gov/nr/travel/american_latino_heritage/old_spanish_national_historic_trail.html.
- _____. 2022b Colorado Plateaus Province. Internet website: <https://www.nps.gov/articles/coloradoplateaus.htm>.
- _____. 2022c. Rocky Mountain System Provinces. Internet website: <https://www.nps.gov/articles/rockies.htm>.
- _____. 2022d. Great Plains Province. Internet website: <https://www.nps.gov/articles/greatplainsprovince.htm>.

- Noise Monitoring Services. 2018. A Guide to Colorado's COGCC Oil and Gas Noise Standards. Internet website: <https://www.noisemonitoringservices.com/a-guide-to-colorados-cogcc-oil-and-gas-noise-standards/>.
- Olivera, J., L. A. Rocha, V. Rotger, and M. Herrera. 2011. "Acoustic pollution in hospital environments." *Journal of Physics: Conference Series*. 332. 012003. 10.1088/1742-6596/332/1/012003.
- ONRR (Office of Natural Resources Revenue). 2022. County-Level Mineral Revenues for Colorado. Internet website: <https://revenue.data.doi.gov/query-data#>.
- Ouren, D. S., C. Haas, C. P. Melcher, S. C. Stewart, P. D. Ponds, N. R. Sexton, L. Burris, T. Fancher, and Z. H. Bowen. 2007. Environmental Effects of Off-Highway Vehicles on Bureau of Land Management Lands: A Literature Synthesis, Annotated Bibliographies, Extensive Bibliographies, and Internet Resources. US Department of the Interior, US Geological Survey, Open-File Report 2007-1353. 225 p.
- Patricelli, G. L., J. L. Blickley, and S. L. Hooper. 2013. "Recommended management strategies to limit anthropogenic noise impacts on greater sage-grouse in Wyoming." *Human-Wildlife Interactions* 7(2):230–249.
- Phillips, G. E., and A. W. Alldredge. 2000. "Reproductive success of elk following disturbance by humans during calving season." *Journal of Wildlife Management* 64(2): 520–530.
- Powell, J. 2003. Distribution, habitat use patterns, and elk response to human disturbance in the Jack Morrow Hills, Wyoming. MS Thesis. University of Wyoming, Laramie, Wyoming, USA.
- Radtke, C., D. A. Autenrieth, T. Lipsey, and W. J. Brazile. 2017. "Noise characterization of oil and gas operations." *Journal of Occupational and Environmental Hygiene* 14(8): 659–667. DOI: 10.1080/15459624.2017.1316386. Internet website: <https://www.tandfonline.com/doi/full/10.1080/15459624.2017.1316386?scroll=top&needAccess=true>.
- Radle, A. L. 2007. The effect of noise on wildlife: a literature review. Internet website: https://winapps.umn.edu/winapps/media2/wilderness/toolboxes/documents/sound/radle_effect_noise_wildlife.pdf.
- Ramboll. 2020. Decline in Measured Volatile Organic Compound Concentrations in Southwestern Weld County. Fact Sheet. Internet website: <https://drive.google.com/drive/folders/1IxVb8jA2IQKQyBf2b7XKYvIvFIJKXkSm>.
- _____. 2021. Preliminary Analysis of Northern Colorado Methane and Ethane Trends Using AIRS Satellite Data and Platteville Surface Measurements. Available online: <https://drive.google.com/drive/folders/1IxVb8jA2IQKQyBf2b7XKYvIvFIJKXkSm>.
- _____. 2023a. BLM Western US Photochemical Air Quality Modeling for 2028. Prepared for EMPSi and Bureau of Land Management. March.
- _____. 2023b. BLM Western US Photochemical Air Quality Modeling for 2032. Prepared for EMPSi and Bureau of Land Management. In progress.

- Reuters. 2022. Factbox: Energy crisis revives coal demand and production. October, 2022. Internet website: <https://www.reuters.com/business/energy/energy-crisis-revives-coal-demand-production-2022-10-19/>.
- Richards, H. 2023. Study Suggests Tie Between Drilling, “Rare” Childhood Cancer. Greenwire. Internet website: <https://subscriber.politicopro.com/article/eenews/2023/08/16/study-suggests-tie-between-drilling-rare-childhood-cancer-0011453>.
- Rondeau, R. K., J. Decker, J. Handwerk, L. Siemers, L. Grunau, and C. Pague. 2011. The State of Colorado’s Biodiversity. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado.
- Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2004. Effects of roads on elk: implications for management in forested ecosystems. In: Transactions of the 69th North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, DC. pp 491-508.
- Rowland, M. M., M. J. Wisdom, R. M. Nielson, J. G. Cook, R. C. Cook, B. K. Johnson, P. K. Coe, et al. 2018. Modeling Elk Nutrition and Habitat Use in Western Oregon and Washington. *Wildlife Monographs* 199: 1-69.
- Sawyer, H., N. Korfanta, R. Nielson, K. Monteith, and D. Strickland. 2017. Mule deer and energy development -- long-term trends of habituation and abundance. *Global change biology* 23: 10.1111/gcb.13711.
- Sawyer, H., M. S. Lambert, and J. A. Merkle. 2020. Migratory Disturbance Thresholds with Mule Deer and Energy Development. *Journal of Wildlife Management* 84: 930-937.
- Sawyer, H., R. M. Nielson, F. Lindzey, and L. L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. *Journal of Wildlife Management* 70 (2): 396-403.
- Sauls, H. S. 2006. “Role of selective foraging and cecal microflora in sage-grouse nutritional ecology.” Master’s thesis, University of Montana, Missoula.
- Shandro, J., V. Marcello, J. Shoveller, M. Scoble, and M. Koehoorn. 2011. Perspectives on community health issues and the mining boom-bust cycle. *Resources Policy* 36: 178-186.
- Shively, K. J., A. W. Alldredge, and G. E. Phillips. 2005. “Elk reproductive response to removal of calving season disturbance by humans.” *The Journal of Wildlife Management* 69(3): 1073–1080.
- Shockley, J. W. 2017. Cultural Hunts Honor Traditional Ways. The Southern Ute Drum. Internet website: <https://www.sudrum.com/culture/2017/11/21/cultural-hunts-honor-traditional-ways/>
- Smil, V. 2022. The Modern World Can't Exist Without These Four Ingredients. They All Require Fossil Fuels. TIME. May 2022. Internet website: <https://time.com/6175734/reliance-on-fossil-fuels/>.
- Smith, J. A. and J. F. Dwyer. 2016. Avian interactions with renewable energy infrastructure—An update. *The Condor* 118(2): 411–423.

- Southern Ute Indian Tribe. 2022. Brunot Area Hunting and Fishing. Internet website: <https://www.southernute-nsn.gov/natural-resources/wildlife-resource-management/hunting/brunot-area-hunting-and-fishing/>.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the Forest Service, and the US Fish and Wildlife Service by the Colorado Natural Heritage Program, Fort Collins, Colorado.
- State of Colorado. 2021. Colorado Greenhouse Gas Pollution Reduction Roadmap. Internet website: <https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap-20>.
- Steinbrecher, B. P. and M. P. Hopkins. 2019. Ethnographic Overview of Canyons of the Ancients National Monument. Canyons of the Ancients National Monument, Tres Rios Field Office, Bureau of Land Management. Dolores, Colorado.
- Stumph, B. P. and R. G. Wright. 2007. Effects of willow quality on moose distribution in a montane environment. *Alces: A Journal Devoted to the Biology and Management of Moose* 43: 129-142.
- Swift, L. W. 1945. A Partial History of the Elk Herds of Colorado. *Journal of Mammalogy* 26: 114-119.
- Taylor, A. R. and R. L. Knight. 2003. "Wildlife response to recreational and associated visitor perceptions." *Ecological Applications* 13: 951-963.
- Taylor, R. L., D. E. Naugle, and L. S. Mills. 2012. Viability Analyses for Conservation of Sage-Grouse Populations: Buffalo Field Office, Wyoming Final Report. Prepared for Bureau of Land Management Buffalo Field Office, Buffalo, Wyoming. Wildlife Biology Program, University of Montana BLM Contract 09-3225-0012 Number G09AC00013. February 27, 2012.
- The Pew Charitable Trusts. 2018. The Economic Contributions of Hunting, Fishing, and Wildlife-Watching on BLM Lands. Internet website: https://www.pewtrusts.org/-/media/assets/2018/09/economiccontributionsrecreationblm_colorado_v1.pdf.
- Thomas, S. L., and S. E. Reed. 2019. "Entrenched ties between outdoor recreation and conservation pose challenges for sustainable land management." *Environ. Res. Lett.* 14 115009. Internet website: <https://iopscience.iop.org/article/10.1088/1748-9326/ab4f52/pdf>.
- U.S. vs Tribes of Colville Indian. 2010. 606 F.3d 698 Internet website: <https://casetext.com/case/us-v-tribes-of-colville-indian>
- US Census Bureau. 2021a. American Community Survey 5-year data 2017-2021. Table DP05. Internet website: [https://data.census.gov/table?q=dp05&g=0400000US08,08\\$0500000&tid=ACSDPIY2021.DP05](https://data.census.gov/table?q=dp05&g=0400000US08,08$0500000&tid=ACSDPIY2021.DP05).
- _____. 2021b. American Community Survey 5-year data 2017-2021. Table S1701, Poverty Status in the Past 12 months. Internet website: [https://data.census.gov/table?q=s1701&g=0400000US08,08\\$0500000&tid=ACSST5Y2021.S1701](https://data.census.gov/table?q=s1701&g=0400000US08,08$0500000&tid=ACSST5Y2021.S1701)
- _____. 2022. American Community Survey 5-year data 2017-2021 for Selected Counties in Colorado, as reported in Headwater Economic, Demographics. Internet Website: <https://headwaterseconomics.org/apps/economic-profile-system/>.

- US Department of Energy and BLM (United States Department of the Interior, Bureau of Land Management). 2009. Approved Resource Management Plan Amendments/Record of Decision (ROD) for Designation of Energy Corridors on Bureau of Land Management-Administered Lands in the 11 Western States (BLM/WO-GI-09-005-1800). January 2009. United States Department of the Interior, Bureau of Land Management, Washington, DC.
- US DOI (US Department of the Interior). 2022. Payments in Lieu of Taxes (PILT): Individual PILT Payments by County. Internet website: <https://www.doi.gov/pilt>.
- US DOI and USDA (United States Department of the Interior and United States Department of Agriculture). 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. Internet website: <https://www.blm.gov/sites/blm.gov/files/Gold%20Book%202007%20Revised.pdf>.
- USFWS (United State Fish and Wildlife Service). 1987. Northern Rocky Mountain Wolf Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 119 pp.
- _____. 1993. Final rule to list the Mexican spotted owl as a threatened species. Federal Register 58(49): 14248–14271.
- _____. 2009. Greenback Cutthroat Trout (*Oncorhynchus clarki stomias*) 5-Year Review: Summary and Evaluation. Colorado Field Office Lakewood, Colorado.
- _____. 2012. Recovery plan for the Mexican spotted owl, First revision. Albuquerque, New Mexico.
- _____. 2020. Recovery implementation strategy for Gunnison sage-grouse (*Centrocercus minimus*). September 2020. U.S. Fish and Wildlife Service, Upper Colorado Basin Region, Lakewood, Colorado. 75 pages.
- _____. 2022. Information for Planning and Consultation. Internet website: <https://ipac.ecosphere.fws.gov/>.
- van Riper III, C., K. L. Paxton, C. J. van Riper, K. A. van Riper, L. McGrath, and J. J. Fontaine. 2008. The Role of Protected Areas as Bird Stop-over Habitat: Ecology and Habitat Utilization by Migrating Land Birds within Colorado River Riparian Forests of Southwestern North America.
- Watson, M. L. 2005. Habitat Fragmentation and the Effects of Roads on Wildlife and Habitats. Conservation Services Division, New Mexico Department of Game and Fish, Raton, New Mexico.
- Wisdom, M. J., A. A. Ager, H. K. Preisler, N. J. Cimon, and B. K. Johnson. 2004. Effects of off-road recreation on mule deer and elk. In: Transactions of the 69th North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, DC. p 531-550.
- Wockner, G., Singer, F. and Schoenecker, K., 2003. Habitat suitability model for bighorn sheep and wild horses in Bighorn Canyon and the Pryor Mountain wild horse range. Fort Collins, CO, USA: Natural Resource Ecology Lab, Colorado State University.
- WRCC (Western Regional Climate Center). 2022. Climate of Colorado. Internet website: https://wrcc.dri.edu/Climate/narrative_co.php.
- Wyoming Game and Fish Department. 2010. Recommendations for development of oil and gas resources within important wildlife habitats. Version 6.0. April 2010. Cheyenne, WY.

- Yale School of Public Health. 2022. Multi-layered Strategies Needed to Protect Public Health from Oil and Gas Drilling Impacts. Internet website: <https://ysph.yale.edu/news-article/multi-layered-strategies-needed-to-protect-public-health-from-oil-and-gas-drilling-impacts/>.
- Zeigenfuss, L. C., F. J. Singer, and M. A. Gudorf. 2000. Test of a modified habitat suitability model for bighorn sheep. *Restoration Ecology* 8(4S): 38-46.
- Zimmermann, B., L. Nelson, P. Wabakken, H. Sand, and O. Liberg. 2014. Behavioral responses of wolves to roads: scale-dependent ambivalence. *Behavioral Ecology* 25(6):1353–1364.

Appendix A

List of Acronyms

This page intentionally left blank.

Appendix A. List of Acronyms

AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
APD	application for permit to drill
ARMP	approved resource management plan
ATMP	approved travel management plan
ATV	all-terrain vehicle
BLM	Bureau of Land Management
BMP	best management practices
CEQ	Council on Environmental Quality
CPW	Colorado Parks and Wildlife
CRVFO	Colorado River Valley Field Office
CSU	controlled surface use
dba	decibels
ECMC	Colorado Energy and Carbon Management Commission
EIS	environmental impact statement
ERMA	extensive recreation management area
ESA	Endangered Species Act of 1973
FLPMA	Federal Land Policy and Management Act of 1976
GIS	geographic information system
GJFO	Grand Junction Field Office
GHG	greenhouse gas
GMU	game management unit
HMP	herd management plan
HPH	high-priority habitat
IPCC	Intergovernmental Panel on Climate Change
IB	informational bulletins
IM	instructional memoranda
KFO	Kremmling Field Office
LSFO	Little Snake Field Office
MLA	Mineral Leasing Act of 1920, as amended
MLB	Management of Land Boundary Plan
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NSO	no surface occupancy
ONRR	Office of Natural Resources Revenue
PFYC	Potential Fossil Yield Classification
PILT	Payment in Lieu of Taxes
PLSSDS	Public Land Survey System Dataset
PRPA	Paleontological Resources Preservation Act
OHV	off-highway vehicle
RGFO	Royal Gorge Field Office
RMA	recreation management area
RMPA	resource management plan amendment
RMZ	recreation management zone
ROD	record of decision
ROW	right-of-way
SBE	Standards for Boundary Evidence
SHPO	State Historic Preservation Office
SMA	Surface Management Agency
SRMA	special recreation management area
SSR	Site Specific Relocation
TL	timing limitation
TRFO	Tres Rios Field Office
UFO	Uncompahgre Field Office
US	United States
USC	United States Code
USFWS	US Fish and Wildlife Service
VRM	visual resource management
WRFO	White River Field Office

Appendix B

Glossary

This page intentionally left blank.

Appendix B. Glossary

All-Terrain Vehicle (ATV)—A wheeled vehicle (other than a snowmobile) that has a wheelbase and chassis of 50 inches in width or less, handlebars for steering, generally a dry weight of 800 pounds or less, three or more low-pressure tires, and a seat designed to be straddled by the operator.

Anthropogenic Disturbance—An effect or object resulting from human activity. Anthropogenic features include but are not limited to paved highways, graded gravel roads, transmission lines, substations, wind turbines, solar developments, oil and gas wells, geothermal wells and associated facilities, pipelines, mines.

Avoid—When used in the Approved RMPA, the intention of the term “avoid” is that the preferred strategy for managing surface disturbing and disruptive activities is to keep away from or bypass sensitive resources. Activities would be relocated. Where avoidance is determined infeasible, mitigation would be required to prevent adverse effects to sensitive resources.

Avoidance/Avoidance Area—An area identified through resource management planning for avoidance; however, a right-of-way (ROW) grant with special stipulations may be considered.

Best management practices (BMPs)—Effective, practicable measures applied on a site-specific basis to avoid, minimize, reduce, remediate, or mitigate impacts to resources and/or resource uses.

Big Game Species—For this resource management plan amendment, big game is defined as those large ungulate species native to Colorado and included within this plan, which consists of mule deer, rocky mountain elk, pronghorn, and rocky mountain and desert bighorn sheep.

Bighorn Sheep Production Area—That part of the overall range of bighorn sheep occupied by pregnant females during a specific period of spring. This period is May 1 to June 30 for Rocky Mountain bighorn sheep and February 28 to May 1 for desert bighorn sheep.

Controlled Surface Use (CSU)—CSU is a category of moderate constraint stipulations that allows some use and occupancy of public land while protecting identified resources or values and is applicable to fluid mineral leasing and all activities associated with fluid mineral leasing (e.g., truck-mounted drilling and geophysical exploration equipment off designated routes, construction of wells and/or pads). CSU areas are open to fluid mineral leasing but the stipulation allows the BLM to require special operational constraints, or the activity can be shifted more than 200 meters (656 feet) to protect the specified resource or value. This is a leasing stipulation that allows certain use and occupancy of surface lands while protecting identified resource values and resource use. Specified controls or constraints are applied.

Conservation Measures—Techniques to preserve, restore, or manage habitat for wildlife species. These would include the use of voluntary BMPs and design features to avoid or minimize impacts to wildlife habitat (e.g., reduction in pad size or shape, pipeline width, remote monitoring, daily timing limitations).

Critical Habitat—An area occupied by a threatened or endangered species “on which are found those physical and biological features (1) essential to the conservation of the species, and (2) which may require special management considerations or protection.”

Cumulative Effect—According to 40 CFR 1508.7, a cumulative effect “is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (GPO 2012). In other words, these effects are the sum of the direct and indirect effects of an action and the direct and indirect effects of other actions on the same affected resources and uses.

Closure—An area where one or more uses are prohibited either temporarily or over the long term. Areas may be closed to uses such as mineral leasing where no leasing is allowed.

Cooperating Agency—Assists the lead federal agency in developing an environmental assessment or environmental impact statement. These can be any agency with jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR 1501.6). Any tribe or Federal, State, or local government jurisdiction with such qualifications may become a cooperating agency by agreement with the lead agency.

Data Analysis Unit (DAU)—a geographic area that represents the year-around range of a big game herd and includes all of the seasonal ranges of a specific herd.

Decision Area—The area affected by the RMPA’s final decision.

Designated Routes—Specific roads and trails identified by the BLM where a type of use is appropriate and allowed.

Disposal lands—The transfer of BLM-administered lands out of federal ownership to another party through sale or exchange, or through the Recreation and Public Purposes Act of 1926, Desert Land Entry, or other land law statutes. The criteria to be used for disposal of BLM-administered lands must be identified in a land use plan, or an amendment to the plan, before the land is offered for sale. Sales are typically conducted through the competitive bid process and cannot be sold at less than fair market value. BLM-administered lands that are classified, withdrawn, reserved, or have special designations are generally not available for sale.

Disruptive activities—Human-caused disturbances that induce stress on a population, community, or ecosystem and cause potential loss of species fitness (survival, reproduction, and recruitment) within crucial habitats or other sensitive areas during specified time periods; may or may not entail surface disturbance. This does not include routine maintenance or daily well visits that individuals would be accustomed to. Examples of disruptive activities include: workovers, intensive equipment replacement, activities requiring more than daily vehicle traffic, snow removal into areas (idle or shut-in wells) with no winter maintenance.

Easement—A right afforded a person or agency to make limited use of another’s real property for access or other purposes.

Ecoregions—Areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. Ecoregions are identified by analyzing the patterns and composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, landforms, soils, vegetation, climate, land use, wildlife, and hydrology.

Elk Production Area—The portion of the overall range of elk occupied by the females from May 15 to June 15 for calving.

Environmental Analysis—An analysis of alternatives and their predictable short-term and long-term environmental effects, incorporating physical, biological, economic, and social considerations.

Environmental Justice Community—Community containing minority and/or low-income populations for which Executive Order 12898 aims to address the potential for disproportionately high and adverse human health or environmental effects that could occur as a result of Federal agencies' programs, policies, and activities.

Exception—A one-time exemption from a stipulation for a given area within a leasehold/authorization; exceptions are determined on a case-by-case basis

Exchange—A transaction whereby the federal government receives land or interests in land in exchange for other land or interests in land. An exchange must be determined to be in the public interest and enhance federal land management objectives. It must be determined that the values and objectives of the lands being acquired are greater than the values of the federal lands being conveyed.

Exclusion Area—An area identified through resource management planning as unavailable for a ROW grant under any conditions. This RMPA would apply management only to new oil and gas-associated land use authorizations.

Effects

Fragile Soils—Soils with a high wind and water erosion potential, prone to impacts from drought conditions, and/or located on steep slopes or on eolian dune deposits on valley floors.

Game Management Unit (GMU)—A CPW administrative boundary which defines hunting areas in order to manage wildlife populations through administration of hunting licenses. The state has been divided into 185 Game Management Units (GMUs) to define hunting areas in order to allow Colorado Parks and Wildlife to not only better manage the wildlife resource but also to limit hunting pressure by restricting licenses in some units.

Greenhouse Gas—An atmospheric gas that traps heat by absorbing infrared radiation.

High Priority Habitat (HPH)—Wildlife habitat areas for which CPW has sound spatial data (i.e. where they occur on the landscape), and science-based recommendations to avoid, minimize, and mitigate adverse impacts resulting from anthropogenic disturbance and protect breeding, nesting, foraging, migrating, or other uses by wildlife. The extent of these High Priority Habitat areas are subject to regular updates by CPW to incorporate the best available science and current wildlife use on the landscape.

Indigenous Knowledge

Impacts (or Effects)—Consequences (the scientific and analytical basis for comparison of alternatives) of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable, or cumulative.

Land Tenure Adjustments—Landownership or jurisdictional changes. To improve the manageability of BLM-administered lands and their usefulness to the public, the BLM has numerous authorities for repositioning lands into a more consolidated pattern, disposing of lands, and entering into cooperative management agreements. The BLM completes these land pattern improvements primarily through the use

of land exchanges but also through land sales, jurisdictional transfers to other agencies, and the use of cooperative management agreements and leases.

Lands with Wilderness Characteristics—Lands inventoried and determined by the BLM to contain wilderness characteristics as defined in Section 2(c) of the Wilderness Act. Attributes include the area's size, its apparent naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Lease—A contract to use, occupy, and/or develop BLM-administered lands. Section 302 of the FLPMA provides the BLM with the authority to issue leases for the use, occupancy, and development of BLM-administered lands. The BLM generally issues two types of leases for oil and gas exploration and development on lands owned or controlled by the Federal government -- competitive and noncompetitive. Congress passed the Federal Onshore Oil and Gas Leasing Reform Act of 1987 requiring that all public lands available for oil and gas leasing be offered first by competitive leasing. The BLM may issue noncompetitive leases only after the agency has offered the lands competitively at an auction in which the lands do not receive a bid. 43 CFR 3100.

Lease Notice (LN)—A notice to mineral leaseholders that provides detailed information concerning limitations already provided by law, lease terms, regulations, or operational orders. A LN addresses special items that lessees should consider when planning operations but does not impose additional restrictions.

Lease Stipulation—A modification of the terms and conditions on a standard lease form at the time of the lease sale.

Leasable Minerals—A class of minerals which can be leased by the BLM for development on federal mineral estate. Leasable minerals include energy minerals such as oil, natural gas, coal, and geothermal resources, as well as certain non-energy solid minerals such as phosphate, sodium, potassium, sulphur, and gilsonite.

Local Roads—These BLM roads normally serve a smaller area than collectors, and connect to collectors or public road systems. Local roads receive lower volumes, carry fewer traffic types, and generally serve fewer uses. User cost, comfort, and travel time are secondary to construction and maintenance cost considerations. Low volume local roads in mountainous terrain, where operating speed is reduced by effort of terrain, may be single lane roads with turnouts. Environmental impacts are reduced as steeper grades, sharper curves, and lower design speeds than would be permissible on collector roads are allowable. (From 9113-BLM Roads Manual.) (Note: for oil and gas development, a local road provides access to more than one well pad and provides the connection between collector roads and resource roads.)

Locatable Minerals—Mineral deposits that include most metallic mineral deposits and certain nonmetallic and industrial minerals (such as gold, silver, and copper).

Major Rights-of-Way (ROWs)—In the context of this EIS, major ROWs are high-voltage transmission lines (100 kilovolt and over) and large pipelines (24 inches in diameter and over).

Mechanized Travel—Moving by means of mechanical devices not powered by a motor, such as a bicycle.

Migration Overall Range—A geographic area used by migrating animals, regardless of the number of individuals, to move between seasonal ranges. Location of which may be delineated by empirical data or by expert knowledge.

Migration Corridor—A specific geographic area that facilitates the movement of a substantial number of animals, *relative to herd or population size*, between seasonal ranges. Location of which may be delineated by empirical data or by expert knowledge.

Minimize Adverse Impacts—means, as provided by § 34-60-106(2.5), C.R.S., providing necessary and reasonable protections to reduce the extent, severity, significance, or duration of Unavoidable direct, indirect, and cumulative Adverse Impacts to public health, safety, welfare, the environment, or Wildlife Resources from Oil and Gas Operations.

Movement Corridor—A specific area that facilitates movement for migrating animals within seasonal ranges or movement of non-migrating animals within home ranges to reach valuable resources. Location of corridors may be delineated by empirical data or by expert knowledge.

Mineral Materials—Common varieties of construction materials and aggregates.

Minor ROWs—In the context of this EIS, anything that is not considered a major ROW, as defined above, is a minor ROW.

Mitigate Adverse Impacts—means, with respect to Wildlife Resources, measures that compensate for Unavoidable direct, indirect, and cumulative Adverse Impacts and loss of such resources from Oil and Gas Operations, including, as appropriate, habitat replacement, on- or off-site habitat enhancement, habitat banking, or financial payment in lieu of habitat replacement or enhancement to compensate for the loss of habitat and ensure that wildlife populations are protected.

Modification—A change to the provisions of a stipulation, either temporarily or for the term of the lease/authorization. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold/authorization to which the stipulation applies.

Motorized Vehicles—Vehicles propelled by motors or engines, such as cars, trucks, off-highway vehicles, motorcycles, snowmobiles, and boats.

Mule Deer Concentration Area—The portion of the overall mule deer range where higher-quality habitat supports significantly higher densities than surrounding areas. These areas are typically occupied year-round and are not necessarily associated with a specific season. They include rough break country, riparian areas, small drainages, and large areas of irrigated cropland.

Non-mechanized Travel—Moving by means without motorized or mechanized equipment, such as hiking and horseback riding.

No Surface Occupancy (NSO)—A major constraint where use or occupancy of the land surface for fluid mineral exploration or development and all activities associated with fluid mineral leasing (e.g., truck-mounted drilling and geophysical exploration equipment off designated routes, construction of wells and/or pads) are prohibited to protect identified resource values. Areas identified as NSO are open to fluid mineral leasing, but surface occupancy or surface-disturbing activities associated with fluid mineral leasing cannot be conducted on the surface of the land. Access to fluid mineral deposits would require horizontal drilling from outside the boundaries of the NSO area. This is a leasing stipulation that prohibits occupancy or disturbance on all or part of the lease surface to protect identified resource values or resource use. Lessees may access the fluid mineral resources under the leases restricted by this constraint through use of directional or horizontal drilling from sites outside the NSO area.

Occupied Habitat—Intact habitat currently supporting special status species. Occupied habitat also includes areas that were previously mapped or confirmed as occupied habitat, but do not contain special status species presently.

Off-highway Vehicle (OHV)—Any motorized vehicle capable of, or designated for, travel on or immediately over land, water, or other natural terrain, excluding 1) any nonamphibious registered motorboat; 2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; 3) any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved; 4) vehicles in official use; and 5) any combat or combat support vehicle when used for national defense.

OHV area designation—A land use planning decision that permits, establishes conditions for, or prohibits OHV activities on specific areas of BLM-administered lands. The BLM is required to designate all BLM-administered lands as open, limited, or closed to OHVs. Below are definitions of these designations as taken from the 2016 BLM Travel and Transportation Management Manual:

OHV route designations—Management designations applied to individual routes (as opposed to OHV areas) during interdisciplinary route evaluation sessions. The BLM designates routes as open, limited, or closed. The designation must be included in all route-specific decisions and recorded in the national ground transportation linear feature data set(s). Definitions and the designation criteria used in this decision-making process stem from those provided for OHV areas in 43 CFR 8340.0 5(f), (g), and (h).

OHV closed area—An area where OHV use is prohibited. Access by means other than OHVs, such as by motorized vehicles that fall outside the definition of an OHV or by mechanized or nonmechanized means, is permitted. The BLM designates areas as closed, if necessary, to protect resources, promote visitor safety, or reduce user conflicts (see 43 CFR 8340.0-5(h)).

OHV closed—OHV travel is prohibited on the route. Access by means other than OHVs, such as by motorized vehicles that fall outside the definition of an OHV or by mechanized or nonmechanized means, is permitted. The BLM designates routes as closed to OHVs, if necessary, to protect resources, promote visitor safety, reduce use conflicts, or meet a specific resource goal or objective.

OHV limited area—An area where OHV use is restricted at certain times, in certain areas, and/or to certain vehicular use. Examples of restrictions include the numbers or types of vehicles; the time or season of use; permitted or licensed use only; use limited to existing, designated roads and trails; or other restrictions necessary to meet resource management objectives, including certain competitive or intensive use areas that have special limitations (43 CFR 8340.0-5(g)).

OHV limited—OHV travel on routes, roads, trails, or other vehicle ways is subject to restrictions to meet specific resource management objectives. Examples of restrictions include the numbers or types of vehicles; the time or season of use; permitted or licensed use only; or other restrictions necessary to meet resource management objectives, including certain competitive or intensive uses that have special limitations.

OHV open area—A designated area where all types of OHV travel are permitted at all times, anywhere in the area without restriction (43 CFR 8340.0-5(f)), subject only to the operating restrictions set forth in 43 CFR 8341.1. Open area designations are made to achieve a specific recreational goal, objective, and setting. Open area designations are only used in areas managed for

intensive OHV activity where there are no special restrictions or no compelling resource protection needs, user conflicts, or public safety issues to warrant limiting cross-country travel.

OHV open—OHV travel is permitted where there are no special restrictions or no compelling resource protection needs, user conflicts, or public safety issues to warrant limiting the timing or season of use, the type of OHV, or the type of OHV user.

Pinch Point (Ungulate)—Any portion of a migration or movement area in which animal movements are physically or behaviorally funneled or constrained by natural or man-made landscape features and a significant number of animals move through. Loss of these areas now, in the future, or cumulatively over time, could disproportionately compromise habitat connectivity (and therefore migration and/or movement ability) because alternate routes are limited, unavailable, or increase the risks and energetic costs of migration.

Plan Maintenance—The BLM regulation in 43 CFR 1610.5-4 provides that land use plan decisions and supporting components can be maintained through plan maintenance actions to reflect minor changes in data. Plan maintenance must not expand the scope of resource uses or restrictions or change the terms, conditions, and decisions of the approved plan.

Primitive Road—A linear route managed for use by four-wheel-drive or high-clearance vehicles. Primitive roads do not normally meet any BLM road design standards. Unless specifically prohibited, primitive roads can also include other uses such as hiking, biking, and horseback riding.

Pronghorn Concentration Area—The portion of the overall pronghorn range where densities are at least 200 percent greater than the surrounding area during a season other than winter.

Remnant Vegetation Association—A plant community that has become established through successional sequences without interference by man and is an expression of the relative degree in which the kinds, proportions, and amounts of the plant community may have resembled that of the original natural community. Examples include but are not limited to ponderosa pine stands and unique or ecologically intact sagebrush communities. **Right-of-way (ROW)**—Where the BLM authorizes a holder to use or occupy BLM-administered lands under a grant pursuant to Title V of the FLPMA; examples are roads, pipelines, power lines, and fiber-optic lines.

ROW Avoidance Area—An area identified through resource management planning for avoidance; however, a ROW grant with special stipulations may be considered.

ROW Exclusion Area—An area identified through resource management planning as unavailable for a ROW grant under any conditions.

Road—A linear route declared a road by the owner, managed for use by low-clearance vehicles that have four or more wheels, and maintained for regular and continuous use. Often, many types of uses are allowed on roads. BLM-allowed uses on roads are often hierarchical such that if motorized use is allowed on a road, various forms of non-motorized use are also allowed.

Routes—A group or set of roads, trails, and primitive roads that represents less than 100 percent of the BLM transportation system. Generically, components of the transportation system are described as “routes.”

Salable Minerals—Also known as mineral materials, include common varieties of sand, stone (such as decorative stone), gravel, pumice, clay, rock and petrified wood. These non-energy-related materials are typically used in construction, agriculture and decorative applications.

Sale (Public Land)—Pursuant to Section 203 of the FLPMA, a method of land disposal whereby the United States receives a fair market payment for the transfer of land from federal ownership. BLM-administered lands determined suitable for sale are offered on the BLM's initiative. The lands must be identified in the RMP. Any lands to be disposed by sale that are not identified in the current RMP, or that do not meet the disposal criteria identified in the RMP, require a RMP amendment before a sale can occur.

Severe Winter Range—The portion of the overall big game range where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.

Stipulation (oil and gas)—A provision that modifies standard oil and gas lease terms and conditions in order to protect other resource values or land uses and is attached to and made a part of the lease. Typical lease stipulations include No Surface Occupancy (NSO), Timing Limitations (TL), and Controlled Surface Use (CSU). Lease stipulations are developed through the land use planning (RMP) process.

Soils of Management Concern—Soils with high water erosion potential, high wind erosion potential, low drought tolerance, poor upland soil health, and prime or unique farmlands.

Special Status Plant Species—Collectively, federally listed or proposed and BLM sensitive species, which include both Federal candidate species and delisted species within 5 years of delisting. (From M6840, Special Status Species Manual.)

Split Estate—Lands on which the mineral estate remains the property of the federal government (BLM), but the surface rights are held by a different entity.

Suitable Habitat—Surveyed and mapped habitat occurring on the geologic substrate on which the special status plant species are known to occur. This includes associated vegetation and other subtle characteristics (such as vegetation cover, light availability, aspect, surface cobble size, soil type). Most habitat mapped as suitable has been surveyed and found to contain the correct geology or soil type but is not occupied by the special status plant species.

Surface-disturbing Activities—Activities that normally result in more than negligible (immeasurable, not readily noticeable) disturbance to vegetation and soils on BLM-administered lands and accelerate the natural erosive process. Surface disturbances could require reclamation and normally involve use or occupancy of the surface, causing disturbance to soils and vegetation. They include, but are not limited to, the use of mechanized earth-moving equipment; construction of oil and gas pads and access roads, oil and gas-associated facilities (e.g., compressor sites, central gathering facilities), power lines and pipelines associated with oil and gas authorizations. Surface disturbance is not normally caused by casual-use activities. Activities that are not considered surface-disturbing activities include, but are not limited to, oil and gas well site staking, noxious weed treatment, low intensity equipment maintenance.

Timing Limitations (TLs)—The TL stipulation, a moderate constraint, is applicable to fluid mineral leasing, all activities associated with fluid mineral leasing (e.g., construction of wells and/or pads, drilling and completion activities, truck-mounted drilling and geophysical exploration equipment off designated routes). Areas identified for TL are restricted during identified time frames to fluid mineral exploration and development, surface-disturbing activities, and intensive human activity. This stipulation does not apply to operation and basic maintenance activities, including associated vehicle travel, unless otherwise specified. Construction, drilling, completions, and other operations considered to be intensive in nature are not allowed. Intensive maintenance, such as workovers on wells, is not permitted. TLs can overlap spatially with

NSO or CSU, as well as with areas that have no other restrictions. Administrative activities are allowed at the discretion of the Authorized Officer. This is a leasing stipulation that prohibits surface use during specified time periods to protect identified resource values or resource use. The constraint does not apply to the operation and maintenance of production facilities unless analysis demonstrates that such constraints are needed and that less stringent, project-specific constraints would be insufficient.

Travel Network—Routes occurring on BLM-administered lands or within easements granted to the BLM that are recognized, designated, decided upon, or otherwise authorized for use through the planning process or other travel management decisions. These may be part of the transportation system and may—or may not—be administered by the BLM.

Unavoidable Adverse Impacts—means direct, indirect, or cumulative adverse impacts to Wildlife Resources that are not entirely eliminated through the application of alternative location selection or other methods designed to Minimize Adverse Impacts from Oil and Gas Operations.

Utility Corridor—A tract of land varying in width and forming a passageway through which various commodities, such as oil, gas, and electricity, are transported.

Valid Existing Rights—Documented legal rights or interests in the land that allow a person or entity to use said land for a specific purpose and that are still in effect. Such rights include fee title ownership, mineral rights, ROW grants, easements, permits, and licenses. Such rights may have been reserved, acquired, leased, granted, permitted, or otherwise authorized over time.

Waiver—A permanent exemption from a stipulation. The stipulation no longer applies to the leasehold/authorization.

Winter Range—That part of the overall range where 90 percent of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up, or during a site-specific period of winter as defined for each DAU. Bighorn Sheep winter range is included as HPH.

Winter Concentration Area—The portion of the big game winter range where densities are at least 200 percent greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten. Management and research have shown that winter range quality and quantity is one of the primary limiting factors for big game population performance.

Withdrawal—An action that restricts the use of BLM-administered land and segregates the land from the operation of some or all of the public land and mineral laws. Withdrawals are also used to transfer jurisdiction of BLM-administered lands to other federal agencies.

B.1 GLOSSARY REFERENCES

Omernik, J.M. 1987. Ecoregions of the conterminous United States. Map (scale 1:7,500,000). *Annals of the Association of American Geographers* 77(1):118-125.

Omernik, J.M. 1995. Ecoregions: A spatial framework for environmental management. In: *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making*. Davis, W.S. and T.P. Simon (eds.), Lewis Publishers, Boca Raton, FL. p. 49-62.

This page intentionally left blank.

Appendix C

Index

This page intentionally left blank.

Appendix C. Index

- Avoidance, 3-207
- Best management practices (BMPs), 2-20, 2-22, 2-35, 2-36, 2-37, 2-38, 2-45, 3-199, 3-208, 3-209
- Bighorn sheep, 2-13, 2-29, 3-84, 3-89, 3-90, 3-92, 3-97, 3-98, 3-99, 3-100, 3-102, 3-103, 3-129
- Bighorn Sheep Production Area, 2-12, 3-83
- Controlled Surface Use (CSU), ES-4, ES-8, 1-7, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, 2-12, 2-25, 2-26, 2-27, 2-29, 2-33, 2-34, 2-35, 2-40, 2-41, 2-42, 2-43, 2-44, 2-45, 3-3, 3-6, 3-8, 3-9, 3-10, 3-11, 3-12, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, 3-20, 3-21, 3-22, 3-23, 3-24, 3-25, 3-26, 3-27, 3-28, 3-29, 3-30, 3-31, 3-32, 3-33, 3-34, 3-35, 3-36, 3-37, 3-39, 3-40, 3-59, 3-60, 3-62, 3-68, 3-70, 3-71, 3-72, 3-74, 3-75, 3-79, 3-80, 3-81, 3-83, 3-84, 3-85, 3-90, 3-96, 3-97, 3-98, 3-99, 3-100, 3-102, 3-106, 3-107, 3-117, 3-120, 3-121, 3-122, 3-123, 3-124, 3-125, 3-137, 3-138, 3-139, 3-142, 3-143, 3-144, 3-145, 3-165, 3-167, 3-169, 3-171, 3-181, 3-182, 3-183, 3-192, 3-193, 3-194, 3-203, 3-209
- Cooperating Agency, 4-6
- Ecoregions, 3-127
- Elk, ES-1, 2-1, 2-13, 2-26, 2-29, 2-30, 2-31, 3-83, 3-84, 3-85, 3-86, 3-88, 3-89, 3-90, 3-91, 3-92, 3-93, 3-94, 3-97, 3-98, 3-99, 3-100, 3-101, 3-102, 3-103, 3-128, 3-129, 3-130, 3-131, 3-187, 3-188
- Elk Production Area, 3-83
- Environmental Justice, ES-6, 1-9, 2-44, 3-2, 3-177, 4-9
- Exception, 2-39
- Game Management Unit (GMU), 2-16
- Greenhouse Gas, 1-11, 2-11, 2-41, 3-37, 3-43, 3-52
- High Priority Habitat (HPH), ES-1, ES-3, ES-5, ES-6, ES-8, ES-9, 1-1, 1-2, 1-6, 1-8, 1-9, 1-10, 2-1, 2-4, 2-5, 2-6, 2-11, 2-12, 2-13, 2-14, 2-16, 2-17, 2-18, 2-19, 2-20, 2-21, 2-22, 2-23, 2-24, 2-25, 2-27, 2-28, 2-29, 2-33, 2-34, 2-35, 2-36, 2-37, 2-38, 2-39, 2-40, 2-41, 2-42, 2-45, 3-2, 3-3, 3-5, 3-6, 3-10, 3-11, 3-17, 3-23, 3-29, 3-30, 3-35, 3-36, 3-37, 3-56, 3-57, 3-58, 3-59, 3-60, 3-61, 3-70, 3-71, 3-74, 3-76, 3-81, 3-82, 3-83, 3-84, 3-85, 3-88, 3-89, 3-90, 3-91, 3-92, 3-93, 3-94, 3-96, 3-97, 3-98, 3-99, 3-100, 3-101, 3-102, 3-103, 3-105, 3-106, 3-118, 3-122, 3-123, 3-126, 3-132, 3-133, 3-134, 3-135, 3-138, 3-140, 3-145, 3-146, 3-173, 3-174, 3-176, 3-177, 3-179, 3-181, 3-184, 3-185, 3-191, 3-193, 3-195, 3-199, 3-203, 3-204, 3-205, 3-206, 3-207, 3-209, 3-210
- Indigenous Knowledge, 2-14
- Lease Notice (LN), 2-29
- Migration Corridor, 1-5, 1-11, 3-84, 3-188
- Mineral Materials, 3-9
- Movement Corridor, 3-82, 3-84, 3-85, 3-90, 3-187, 3-188
- Mule deer, ES-1, 2-1, 2-31, 3-83, 3-84, 3-86, 3-88, 3-89, 3-90, 3-92, 3-94, 3-95, 3-97, 3-99, 3-100, 3-101, 3-102
- No Surface Occupancy (NSO), ES-4, 1-7, 2-6, 2-7, 2-8, 2-9, 2-12, 2-25, 2-26, 2-27, 2-28, 2-31, 2-36, 2-38, 2-39, 2-40, 2-41, 2-42, 2-43, 2-44, 2-45, 3-3, 3-6, 3-8, 3-9, 3-10, 3-11, 3-12, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, 3-20, 3-21, 3-22, 3-23, 3-24, 3-25, 3-26, 3-27, 3-28, 3-29, 3-30, 3-31, 3-32, 3-33, 3-34, 3-35, 3-36, 3-59, 3-60, 3-62, 3-68, 3-70, 3-71, 3-72, 3-74, 3-75, 3-78, 3-79, 3-80, 3-81, 3-83, 3-90, 3-96, 3-97, 3-98, 3-99, 3-100, 3-102, 3-106, 3-107, 3-117, 3-120, 3-121, 3-122, 3-123, 3-124, 3-125, 3-137, 3-138, 3-139, 3-142, 3-143, 3-144, 3-165, 3-167, 3-169, 3-171, 3-181, 3-182, 3-183, 3-192, 3-193, 3-194, 3-203, 3-209
- Off-highway Vehicle (OHV), ES-6, 1-9, 3-59, 3-69, 3-92, 3-93, 3-186, 3-195, 3-196, 3-197, 3-198, 3-199
- Pinch Point, 2-12, 2-27
- Pronghorn, ES-1, 2-1, 2-13, 2-29, 2-30, 2-31, 3-83, 3-84, 3-85, 3-87, 3-88, 3-89, 3-90, 3-91, 3-92, 3-93, 3-94, 3-97, 3-99, 3-100, 3-101, 3-102, 3-103, 3-104, 3-130, 3-188
- Right of Way (ROW), 2-15, 2-40, 3-3, 3-36, 3-58, 3-74, 3-105, 3-117, 3-125, 3-195, 3-199, 3-205, 3-206, 3-207, 3-208, 3-209, 3-210
- Road, 3-3, 3-74, 3-89, 3-197

Routes, 3-93, 3-195, 3-196, 3-197

Severe Winter Range, 2-29, 3-83, 3-84, 3-90,
3-92, 3-187, 3-188

Timing Limitations (TLs), ES-4, 1-7, 2-25, 3-3,
3-9, 3-60, 3-90, 3-96, 3-118, 3-122, 3-123,
3-209

Utility Corridor, 3-207, 3-208

Waiver, 2-39

Winter Concentration Area, 2-29, 3-83, 3-84,
3-90, 3-92, 3-187, 3-188

Winter Range, 1-5, 1-11, 2-29, 3-83, 3-84, 3-90,
3-92, 3-188