4.0 Environmental Consequences

4.1 Introduction

This chapter presents the analysis of impacts for each resource that may be affected by reaffirming, modifying, or canceling the 65 leases under consideration.

4.1.1 Direct and Indirect Effects

Leasing, by itself, would not directly impact most resources with the possible exception of some aspects of socioeconomics but, given that the development of the leases is a reasonably foreseeable result of the granted lease right, the impact analysis considers the potential impacts of reasonably foreseeable future development. The basis for the analysis of future oil and gas development is the Reasonably Foreseeable Development Scenario (RFDS) for Oil and Gas Activities on the White River National Forest (WRNF) (U.S. Forest Service [Forest Service or USFS] 2010a), which has been scaled to the amount of development feasible under each alternative (see Chapter 2.0, **Table 2-7** for details by lease zone). To scale the development for each alternative, the RFDS was adjusted to reflect each alternative using the assumptions presented in Chapter 2.0, Section 2.7.3 derived from the RFDS, the WRNF Mineral Specialist Report (Mattson 2010) prepared in support of the WRNF Oil and Gas Leasing Draft Environmental Impact Statement (EIS) (USFS 2012), as well as knowledge of the historical development in the area. The adjustments to the RFDS were made using data on the extent of No Surface Occupancy (NSO) stipulations in and around each of the 65 leases, in conjunction with an assumed maximum lateral offset for directional (i.e., “s-curve”) and horizontal wells that could be used to access the target gas formations. It should be noted that many of the reasonably foreseeable wells may extract minerals from each lease using directional or horizontal well bores so that well pads may be located either on-lease or off-lease. Assumed development (for analysis of each alternative) using the constraints resulting from NSO limitations are somewhat less than the full development potential documented in the RFDS. Additional details are included in **Appendix D**, Methodology for Scaling RFDS for EIS Alternatives.

Using the assumptions for average initial and long-term surface disturbance for well pads, roads, and pipelines and the estimated number of wells per pad, acres of surface disturbance were calculated for each lease and totaled for each lease zone (see Chapter 2.0, **Table 2-8** for details by lease zone). Surface disturbance is an important factor in predicting the potential impacts for most of the resources that are analyzed. Until the actual locations and number of proposed wells are known, the analysis of impacts from fluid mineral development cannot be site-specific. For this reason, the impacts analyses focuses on the extent of protection of surface resources that would result from implementation of the stipulations proposed under each alternative and the potential risk to the resources where no protection through stipulations would occur. The extent to which different types of stipulations vary across the alternatives is analyzed in detail in this chapter.

Each section provides an overview of the issues identified during public scoping. The impacts presented in each section address the scoping issues to the degree possible. However, because this is a leasing analysis with general projections of the amount of development likely to occur within each lease, those scoping issues that call for analysis of site-specific conditions or potential impacts in precise locations cannot be addressed until the Application for Permit to Drill (APD) stage of permitting, when onsite surveys and site-specific National Environmental Policy Act (NEPA) analysis is completed and mitigation measures or management practices are prescribed.

Each resource section summarizes the methods of analysis, including the type of information and assumptions used in the analysis, and the indicators (quantitative or qualitative metrics) used to identify impacts, and then presents a description of the types of impacts likely to result from reasonably

foreseeable development under these alternative leasing decisions, followed by details of the anticipated impacts under each of the five alternatives. Resources were evaluated according to the available data, so some discussions are based on qualitative information and others on more detailed quantitative data when available and feasible within the scope of this EIS.

The impact analyses assume that the environmental protection measures required by Forest Service and Bureau of Land Management (BLM) policies and guidelines would be successfully implemented. It also assumes that operators and lessees would comply with applicable state and federal regulations and conditions of required permits. As noted in Chapter 2.0, Section 2.6, specific environmental protection measures, such as project design features, best management practices (BMPs), and conditions of approval (COAs), would be evaluated during the onsite review at the APD stage of oil and gas development. These measures would become part of the Forest Service Surface Use Plan of Operations and the permit to drill issued by the BLM. Because site-specific locations and conditions are unknown at this time, recommended mitigation measures have not been incorporated into the resource sections in Chapter 4.0 and are deferred to future NEPA analyses.

4.1.2 Cumulative Impact Analysis

Toward the end of each resource section is a discussion of cumulative impacts. In its Regulations for Implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), the Council on Environmental Quality (CEQ) defines a cumulative impact as follows in Section 1508.7:

> *"Cumulative impact" 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 impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Cumulative impacts are the combination of the individual effects of multiple actions over time in the context of other development in the analysis area or the region. The individual effects may be minor when considered separately, but may be major when considered in combination with all others in the region. A CEQ memorandum issued in 2005 (CEQ 2005) provides additional guidance on the consideration of past actions in cumulative effects analysis. Per 43 CFR 46.115, the Responsible Official must analyze the effects of past action in accordance with this or other superseding guidance CEQ guidance. The 2005 memorandum stresses the "forward-looking" nature of NEPA analysis. It states that the effects of past actions are only required to be analyzed if they are relevant and useful to determine whether the proposed project "may have a continuing, additive and significant relationship" to projected future impacts in the region.

Cumulative impacts are those that would result if lease development (as outlined in Chapter 2.0) is combined with disturbances of past and present actions and other reasonably foreseeable future actions (RFFAs), regardless of what agency or private entity undertakes such actions. Per 43 CFR 46.30, *reasonably foreseeable future actions* include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a Responsible Official of ordinary prudence would take such activities into account in reaching a decision. These federal and non-federal activities that must be taken into account in the analysis of cumulative impact include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by the bureau. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

The following sections summarize the past and present actions and RFFAs that are likely to have similar impacts to those analyzed in this chapter for each resource. The focus is on surface disturbing actions that are quantified to the degree possible with available information. **Appendix B** contains a more

detailed description of past and present actions and RFFAs; and the assumptions used to calculate long-term surface disturbing actions.

The geographic extent of cumulative impacts varies by resource. Impacts to some resources, such as cultural resources or soils, are restricted to the area within the leases. Other resources, such as wildlife and water resources, may be affected over a larger area; therefore, cumulative impacts are assessed beyond the leases. Twelve spatially distinct CIAAs are identified in **Table 4.1-1**. The CIAAs primarily comprise National Forest System (NFS) lands (WRNF and Grand Mesa, Uncompahgre, and Gunnison National Forest [GMUGNF]) but also include BLM lands within the Colorado River Valley Field Office (CRVFO), Grand Junction Field Office (GJFO), and White River Field Office (WRFO), as well as non-federal lands, particularly in situations where cumulative effects extend beyond the leases.

4.1.2.1 Past and Present Actions

Surface-disturbing Actions

The primary past and present actions with surface disturbance affecting the resources analyzed in this EIS include mineral development; road development and other land development such as rights-of-way (ROWs) for pipelines, telephone lines or other developments. **Table 4.1-2** presents total quantifiable past and present surface disturbance by CIAA. **Appendix B** discusses each of these actions in more detail in Section B.2.1. Water use associated with oil and gas development also is quantified in Section B.2.1.

Other Forest Service District or BLM Field Office Actions

Other past and present actions, such as farming, timber harvests, livestock grazing, vegetation treatments, and land management decisions, may not have adverse impacts on all resources; and in some cases may have a countervailing effect on cumulative impacts. These include livestock grazing, agriculture, vegetation treatments and timber sales. These are discussed qualitatively in **Appendix B**, Section B.2.2 as well as in applicable Affected Environment sections.

4.1.2.2 Reasonably Foreseeable Future Actions

RFFAs are those actions for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. RFFAs within each CIAA that have potential for similar impacts to those analyzed in this chapter for each resource are summarized briefly below and are described in detail in **Appendix B**.

Surface-disturbing Actions

The WRNF, GMUGNF, CRVFO, GJFO, and the WRFO have identified lands available for oil and gas leasing that fall within some or all of the CIAAs. Each agency has developed an RFDS for future oil and gas development within its administrative boundaries. Each RFDS is discussed in detail in **Appendix B**, Section B.3.1.1, along with the projections and assumptions used to estimate long term surface disturbance within each CIAA, which is presented in **Table B-3**, Long-term Surface Disturbance from Oil and Gas Development by CIAA. Other RFFAs with surface disturbing actions identified in **Appendix B** include ROW development projects within the WRNF and CRVFO; road improvements within the WRNF and GMUGNF; trail developments within the CRVFO and GMUGNF; and a reservoir enlargement project within the GMUGNF (see **Table B-7**, Long-term Surface Disturbance from Non-oil and Gas Development by CIAA). **Table 4.1-3** summarizes the total quantifiable RFFA surface disturbances contained in **Tables B-5** and **B-6**.

Table 4.1-1 Cumulative Impact Analysis Areas by Resource[1]

Resource	Cumulative Impact Analysis Area (CIAA) Description	Spatial Extent (acres)	Rationale for Use
Geology/Minerals/Paleontology, Soils, General Vegetation, Nongame and Small Game Terrestrial Wildlife, Special Status Species Terrestrial Wildlife, Land Use, Recreation, Visual Resources	65 existing leases (identified as (Lease Area in subsequent tables)	80,380	Primary impact from reasonably foreseeable future development would be due to surface disturbance on the leases.
Special Status Plants[1]	Lease area plus a 300-foot buffer around known populations within 65 existing leases	Varies depending on species	Buffer considers impacts to known plant species and surrounding area that may be disturbed.
Cultural Resources/Native American Traditional Values, Groundwater	Lease area plus a 2-mile buffer around 65 existing leases (identified as “Lease+2 miles” in subsequent tables)	332,040	Buffer considers impacts to the context of cultural resources and extent groundwater sources that may encountered within the leases.
Transportation, Hazardous Materials/ Human Health and Safety	Lease area plus the regional road network used to access leases	N/A	Addresses impacts to new and existing local access roads from project-related transportation.
Surface Water Quality and Quantity, Aquatics [4]	Hydrologic Unit Code (HUC)12 watersheds crossed by leases (identified as “HUC-12” in subsequent tables)	606,006	Takes into account effects of activity on-lease and downstream.
Big Game	Big Game Management Units (GMUs) crossed by lease.	2,121,890	Puts habitat disturbance from future development into context of entire area used by big game.
Greater Sage-grouse	Priority Habitat Management Area and General Habitat Management Area (GHMA) polygons crossed by leases	14,155	Puts habitat disturbance from future development into context of entire sage-grouse habitat areas in vicinity.
Lynx	Lynx Analysis Units (LAUs) polygons crossed by leases	510,805	Puts habitat disturbance from future development into context of entire area used by lynx.
Livestock Grazing	Grazing allotments crossed by lease.	308,666	Puts disturbance from future development into context of entire allotment.

Table 4.1-1 Cumulative Impact Analysis Areas by Resource[1]

Resource	Cumulative Impact Analysis Area (CIAA) Description	Spatial Extent (acres)	Rationale for Use
Special Designations	Special Designations within leases (1 Research Natural Area [RNA] and portions of roadless areas)	64,864	Future development outside existing leases would be limited by special designation management requirements. Impacts from future development therefore limited to special designations within existing leases.
Socioeconomics and Environmental Justice[2]	Mesa, Garfield, Pitkin, and Rio Blanco counties	N/A	Economics and populations of four-county area could be affected by future development.
Air Quality; Climate[3]	Northwest region of Colorado	N/A	Incorporates the analysis contained in the Colorado Air Resource Management Modeling Study (CARMMS).

[1] Acreage for Special Status Plant CIAA is not included in subsequent tables because the scale at which projects are identified is too coarse to differentiate between this CIAA and the lease CIAA.

[2] Acreage for Social and Economic Values/Environmental Justice CIAA, which comprises Garfield, Mesa, Pitkin, and Rio Blanco counties, are not included in this or subsequent tables because surface disturbance is not an impact indictor used for cumulative analysis of this resource.

[3] Acreages for an Air Resources CIAA are not included because the cumulative impact analysis for air resources considers the entire northwest region of Colorado and relates to the analysis contained in the CARMMS.

[4] The aquatics CIAA also extends downstream into Designated Critical Habitat for Colorado pikeminnow, razorback sucker, bonytail and humpback chub in the Colorado River.

Table 4.1-2 Past and Present Surface Disturbing Actions by CIAA

Past/Present Actions	Long-term Disturbance by CIAA (acres/percent)							
	Lease Area	**Lease+2 miles**	**HUC-12**	**Big Game**	**Sage-grouse**	**Lynx**	**Range**	**Special Desig.**
Mineral Development[1]	38 / <1	590 / <1	2,658 /<1	4,262 /<1	22 / <1	693 / <1	92 / <1	3 / <1
Transportation Corridors[2]	91 / <1	249 / <1	1,460 /<1	3,282 /<1	28 / <1	669 / <1	390 / <1	1 / <1
Other Land Development	325 / <1	304 / <1	1108 /<1	1153 /<1	0 / <1	695 / <1	627 / <1	0 / <1
TOTAL	**454 / <1**	**612 / <1**	**5,226** /<1	**8,697** /<1	**50** /<1	**2,057** / <1	**1,109** / <1	**4** / <1

[1] Number of wells by CIAA: Lease Area-75; Lease+2 miles -1,180; HUC-12-5,315; Big Game-8,523; Sage-grouse-43; Lynx-1,385; Range-183; Special Designations-5. Well count incudes all Colorado Oil and Gas Conservation Commission (COGCC) well categories except “permitted locations”. Long-term surface disturbance assumptions: Wellpad size- 0.5 acre per well (see Chapter 2.0).

[2] Disturbance acreages for roads assume the following widths: Interstate: 72 feet (4 lanes); principal arterial: 60 feet (4 lanes); minor arterial: 60 feet (2 lanes); major collector: 30 feet (2 lanes); minor collector: 15 feet (2 lanes); local road: 22 feet (1 lane).

Source: BLM 2015g; COGCC 2015b; Colorado Department of Transportation 2015; U.S. Department of Transportation (USDOT) 2013.

Table 4.1-3 RFFA Long-term Surface Disturbance by CIAA

Management Area	Estimated Future Disturbance by CIAA (acres/percent)[1, 2]					
	Lease+2 Miles	**HUC-12**	**Big Game**	**Range**	**Lynx**	**Sage-grouse**
In and around Zones 1, 2, and 3						
USFS WRNF Reasonably Foreseeable Development (RFD) Glenwood Springs FO	496 / <1	496 / <1	496 / <1	496 / <1	496 / <1	0
USFS WRNF RFD-GJFO	94 / <1	94 / <1	94 / <1	94 / <1	94 / <1	0
USFS GMUGNF RFD	23 / <1	23 / <1	23 / <1	0	0	0
BLM CRVFO RFD-excluding Roan Plateau Planning Area (RPPA)	6,893 / 2	13,256 / 2.2	13,256 / <1	0	0	0
BLM RPPA	0	382 / <1	0 / 0	0	0	0
BLM GJFO RFD	71 / <1	560 / <1	1,897 / <1	0	0	71 / <1
Hunter Reservoir Enlargement			61 / <1			
Colorado Department of Transportation Highway 133 Debris Dump Site and Placita Roadside Landscaping			9 / <1			
Rio Grande Connection Trail Reroute			<0.5 / <1			
Trickel Park Road Improvement Project			9 / <1			
In and around Zone 4						
BLM WRFO RFD	9 / <1	43 / <1	625 / <1	9 / <1	97 / <1	0
TOTAL	**7,586 / 2**	**14,854 / 2.5**	**16,490 / <1**	**599/ <1**	**687 / <1**	**71 / <1**

[1] Disturbance acreages do not include projects for which no acreage of surface disturbance has been defined.

[2] The Special Designations and Lease Area CIAAs are not included in this table because those CIAAs comprise only lands within the existing leases, and future oil and gas development on the existing leases is already considered in Chapter 2.0 of this EIS as part of the alternatives.

Source: BLM 2015b, 2014d, 2012, 2008a, 2007; USFS 2015c, 2015d, 2014d, 2010a, 2007b.

As noted in **Appendix B**, Section B.3.1.2, not all development forecasted in the RFDS would occur immediately or at the same time. The COGCC database was used to identify recently approved and pending APDs in order to understand what portion of the disturbance identified in the RFDSs for each area might be developed within the next few years. This disturbance is presented in **Table 4.1-4**.

Table 4.1-4 Long-term Surface Disturbance from Recently Approved or Pending APDs by CIAA

Management Area	Estimated Future Disturbance by CIAA (acres / percent)[1,2]					
	Lease+2 Miles	HUC-12	Big Game	Range	Lynx	Sage-Grouse
In and around Zones 1, 2, and 3	242 / <1	704 / <1	2,300 / <1	14 / <1	105 / <1	7 / <1
In and around Zone 4	0	0 / 0	10 / <1	0 / 0	0 / 0	0 / 0
TOTAL	**242 / <1**	**704 / <1**	**2,310 / <1**	**14 / <1**	**105 / <1**	**7 / <1**

[1] The Special Designations and Lease Area CIAAs are not included in this table because those CIAAs comprise only lands within the existing leases, the development of which is already considered in this EIS in the alternatives.

[2] As of May 2015, recently approved and pending APDs by CIAA were as follows: Lease+2 miles-1 recently approved APD and 68 pending APDs; Big Game CIAA- 591 recently approved APDs and 69 pending APDs; HUC-12 CIAA- 197 recently approved APDs and 4 pending APDs; Range- 2 recently approved APDs and 2 pending APDs; Lynx- 26 recently approved APDs and 4 pending APDs; and Sage-grouse- 2 recently approved APDs. Long-term surface disturbance assumptions: Wellpad - 0.5 acre per well, road -3 acres per well (see Chapter 2.0).

Source: COGCC 2015h.

As discussed in Section B.3.1.2, and disclosed in **Table B-4**, based on the well projection included in each RFDS and using the water demand assumptions as discussed in **Appendix B**, there would be 22,304 acre-feet of freshwater required for drilling and 431,291 acre-feet of recycled water for well completions. Full RFDS development would require 2,061,180 truck trips for drilling activities, 2,620,030 truck trips for completion activities and 368,820 truck trips for reclamation. Water use and transportation requirements would change over time. As of May 2015, there were 1,529 recently approved and pending APDs within Garfield, Mesa, and Pitkin counties. Development of these wells would require 1,177 acre-feet of freshwater for drilling and 9,847 acre-feet of recycled water for completion. Assuming 7 wells per well pad, there would be 26,752 truck trips for drilling, 37,915 trips for completion and 5,431 trips for reclamation.

Other Forest Service District or BLM Field Office Actions

The following sections describe other types of RFFAs within the CIAAs. These actions are not included in **Table 4.1-3** because they do not necessarily result in surface disturbance; may not have adverse impacts on all resources; and in some cases may have a countervailing effect on cumulative impacts. Identified RFFAs include vegetation treatments and hazardous fuel reduction projects, the Battlement Reservoir Reconstruction Project; and continued livestock grazing and agriculture. These projects are discussed in more detail in **Appendix B**, Section B.3.2. **Table 4.1-5** provides a summary by CIAA of vegetation treatment and hazardous fuels reduction RFFAs within the WRNF, GMUGNF, and CRVFO. There are no identified vegetation treatments in any of the CIAAs within the GJFO or WRFO.

Table 4.1-5 Vegetation Treatments and Hazardous Fuels Reduction RFFAs by CIAA

Treatment Project	Disturbance Acreages by CIAA (acres/percent)[1, 2]							
	Lease	**Lease +2 mi.**	**HUC-12**	**Big Game**	**Lynx**	**Sage-grouse**	**Range**	**Special Desig.**
South Rifle Habitat Enhancement Project	6,000 / 7	6,000 / 2	6,000 / 1	6,000 / <1	6,000 / 1	0 / 0	6,000 / 2	3,000 / 9
Aspen/Sopris Wildlife Habitat Improvement Project	0	0	2,100 /<1	11,500 / 1	6,370 / 1	0 / 0	0 / 0	0 / 0
Lookout Mountain Communications Site Hazardous Fuels Reduction Project	0	0	25 / <1	25 / <1	0 / 0	0 / 0	0 / 0	0 / 0
Spruce Creek Oakbrush Thinning Project	0	0	100 / <1	100 / <1	100 / <1	0 / 0	0 / 0	0 / 0
Uncle Bob Oakbrush Thinning Project	0	0	200 / <1	200 / <1	200 / <1	0 / 0	0 / 0	0 / 0
Uncle Bob Mountain Road Hazardous Fuels Treatment Project	0	0	2,100 / <1	2,100 / <1	2,100 / <1	0 / 0	0 / 0	0 / 0
Cedar Springs II Vegetation Treatment Project	0	0	800 / <1	800 / <1	0 / 0	0 / 0	0 / 0	0 / 0
Cedar Mountain Fuels Reduction Project	0	0	667 /<1	667 / <1	0 / 0	0 / 0	0 / 0	0 / 0
TOTAL	**6,000 / 7**	**6,000 / 2**	**11,992 / 2%**	**21,392 / 1**	**14,770 / 3**	0 / 0	**6,000 / 2**	**3,000 / 9**

[1] Disturbance acreages do not include projects for which no acreage of surface disturbance has been defined.

[2] For each project, the total projected treatment acreages have been included within each CIAA because there is significant overlap between the CIAAs and because treatments areas and treatment locations have not been finalized and therefore have potential to occur within any of the CIAAs.

Source: BLM 2015a-c; Larson 2015a,b; Ringer 2015; USFS 2014d, 2010c.

County Actions

Appendix B, Section B.3.3, describes the future goals and plans for each of the four counties in which the CIAAs are located. In general, all four counties all strive to retain the rural character of the area. Mesa and Garfield county plans anticipate transportation issues due to the continued need to commute from affordable housing to places of employment and continued oil and gas development. Both counties have identified areas where road improvements are planned or may be required. Rio Blanco County also identified several proposed road improvements and mitigations to improve transportation issues related to continued oil and gas development. Within Pitkin County, the Snowmass-Capitol Creek Valleys Master Plan (which guides land use in a portion of the Big Game CIAA) actively discourages oil and gas development.

4.2 Air Quality

The burning of fossil fuels (natural gas, crude oil, coal, etc.) produces various emissions, including greenhouse gases (GHGs). These GHGs (primarily carbon dioxide [CO_2]) are widely believed to cause contribute to climate change. The continued or increased production and combustion of natural gas from resources in the 65 federal fluid minerals leases underlying White River National Forest (WRNF) considered under the alternatives would produce GHGs. However, the amount of GHGs produced from potential development of future WRNF resources would be an extremely small fraction of global emissions and lower than it would be if other fuels (coal, oil, etc.) were to be used for the same energy demand. Standardized protocols designed to measure factors that may contribute to climate change and to quantify climatic impacts are presently unavailable. However, no significant adverse impacts on climate are anticipated from implementation of any of the alternatives because it is reasonable to assume that they would not add to the demand or consumption of fossil fuels. In other words, global and U.S. energy supply and demand would not be affected by whether or not WRNF resources are developed.

Air pollution impacts are limited by state and federal regulations, standards, and implementation plans established under the Clean Air Act (CAA) and administered by the Colorado Department of Public Health and Environment – Air Pollution Control Division (CDPHE-APCD). Colorado regulations require that proposed air pollutant emission sources—including dehydrators, separators, and natural gas compressors—undergo a permitting review. Therefore, CDPHE-APCD has the authority to review emission permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. In addition, Section 116 of the CAA authorizes tribal, state, and local air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Additional site-specific air quality analysis would be performed during permitting, and additional emission control measures, including best available control technology, may be required to protect air quality resources.

Under the Federal Land Policy and Management Act (FLPMA) and the CAA, the BLM provides for compliance with all applicable federal, tribal, state, and local air quality laws, statutes, regulations, standards, and implementation plans. For this environmental impact statement (SEIS), potential air quality impacts for specific development projects were not analyzed in detail; rather, rates of oil and gas related emissions in a low, medium and high range were used to bound anticipated future oil and gas development in the WRNF lease area. The BLM has developed various emission and air quality impact analysis tools under the CARPP that will be used for authorizing future WRNF oil and gas development on the 65 lease area. When future projects are proposed by an applicant, the BLM will use these tools to prepare a project-specific assessment of impacts of the maximum “near-field” (local) ambient air pollutant concentrations and hazardous air pollutant impacts. Future project-specific air quality analyses also will include an evaluation of the Colorado Air Resources Modeling Management Study (CARMMS) for specific and cumulative regional impacts to determine its usefulness and applicability for assessing regional ambient air pollutant concentrations and air quality related values impacts for a proposed project in the WRNF area.

Computational models that estimate the dispersion and formation of atmospheric pollutants are mathematical approximations regardless of their level of complexity, based on fluid dynamics and atmospheric chemistry. Thus, given the uncertain nature of the number and placement of future emissions sources under the alternatives in this analysis, the results should be viewed as the best possible estimates of future concentrations based in known or available information at this time and not as exact predictions in time and space. Because of this, modeling air pollution is generally conducted using assumptions that ensure that the modeled results do not underestimate actual future impacts so that appropriate planning decisions can be made. For example, sources may be assumed to operate for longer periods or emit more pollutants than actual conditions to ensure that health-based standards are protected. At the same time, analyses are not conducted assuming “worst-case” conditions over the

entire analysis area because this could lead to results that are unreasonable and unrealistic. Hence, air pollution modeling uses the best available information and methods (USEPA-approved models, emission factors, previous or current/ongoing studies, etc.) when possible, and the best scientific and professional judgment in attempting to ensure that projections of future air quality are neither under-predicted nor unrealistically over-predicted.

The remainder of this section describes the methodologies used to assess air quality impacts for low, medium, and high oil and gas development scenarios. No results for modeling specific development sites' near-field air quality impacts in the RNF are presented; however, this chapter will present the procedure that BLM field offices will use to evaluate individual development projects under NEPA.

4.2.1 Colorado Air Resources Protection Protocol

The following section provides a brief overview of the CARPP and describes the process and strategies the BLM will use when authorizing activities that have the potential to adversely impact air quality within the state of Colorado (BLM, 2014). The process described includes those activities that could come as a result of the previously issued 65 oil and gas leases in the WRNF. The CARPP is not a decision document, but rather a strategy to address air quality concerns throughout BLM-managed lands and resources in Colorado. Because the CARPP is not a field office specific management tool, it may be modified as necessary to comply with changing laws, regulations, BLM policy, or to address new information and changing circumstances without maintaining or amending any specific field office Resource Management Plan (RMP). Through CARPP the BLM cooperates with other federal, state, tribal and local air resource management partners. In particular when making oil and gas implementation decisions, the BLM will consider or apply, as appropriate, the provisions of the Memorandum of Understanding (USEPA 2011).

Appropriate air resources protection requires the BLM to manage its authorized activities and actions at broad spatial and temporal scales that are dynamic and thus subject to change. The BLM would accomplish this through an adaptive management approach, which includes establishing baseline conditions, monitoring, reevaluation, and adjustment as necessary. Adaptive management therefore incorporates regular review and adjustment of management approaches during the authorization of emissions generating activities commensurate with changing circumstances. The BLM will take the any of the following actions to ensure an adequate analysis and guide subsequent protection of air quality resources within Colorado.

- Monitoring: Ambient air monitoring provides valuable data for determining current and background concentrations of air pollutants. The BLM participates in a cooperative effort with industry, and other entities to establish, operate, and maintain a comprehensive air monitoring network. The BLM may request proponents of projects with the potential to generate substantial air emissions, to submit pre-construction air monitoring data from a site within the proposed development area. BLM also could to request that air monitoring for the life of the project to be conducted based on the availability of representative air monitoring data. Finally, project-specific monitoring data may be used by the BLM in subsequent NEPA analysis required for project approvals.
- Emissions Inventories: The BLM will request the proponent of an oil and gas development activity to submit a comprehensive inventory of anticipated direct and indirect emissions associated with a proposed project. The BLM will review the emissions inventory to determine its completeness and accuracy.
- Modeling: The BLM will use regional air modeling and project-specific modeling, in conjunction with other air analysis tools, to develop air resource protection strategies. Further, the BLM will provide appropriate disclosure for any modeling of direct, indirect, and cumulative impacts of proposed actions during required NEPA analysis. Currently, the BLM is facilitating the Colorado

Air Resources Management Modeling Study (CARMMS 2015). CARMMS is a BLM funded regional air quality modeling study of expected impacts on air quality from projected increases in oil and gas development across Colorado. CARMMS results include the predicted impacts from all projected federal and non-federal oil and gas development within the region and will be presented in more detail in the following section.

- Permitting: The BLM would consider or apply, as appropriate, any state or federal permit requirements. As part of the NEPA process and prior to the authorization of any federal mineral development activity, the BLM would conduct an air analysis to determine the potential impacts on air quality based on the estimated emissions from the activity being authorized.
- Mitigation: Many activities that the BLM authorizes, permits, or allows generate air pollutant emissions that have the potential to adversely impact air quality. The primary mechanism to reduce air quality impacts is to reduce emissions via project design features and mitigation. The BLM will ensure implementation of reasonable mitigation, control measures, and design features through appropriate mechanisms, including lease stipulations, notices to lessees, and conditions of approval (permit terms and conditions) as provided for by law and consistent with lease rights and obligations.

One important aspect of the CARPP is the concept of adaptive management, which incorporates the principles of monitoring current conditions, predicting future impacts, and adapting strategies to account for changing conditions. An adaptive management strategy for air quality resources allows the BLM to comply with NEPA and complete an appropriate analysis to ensure that activities approved by the BLM minimize adverse impacts to air quality. The strategy includes evaluating air quality on an ongoing basis, and if necessary, implementing appropriate mitigation measures to meet the identified objectives and targets for any applicable Colorado land use plan.

4.2.2 Regional Air Quality Impacts Analysis

In order to disclose cumulative and regional air quality impacts, the BLM has initiated the Colorado Air Resources Management Modeling Study (CARMMS). CARMMS was developed to provide an analysis of regional and cumulative air quality and air quality related values (AQRV) impacts for future projected oil and gas and mining development throughout Colorado. Several Colorado-based RMPs are currently being prepared or are in a pre-planning phase. For these RMPs and the White River National Forest EIS, air quality and AQRV impacts are being analyzed for BLM-authorized mineral development activities. A goal of CARMMS is to avoid potential inconsistencies in how future year impacts are evaluated and the inefficiency of having individual projects conduct regional and cumulative analysis.

The CARMMS modeling study consist of a photochemical grid model (PGM) and far-field dispersion modeling protocol. The protocol describes modeling procedures for addressing potential air quality and AQRV impacts due to BLM-authorized mineral development and other BLM-authorized activities in Colorado. CARMMS leveraged the West-Wide Jump-Start Air Quality Modeling Study (WestJumpAQMS) 2008 modeling platform. The modeling protocol was developed by BLM and reviewed by an Interagency Air Quality Review Team (IAQRT). The IAQRT consists of federal (USEPA Region 8 and Region 6, National Park Service [NPS], U.S. Fish and Wildlife Service (USFWS) and the U.S. Forest Service (USFS) and state air quality agencies (Colorado and New Mexico). The protocol lists the components of the CARMMS modeling system which include:

- The Weather Research Forecasting Model (WRF) was used to develop meteorological data for year 2008.
- The Sparse Matrix Operator Kernel Emissions (SMOKE) model was used for emissions processing and to produce CAMx-ready emissions

- The USEPA Motor Vehicle Emissions Simulator (MOVES) model was used to prepare on-road mobile source emissions.
- Biogenic emissions in the western United States were developed using the Model for Emissions of Gases and Aerosols in Nature (MEGAN).
- Photochemical grid modeling simulations were performed with the Comprehensive Air-Quality Model with extensions (CAMx). The ability of the model to provide source apportionment information was critical to the CARMMS study.

All models used the most recent versions available and provide the most advanced analysis techniques.

In order to estimate future air quality and AQRV impacts, two sets of emission and modeling impacts data were developed: 1) a 2008 base- case emissions that serve as baseline emissions and 2) a future-year 2021 emissions that consider emission changes including growth from Colorado-based oil and gas sources along with mining sources.

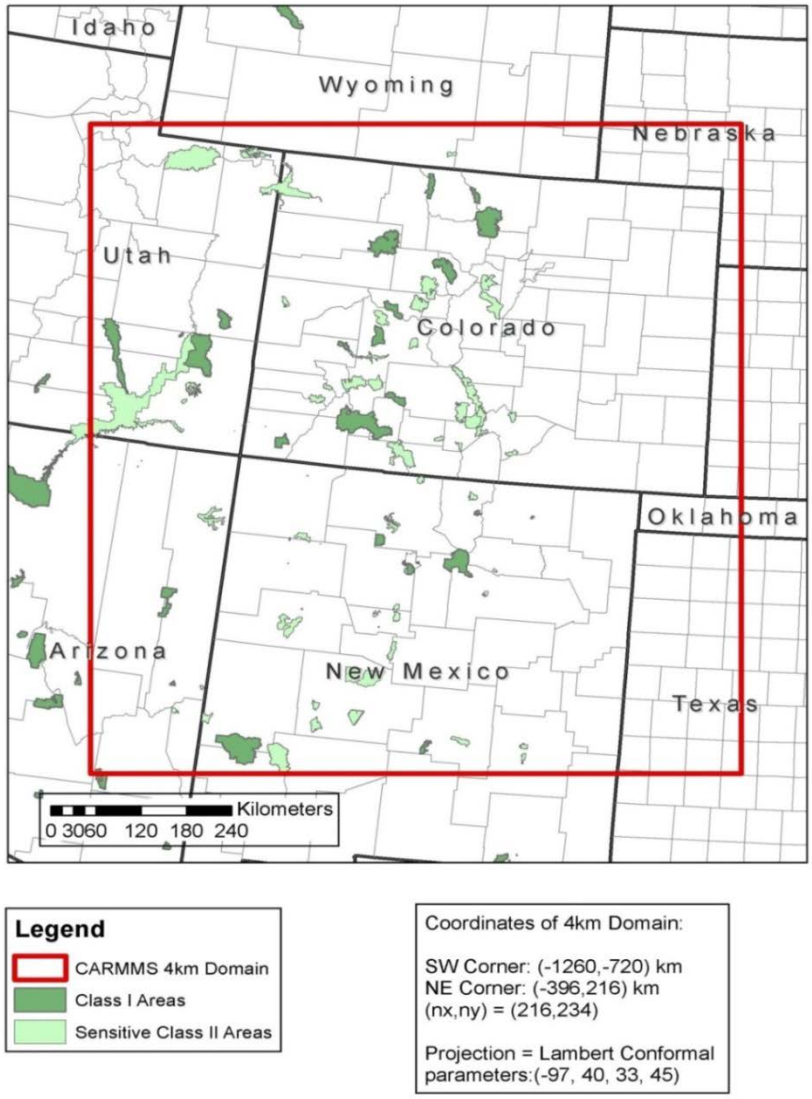
The CARMMS 2008 Base Case emissions and modeling platform were developed by WestJumpAQMS and the primary source for the 2008 Base Case emissions was Version 2.0 of the National Emissions Inventory. The comprehensive and detailed documentation for the WestJumpAQMS 2008 Base Case emissions inventory and modeling platform is available on the WestJumpAQMS website (http://www.wrapair2.org/WestJumpAQMS.aspx) and includes a final report and 16 Emissions Technical Memorandums that provide details on the 2008 emissions for each source category (WestJumpAQMS 2008).

Future-year oil and gas emissions databases were developed for a range of potential outcomes with the intent to bound the actual future-year oil and gas development in Colorado. These potential outcomes are defined in CARMMS as low, medium, and high development scenarios. The CARMMS cumulative emissions inventory also includes non-oil and gas emission inventories encompassing biogenic (natural) emissions, electric generating units (EGUs), fires and mobile sources. The non-oil and gas emissions estimates for CARMMS were developed by USEPA and updated for the Three-State Air Quality Study (3SAQS) projected year 2020 emissions inventory. Oil and gas future year emissions estimates for nearby states were obtained from the latest studies for future oil and gas development in the region. Future year 2021 emissions inventories for Colorado based mining were developed specifically for CARMMS and were based on the latest foreseeable mining projections.

The CARMMS modeling area covers all of Colorado and portions of adjacent states for a short-term period of approximately 10 years (up to year 2021). **Figure 4.2-1** shows the extent of CARMMS modeling domain which has a horizontal grid spacing of 4 kilometers. Results from CARMMS include prediction of future potential O_3 and other criteria pollutant (i.e., NO_2, CO, PM_{10}, $PM_{2.5}$, and SO_2) concentrations. AQRVs impact evaluation includes nitrogen and sulfur deposition rates, visibility impairment, and lake acid neutralizing capacity (ANC).

The prediction of ozone formation is a complex process that requires adequate input data requirements and could consume significant modeling time. Ozone is formed in the atmosphere from a combination of VOCs and NO_X precursors from various sources within a region and has the potential to be transported across long distances. CARMMS was used to model potential ozone impacts for the low, medium, and high oil and gas development scenarios in order to provide ozone impact analyses for the White River National Forest and other BLM Colorado regions. In doing so, the potential impacts of an individual project on regional ozone formation and transport, including the White River National Forest EIS Alternatives, were considered by the CARMMS analysis. For more detailed information regarding

CARMMS, the full CARMMS Report (based on 2008 modeling platform) and Excel Workbooks with CARMMS results can be found online[1] (CARMMS 2015).



Source: CARMMS 2015.

Figure 4.2-1 CARMMS 4-kilometer Modeling Domain

The study assesses impacts from projected oil and gas development through 2021 for both federal and fee (private) lands for three development scenarios: low, medium, and high. The low development scenario is based on historical average oil and gas development over the 5-year period from 2008 through 2012 for most BLM Colorado planning areas, but not all including the Roan Plateau Planning

[1] CARMMS webpage: http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carmms.html.

Area and the Uncompahgre Field Office. The historical average is then used to estimate potential oil and gas emissions for each year between 2011 and 2021. Applicable state and federal controls are applied to the oil and gas emissions starting in the year that they are required. The medium development scenario is based on the most recent field office (FO) Reasonably Foreseeable Development (RFD). The RFD is based on 20-year projections estimated by the oil and gas industry and BLM resource specialists. For the medium development scenario, additional controls beyond the application of existing state and federal requirements were applied. The high development scenario considers the same level of development assumed by the medium development scenario; however, only applicable federal and state controls were applied.

The following subsection summarizes CARMMS results for new CRVFO federal oil and gas development (from year 2012 through year 2021) outside the Roan Planning Area. The analysis of the CRVFO outside the Roan Planning Area is most relevant to this EIS because the previously issued oil and gas leases on the WRNF are not located within the Roan Planning Area boundary and the CRVFO includes most of the WRNF.

4.2.2.1 CARMMS Oil and Gas Development and Emissions

A full description of the alternatives analyzed in detail and the projected oil and gas development activity under each alternative can be found in Sections 2.2 and 2.6 of this EIS. In general, the highest air quality impacts would be associated with those alternatives that have more potential for oil and gas development activity. The concentrations of directly emitted pollutants such as CO, SO_2, and greenhouse gases (GHG) are expected to increase as a result of increased oil and gas development. However, the concentrations of pollutants formed in the atmosphere as a result of multiple physical and chemical processes (secondary pollutants including ozone and $PM_{2.5}$) do not always increase near the emissions source. For instance, ozone formation is a complex process in which ozone concentrations do not always increase when the emissions of precursors increase. The impact assessment of these secondary pollutants usually requires modeling that includes project specific emission inventories.

Emission estimates for each alternative were not developed for this analysis because the scope of analysis is regional and cumulative. Instead, emission scenarios developed for the CARMMS have been used in the analysis. In the CARMMS, the BLM developed three future emission scenarios (low, medium and high) for a range of potential outcomes that will bound all alternatives for regional analysis. Because emissions created by oil and gas wells are proportional to the number of wells and development rate, the CARMMS emission scenarios are discussed in terms of total well development. For projected Colorado oil and gas development, the high oil and gas development scenario is based on the reasonably foreseeable development (RFD). The medium development scenario's development rates are identical to the high scenario in terms of location and wells drilled per year; however, the medium development scenario assumes additional mitigation measures summarized below, to reduce potential air pollutant emissions. The low CARMMS scenario annual emissions rates were developed by projecting current 5-year average oil and gas development paces forward to year 2021. Potential emissions for the high, medium and low scenarios were calculated for each new well assuming the minimum and basic legally required emissions control measures, and the medium scenario accounted for additional mitigation measures to reduce air pollutant emissions, as follows:

- All development (drilling/completion/hydraulic fracturing) engines will be Tier 4. Tier 4 gen-set standards will be applied for all engines with a nameplate horsepower (hp) greater than 750 hp.
- All condensate tank, oil tank, and dehydrator emissions are captured and controlled by vapor recovery units (VRUs) with an assumed control efficiency of 95 percent.
- All pneumatic devices are low-bleed or no-bleed. It was assumed that 50 percent of devices are low bleed with a bleed rate of less than 6 cubic feet per hour (cfh) and that 50 percent of the devices are no-bleed.

- 30 percent of the production engines are powered by electricity.
- Dust control for unpaved road traffic is controlled with an assumed control efficiency of 80 percent.
- Truck loading emissions are captured and controlled by VRUs.

For each CARMMS scenario, air pollutant emissions were calculated from the following emissions source equipment and activities:

- Emissions from well pad construction and development:
  - Well pad, access road, and pipeline construction equipment and traffic
  - Drilling, completion and hydraulic fracturing equipment
  - Drilling and well completion traffic
  - Fugitive dust emissions from construction equipment, drilling, and completion support vehicles
  - Construction wind erosion
  - Well completion venting and flaring
- Emissions from the production phase:
  - Well workovers equipment
  - Production traffic (well workovers, road maintenance, well pad reclamation, and production)
  - Fugitive dust emissions from production traffic (well workovers, road maintenance, well pad reclamation, and other production)
  - Blowdown and well recompletion venting
  - Wellhead fugitives
  - Pneumatic devices and pumps
  - Water injection pumps
  - Miscellaneous engines
  - Compressor station maintenance traffic exhaust
  - Fugitive dust emissions from compressor station maintenance traffic
  - Condensate tank flashing
  - Loading emissions from condensate tanks
  - Condensate, crude oil and produced water hauling traffic exhaust
  - Heaters
  - Dehydrator emissions
- Midstream sources:
  - Glycol dehydrators
  - Natural gas processing facilities, gas sweetening: amine process
  - Condensate tanks
  - Natural gas processing facilities, flanges and connections

- Compressor engines
- Process heaters
- Flares

Detailed emission estimation procedures can be found in the CARMMS Report Appendix C, CARMMS Oil and Gas Emission Calculator.

Emissions from the high, medium, and low CARMMS scenarios are expected to be representative, but not equal to, emissions that could occur from future oil and gas developed under all the alternatives. In general, new oil and gas development / emissions from Alternatives 1 to 4 are expected to be above the low development scenario and below high scenario rates. Emissions from Alternative 4 are expected to be the closest to the low development scenario because of the reduced level of oil and gas development as a result of leases that would be cancelled to match the Forest Service draft decision. New projected oil and gas development /emissions from Alternatives 1, 2, and 3 are expected to be above the low scenario but below the high scenario as the process for management of exploration, development, and reclamation would continue under those leases. As noted above, the potential emissions associated with new oil and gas development for Alternatives1, 2, 3, and 4 would be bound by the development rates represented in the CARMMS high and low scenarios. New oil and gas development under Alternative 5 would be expected to see the lowest level of emissions as all previously leases would be cancelled and all producing wells would have to be plugged and abandoned under this alternative. **Table 4.2-1** provides the CRVFO outside the Roan Planning Area oil and gas development and projected production rates modeled with the CARMMS' high, medium and low development scenarios. Development and projected production rates for the medium scenario are identical to the high scenario.

Table 4.2-1 CARMMS-Predicted Future Oil and Gas Development for CRVFO (Outside Roan Planning Area)

Parameter	High and Medium Development Scenario (RFD)[1]	Low Development Scenario (5-year Average)[2]
Federal Wells Per Year	166 (1,661 in 10 years)	107 (1,069 in 10 years)
Cumulative (Federal and non-Federal) Wells Per Year	584	359
Wells Per Pad (assumed for analysis)	12	8
2021 Cumulative Active Well Counts	11,811	9,561
% 2021 Cumulative Wells that Are Federal	28%	24%
Cumulative Average Annual No. Drill Rigs Operating	12	10
Cumulative 2021 Gas Production (MMscf/yr)	427,908	282,155
Cumulative 2021 Oil / Condensate Production (Mbbl/yr)	1,985	1,252

[1] RFD based on Oil and Gas Industry and BLM Resource Specialists 20-year projections for the CRVFO.

[2] Future oil and gas development projections based on recent 5 years (2008-2012) of oil and gas development data for the CRVFO.

Source: CARMMS 2015.

Emission estimates for oil and gas activities were calculated using oil and gas emissions calculators developed specifically for CARMMS and are shown in the CARMMS report (http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carmms.html). The CARMMS western Colorado oil and gas emissions calculators were based directly on survey responses from oil and gas operators in the CRVFO and WRFO (Piceance Basin) area. **Table 4.2-2** provides a summary of the annual oil and gas emissions for the CRVFO outside the Roan Planning Area in tons per year (tpy) for selected pollutants. The table shows the emissions from the baseline year (2011) and the high, medium and low development scenarios (2021). In addition to the emission totals, the table also shows the emissions changes from the baseline year 2011 to year 2021. The year 2011 baseline annual emissions were calculated using CDPHE permitted APEN data / information and historical oil and gas development information (i.e., oil and gas well drilling and completion information for calendar year 2011). These year 2011 emissions for "existing" conditions were adjusted for projected year 2021 inventory accounting for oil and gas production decline for current / existing year 2011 oil and gas wells. The emissions inventories were developed for the high, medium, and low oil and gas development scenarios and include emissions from construction, development (upstream) and production (upstream and "midstream") operations. The following pollutants were inventoried when an appropriate methodology, and sufficient data existed: carbon monoxide (CO), oxides of nitrogen (NO_X), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), volatile organic compounds (VOCs), hazardous air pollutants (HAPs), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The emissions inventory was developed using reasonable but conservative scenarios for each construction and production activity. Production emissions were calculated for an entire year and included activities that are not likely to occur every year (i.e., well workovers and recompletions); thus, the project inventory is conservative on an annualized basis. Potential emissions for the CARMMS high, medium and low scenarios were calculated for each new well post year 2011, assuming the minimum and basic legally required emissions control measures; the medium scenario accounted additional emissions controls previously described.

Table 4.2-2 CARMMS CRVFO Federal Oil and Gas (outside Roan Planning Area) Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
High Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
High Development (2021)	328	96	1,679	5,070	1,279	2	773,232	23,898	13
Difference[1] (2021 – 2011)	128	43	643	2,474	545	-5	440,770	13,984	8
Percent Change	64%	81%	62%	95%	74%	-71%	133%	141%	160%
Medium Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
Medium Development (2021)	202	76	1,428	3,174	1,257	2	771,396	19,946	13
Difference[1] (2021 – 2011)	2	23	392	578	523	-5	438,934	10,032	8
Percent Change	1%	43%	38%	22%	71%	-71%	132%	101%	160%

Table 4.2-2 CARMMS CRVFO Federal Oil and Gas (outside Roan Planning Area) Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
Low Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
Low Development (2021)	239	71	1,212	3,701	949	2	604,270	18,767	10
Difference[1] (2021 – 2011)	39	18	176	1,105	215	-5	271,808	8,853	5
Percent Change	20%	34%	17%	43%	29%	-71%	82%	89%	100%

[1] Reduction of SO_2 emissions in the future year for both scenarios (High and Low) are due to Federal regulations on diesel fuel sulfur content.

Source: CARMMS 2015.

Table 4.2-3 provides a summary of the annual oil and gas emissions for the fraction of the CRVFO outside the Roan Planning Area that are colocated with the WRNF surface. The fraction of the emissions modeled for the source group that encompasses the CRVFO outside the Roan Planning Area that are co-located with WRNF surface is approximately 11.35 percent, and the CARMMS emissions that were modeled and "associated" with new (after year 2011 through year 2021) WRNF (in CRVFO) oil and gas emissions presented in **Table 4.2-3** take into account this factor. This percentage of new projected CRVFO outside Roan Planning Area oil and gas development was estimated using ArcMap with USFS and CARMMS oil and gas RFD Shapefiles. The table shows the emissions from the baseline year (2011) and the high, medium and low development scenarios (year 2021) as well as their differences relative to the baseline year 2011.

Table 4.2-3 CARMMS WRNF Federal Oil and Gas Annual Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
High Development Scenario									
Baseline (2011)	23	6	118	295	83	1	37,734	1,125	1
High Development (2021)	37	11	191	575	145	0	87,762	2,712	1
Difference[1] (2021 – 2011)	14	5	73	280	62	-1	50,028	1,587	0
Medium Development Scenario									
Baseline (2011)	23	6	8	295	83	1	37,734	1,125	1
Medium Development (2021)	23	9	162	360	143	0	87,553	2,264	
Difference[1] (2021 – 2011)	0	3	44	65	60	-1	49,819	1,139	
Low Development Scenario									
Baseline (2011)	23	6	118	295	83	1	37,734	1,125	
Low Development (2021)	27	8	138	420	108	0	68,585	2,130	
Difference[1] (2021 – 2011)	4	2	20	125	25	-1	30,851	1,005	0

[1] Reduction of SO_2 emissions in the future year for both scenarios (High and Low) are due to Federal regulations on diesel fuel sulfur content.

Source: CARMMS 2015.

Table 4.2-4 provides year 2021 federal oil and gas emissions that were explicitly modeled for the CRVFO outside the Roan Planning Area estimated for the emissions source group specific / source apportionment air quality impacts analysis in CARMMS. For comparison with the CRVFO outside the Roan Planning Area, **Table 4.2-4** also shows the sum of the 13 BLM Colorado planning areas (including all of the CRVFO [inside and outside the Roan Planning Area]), total oil and gas emissions (which include the 13 BLM Colorado planning areas, one BLM New Mexico planning area and oil and gas emissions outside of the BLM planning areas all within the CARMMS 4-kilometer modeling domain [see **Figure 4.2.1**]) and total CARMMS 4-kilometer domain emissions (includes man-made and natural [biogenic and fires]) modeled. For the CRVFO outside the Roan Planning Area and the sum of 13 LM Colorado planning areas, these emission rates represent emissions only from new federal oil and gas development post year 2011 through year 2021.

Table 4.2-4 CARMMS Projected Year 2021 Annual Emissions Rates Modeled

Group	CARMMS 2021 Emissions (tpy)[1]				
	NOx	VOC	SO_2	$PM_{2.5}$	PM_{10}
High Development Scenario					
CRVFO (outside Roan Planning Area)	1,311	6,076	2	71	250
Colorado Groups 1-13 [2] (“Colorado Federal”)	29,246	67,930	943	1,429	5,586
Total Oil and Gas	240,667	835,785	6,071	10,530	43,859
Total Emissions Modeled	814,245	2,140,889	102,931	339,768	2,025,594
Medium Development Scenario					
CRVFO (outside Roan Planning Area)	1,060	3,253	2	51	123
Colorado Groups 1-13 [2] (“Colorado Federal”)	24,519	43,039	943	996	2,494
Total Oil and Gas	234,309	808,100	6,068	9,935	39,621
Total Emissions Modeled	808,067	2,113,203	102,928	339,173	2,021,356
Low Development Scenario					
CRVFO (outside Roan Planning Area)	844	3,916	1	46	161
Colorado Groups 1-13 [2] (“Colorado Federal”)	5,066	13,547	155	256	899
Total Oil and Gas	182,021	656,912	5,099	6,865	22,152
Total Emissions Modeled	755,779	1,962,016	101,958	336,104	2,003,888

1 Total emissions for source group and combination of source categories from the CAMx source apportionment diagnostic output files after process by SMOKE.

2 Colorado groups include Little Snake Field Office, White River Field Office, Colorado River Valley Field Office, Roan Plateau, Grand Junction Field Office, Uncompahgre Field Office, Tres Rios Field Office, Kremmling Field Office, Royal Gorge Field Office, Areas 1 through 4, and Pawnee Grasslands portion of Royal Gorge Area #1.

Source: CARMMS 2015

As part of a strategy for the CARPP, annual oil and gas completions/development inventories (post-year 2011) are routinely compiled by the BLM to verify whether actual current and future oil and gas development and cumulative emissions rates are consistent with the annual emissions rates modeled in

CARMMS. Since year 2011, there have been approximately 363 new Federal wells completed in the CRVFO at a maximum rate of 153 new Federal oil and gas wells completed per year for year 2012 (recent years 2013 and 2014 have averaged just above 100 new Federal wells completed per year). For this comparison, it is assumed that most wells developed since the year 2011 were developed outside of the Roan Plateau Planning Area. This development rate for the CRVFO outside the Roan Planning Area is lower than the 166 new Federal wells per year for the High Development Scenario, but is slightly higher than the approximately 107 new Federal wells per year for the Low Development Scenario.

In addition, the BLM tracks emissions changes and air quality conditions to determine which of the CARMMS' scenarios (low, medium, high) is most representative of current trends. Emissions data from recently approved Applications for Permit to Drill (APDs) are added to the total regional emissions estimates to derive an annual estimate of regional emissions levels. These regional emissions are compared to the CARMMS scenarios. Based on the oil and gas development level analysis conducted regularly by the BLM as described above and the information provided in **Table 4.2-2** and **4.2-3**, it is observed that current levels of CRVFO Federal oil and gas development outside the Roan Planning Area are tracking below the CARMMS high development scenario and slightly above the low oil and gas development scenario. Therefore, it is expected that the CARMMS modeling results for the low development scenario are adequate for assessing future potential regional and cumulative air quality impacts assuming that Colorado based oil and gas development continues at current annual development rates. The results and summaries of BLM's annual analyses (data / information tracking and comparisons to modeled rates) will be included in the BLM Colorado Air Resources annual reports beginning in year 2015 based on data from calendar year 2014.

4.2.2.2 CRVFO Outside the Roan Planning Area specific New Oil and Gas End-Use and Energy Consumption CO_2 Emissions

The year 2021 GHG CO_2 emissions shown in the previous tables correspond to upstream (wellhead) and "midstream" (gas processing, consolidated storage, etc.) federal oil and gas development and operations in WRNF. For disclosure purposes only, downstream / end-use GHG CO_2 emissions have been estimated for projected year 2021 CRVFO outside the Roan Planning Area federal oil and gas production. Downstream GHG emissions are directly related to the end-use energy consumption. The U.S. Energy Information Administration (USEIA) releases an Annual Energy Outlook each year that provides projected U.S. energy consumption and corresponding GHG CO_2 emissions for future years (USEIA 2014b). The 2014 Annual Energy Outlook predicts that the total year 2021 U.S. energy consumption for natural gas will be approximately 27.9 (quadrillion BTU) and 36.8 (quadrillion BTU) for petroleum and other liquids, which corresponds to GHG emissions of approximately 1,460 million metric tons of CO_2 for natural gas approximately 2,240 million metric tons of CO_2 for petroleum and other liquids.

Using standard conversion factors, CARMMS projected year 2021 CRVFO outside the Roan Planning Area federal oil and gas production was converted to annual energy units, and the following shows projected year 2021 energy production:

- High Scenario: approximately 124.1 (trillion BTU) for natural gas and approximately 3.3 (trillion BTU) for oil and other petroleum liquids production.
- Medium Scenario: it would be the same as for CARMMS high scenario.
- Low Scenario: approximately 83.8 (trillion BTU) for natural gas and approximately 2.1 (trillion BTU) for oil and other petroleum liquids production.

End-use GHG CO_2 emissions for future year 2021 CRVFO outside the Roan Planning Area federal oil and gas can be estimated by simply assuming that all CRVFO outside the Roan Planning Area federal oil and gas is part of the total year 2021 U.S. energy consumption and calculating the ratio to determine the fraction of total year 2021 U.S. energy consumption that would be associated with 2021 CRVFO

outside the Roan Planning Area federal oil and gas, and then apply this year 2021 CRVFO outside the Roan Planning Area federal oil and gas fraction to the total U.S. energy consumption GHG CO_2 emissions that have been estimated for AEO. The following presents the results of using this methodology for projected end-use energy consumption year 2021 GHG CO_2 emissions for CRVFO outside the Roan Planning Area federal oil and gas:

- High Scenario: approximately 6.5 (million metric tons) for natural gas and approximately 0.2 (million metric tons) for oil / petroleum liquids consumption.
- Medium Scenario: it would be the same as for CARMMS high scenario.
- Low Scenario: approximately 4.4 (million metric tons) for natural gas and approximately 0.1 (million metric tons) for oil / petroleum liquids consumption.

4.2.2.3 CRVFO Federal oil and gas Outside the Roan Planning Area CARMMS Modeling Results

In order to estimate the impact associated with new projected oil and gas development in various BLM Colorado planning areas / FOs, the new Federal oil and gas emissions from each planning area / FO were modeled using a source apportionment technique. By using source apportionment tools, the incremental impacts to regional ozone and AQRVs from Federal oil and gas development in each of the BLM Planning Areas are tracked and accounted to better understand the significance of such development on impacted resources and populations.

Table 4.2-5 provides a summary of O_3 and $PM_{2.5}$ impacts for the projected new CRVFO outside the Roan Planning Area federal oil and gas emissions associated with the three modeling scenarios (high, medium and low). **Table 4.2-6** shows the visibility and nitrogen deposition impacts for the projected CRVFO outside the Roan Planning Area federal oil and gas emissions associated with the three CARMMS modeling scenarios. These impacts show the relative contribution to full cumulative impacts (impacts due to all "world-wide" emissions sources) for new (i.e., post-year 2011) projected year 2021 CRVFO outside the Roan Planning Area oil and gas emissions associated with each modeling scenario.

Table 4.2-5 CARMMS – 2021 Maximum CRVFO (Outside Roan) New Federal Oil and Gas Contributions to Modeled Ozone and $PM_{2.5}$ Impacts at any Class I or Sensitive Class II Area

Source Group[1] - Modeling Scenario	Maximum Contribution to 4th High Daily 8-hour Ozone (ppb)[2]	Maximum Contribution to 4th High Daily 8-hour Ozone Modeled Exceedance (ppb)[2]	Maximum Contribution to 8th High 24-hour Average $PM_{2.5}$ ($\mu g/m^3$)	Maximum Contribution to Annual Average $PM_{2.5}$ ($\mu g/m^3$)
CRVFO (Outside Roan) High Scenario	2.6	0.18	0.4	0.3
CRVFO (Outside Roan) Medium Scenario -	2.3	0.15	0.3	0.2
CRVFO (Outside Roan) Low Scenario	1.5	0.14	0.2	0.2

[1] Maximum modeled concentrations corresponding to any Class I or sensitive Class II area when referring to AQRV impacts or the concentrations within any grid cell (Class I or Class II) when referring to ozone impacts.

[2] Overall maximum ozone contributions (first column of numeric values) are determined for all levels of cumulative modeled ozone values; while the maximum contributions to modeled ozone Standard exceedances (second column of numeric values) only considers contributions for cumulative ozone concentrations above the former 75 ppb 8-hour ozone standard (subset of all cumulative modeled ozone values).

Source: CARMMS 2015.

Table 4.2-5 CARMMS – 2021 Maximum CRVFO (Outside Roan) New Federal Oil and Gas Contributions to Modeled Visibility and Nitrogen Deposition Impacts

Source Group - Modeling Scenario	Number of Annual Days Above 0.5 dv Change	Class I Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr)	Class II Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr)
CRVFO (Outside Roan) – High Scenario -	0	0.0198 (Flat Tops)	0.0118 (Holy Cross)
CRVFO (Outside Roan) – Medium Scenario -	0	0.0156 (Flat Tops)	0.0097 (Holy Cross
CRVFO (Outside Roan) – Low Scenario -	0	0.0122 (Flat Tops)	0.0072 (Holy Cross)

Source: CARMMS 2015.

Overall, **Table 4.2-5** shows that the maximum contributions to the fourth highest daily maximum 8-hour ozone concentrations are minimal with respect to the 70 ppb eight-hour ozone standard, and that the maximum contributions to the eighth highest maximum 24-hour $PM_{2.5}$ concentration also are minimal with respect to the 35 µg/m^3 24-hour $PM_{2.5}$ standard. For all the CARMMS scenarios, **Table 4.2-6** shows there are no days with a significant (approximately 0.5 dv) visibility change impact at any Class I or sensitive Class II area from the projected new CRVFO outside the Roan Planning Area year 2021 federal oil and gas emissions for any scenario. The maximum modeled annual nitrogen deposition contributions for each scenario is minimal with respect to the cumulative critical nitrogen deposition load of 2.3 kg/ha-yr value. CRVFO source apportionment impacts for sulfur deposition are not shown because of minimal sulfur emissions associated with projected CRVFO federal oil and gas development.

Table 4.2-7 lists selected sensitive areas (areas with highest modeled impacts) where the CRVFO high, medium, and low development scenarios contribute to nitrogen deposition. **Table 4.2-8** lists the change in the acid neutralizing capacity (ANC) in sensitive lakes due to the CRVFO outside the Roan Planning Area high, medium and low development scenarios, respectively. The changes in ANC specific to the CRVFO outside the Roan Planning Area for all scenarios are below the U.S. Forest Service ANC Level of Acceptable Change (LAC) thresholds.

Table 4.2-6 CARMMS – 2021 CRVFO (Outside Roan) New Federal Oil and Gas Nitrogen Deposition Contributions to Class I and Sensitive Class II Areas

Class I / Sensitive Class II Area	Total Nitrogen Deposition Contribution[1] (kg-N/ha-yr)		
	High Scenario	Medium Scenario	Low Scenario
Black Canyon of the Gunnison	0.0038	0.0032	0.0023
Colorado National Monument	0.0050	0.0042	0.0032
Eagles Nest Wilderness	0.0121	0.0100	0.0073
Flat Tops Wilderness	0.0198	0.0156	0.0122
Maroon Bells – Snowmass Wilderness	0.0126	0.0105	0.0077

[1] Maximum nitrogen deposition for all Class I / Class II area grid cells.

Source: CARMMS 2015.

Table 4.2-7 CARMMS – 2021 CRVFO (Outside Roan) New Federal Oil and Gas Lake Impacts

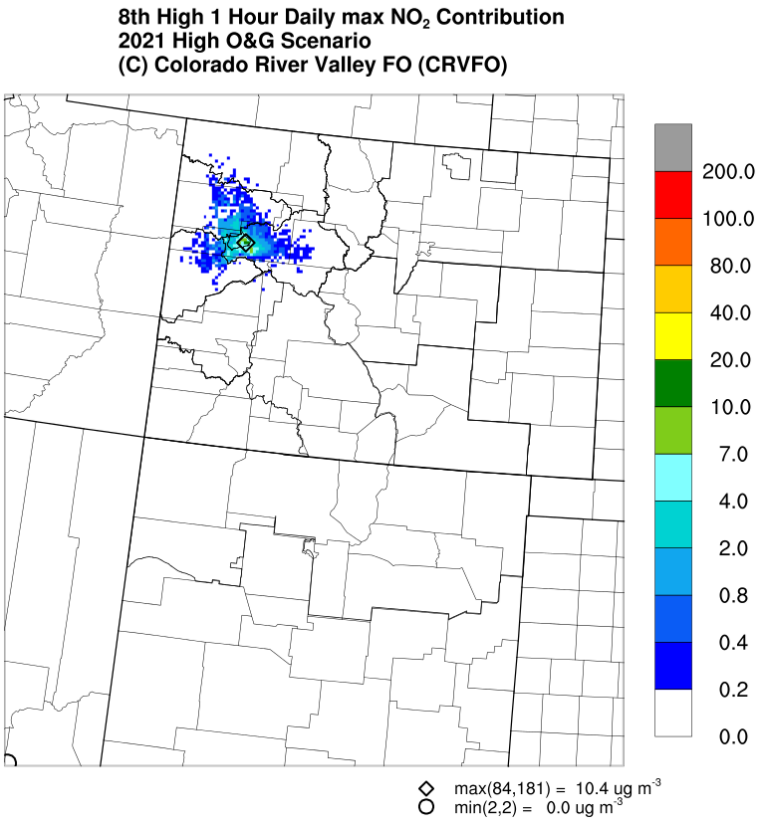
Sensitive Lake / Wilderness Area	Delta ANC (μeq/L) or Delta ANC Percent Change (%) [1]	USFS LAC Threshold
High Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.1169 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0742 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0684 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.39 %	<10%
White Dome Lake / Weminuche	0.0087 μeq/L	<1 (μeq/L)
Medium Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.0921 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0607 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0562 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.31 %	<10%
White Dome Lake / Weminuche	0.0071 μeq/L	<1 (μeq/L)
Low Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.0716 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0448 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0409 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.24 %	<10%
White Dome Lake / Weminuche	0.0052 μeq/L	<1 (μeq/L)

[1] USDA Forest Service methodology reports Delta ANC calculation as positive quantities; however they reflect a decrease in lake ANC

Source: CARMMS 2015

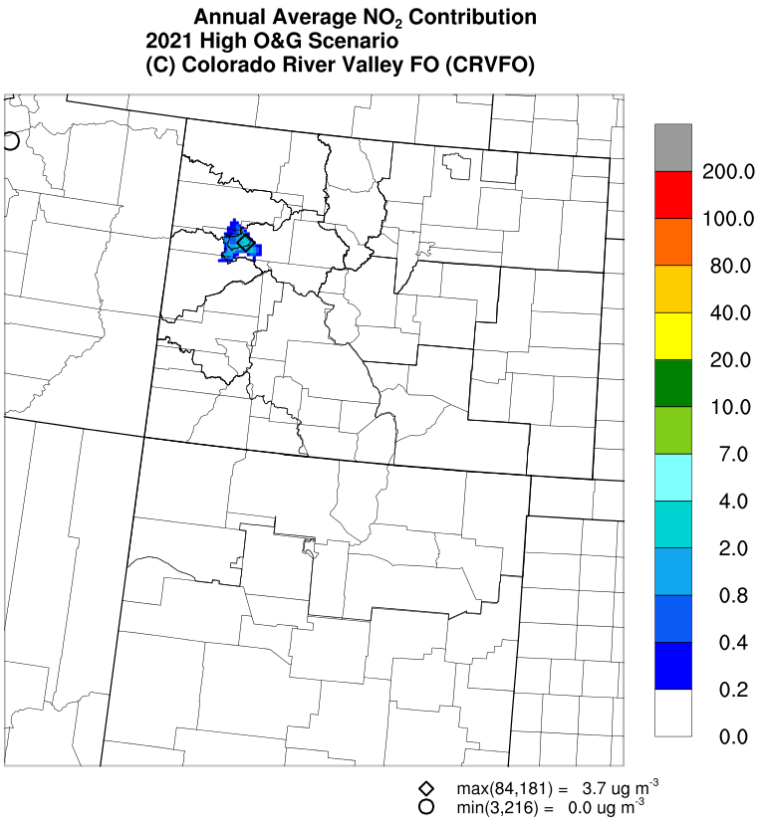
The information above shows that the predicted air quality impacts associated with the CARMMS future oil and gas development scenarios that bound the anticipated development for the CRVFO outside the Roan Planning Area are minimal, and it is reasonable to conclude that any future oil and gas development projects in the Planning Area would have lower contributions to the overall cumulative air quality since these projects would be a subset of entire CRVFO (outside RPPA) projected oil and gas development.

Figures 4.2-2 through **4.2-7** show the CRVFO outside the Roan Planning Area contribution to ambient NO_2 for the eighth highest 1-hour daily maximum period and annual average period for the high, medium, and low development scenarios. **Figures 4.2-8** through **4.2-13** show the CRVFO outside the Roan Planning Area contribution to ambient $PM_{2.5}$ for the 8th highest daily average $PM_{2.5}$ and annual average $PM_{2.5}$ periods for the high, medium and low development scenarios. **Figures 4.2-14** through **4.2-16** show the CRVFO outside the Roan Planning Area contributions to ambient ozone for the fourth highest 8-hour average daily maximum concentrations for the high, medium, and low development scenarios. The maximum concentration contribution values for the CRVFO outside the Roan Planning Area are shown in the bottom right corner of the plots.



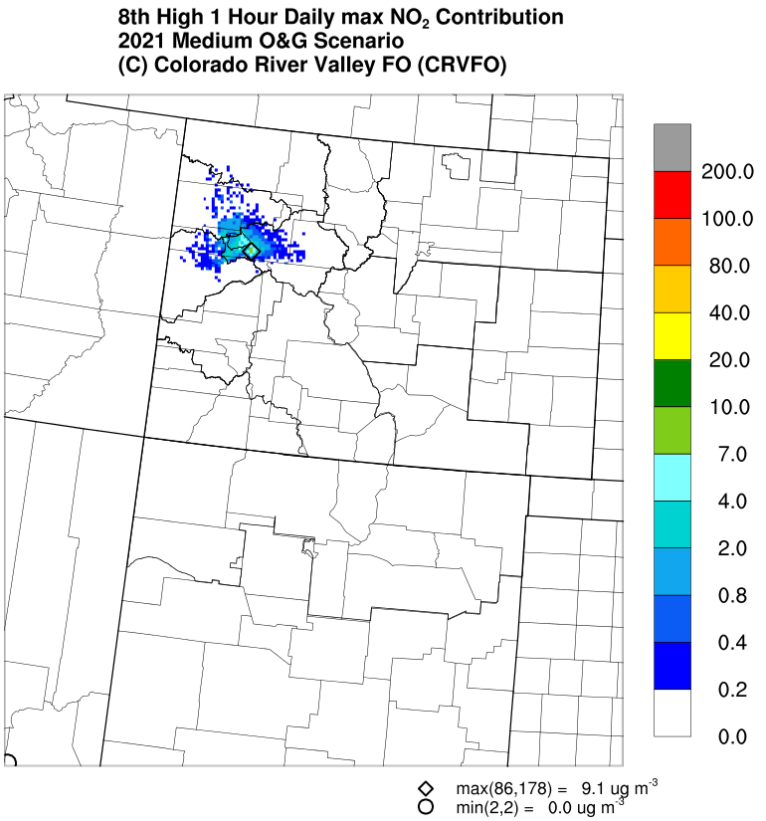
Source: CARMMS 2015.

Figure 4.2-2 CRVFO (Outside Roan) Contribution to the 8th Highest 1-hour Daily Maximum NO_2 Concentration for the 2021 High Scenario



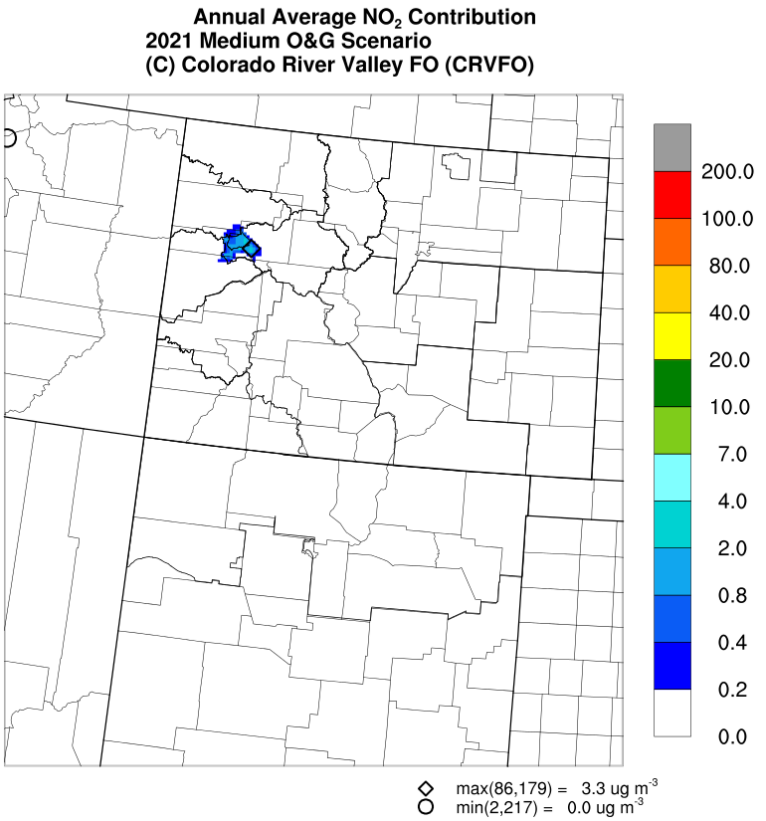
Source: CARMMS 2015.

Figure 4.2-3 CRVFO (Outside Roan) Contribution to The Annual Average NO_2 Concentration for the 2021 High Scenario



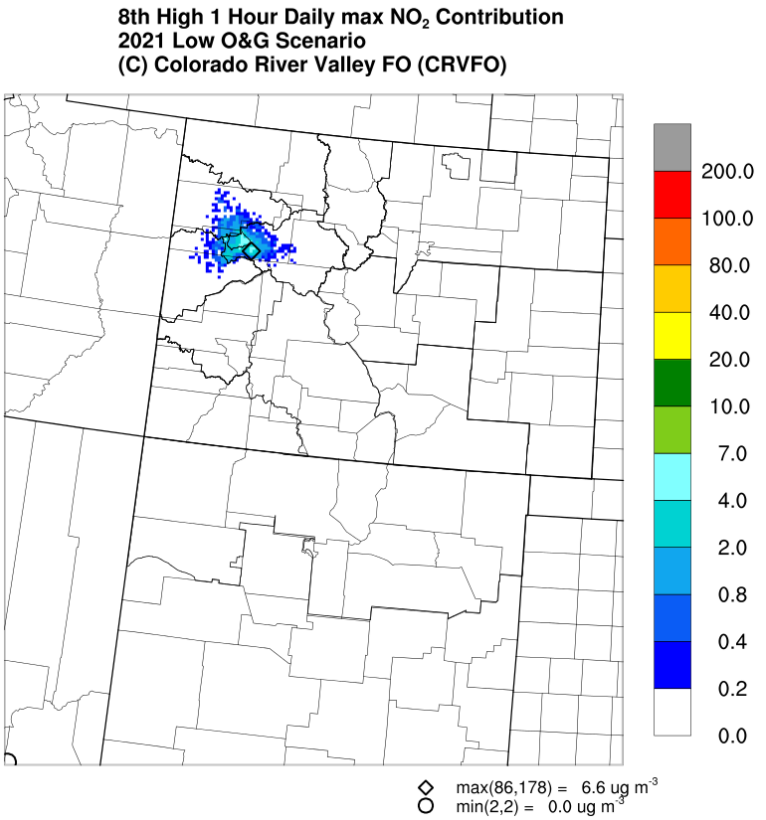
Source: CARMMS 2015.

Figure 4.2-4 CRVFO (Outside Roan) Contribution to the 8th Highest 1-Hour Daily Maximum NO_2 Concentration for the 2021 Medium Scenario



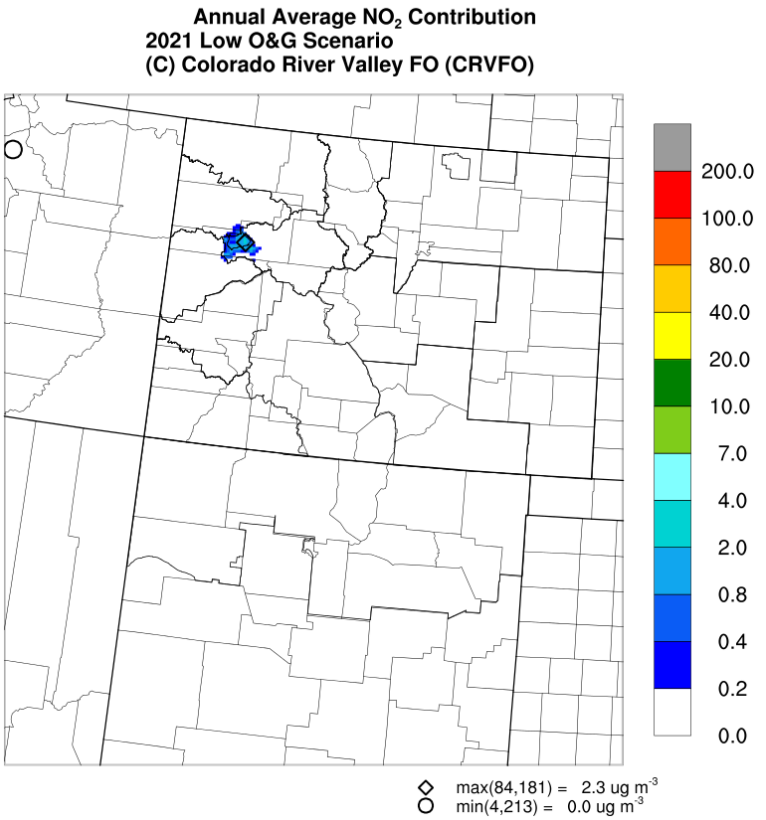
Source: CARMMS 2015.

Figure 4.2-5 CRVFO (Outside Roan) Contribution to the Annual Average NO_2 Concentration for the 2021 Medium Scenario



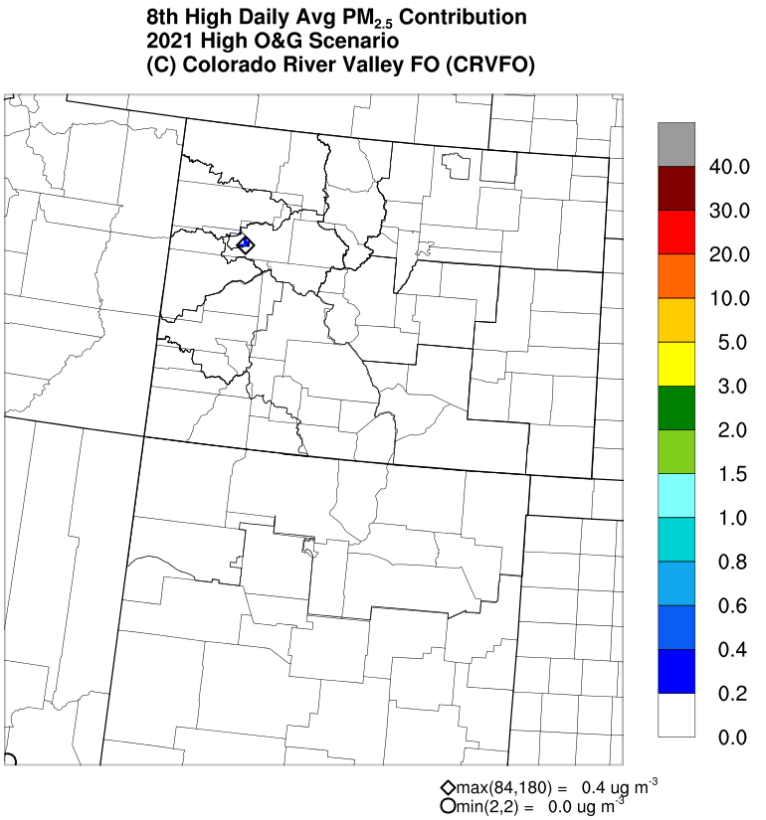
Source: CARMMS 2015.

Figure 4.2-6 CRVFO (Outside Roan) Contribution to the 8th Highest 1-Hour Daily Maximum NO_2 Concentration for the 2021 Low Scenario



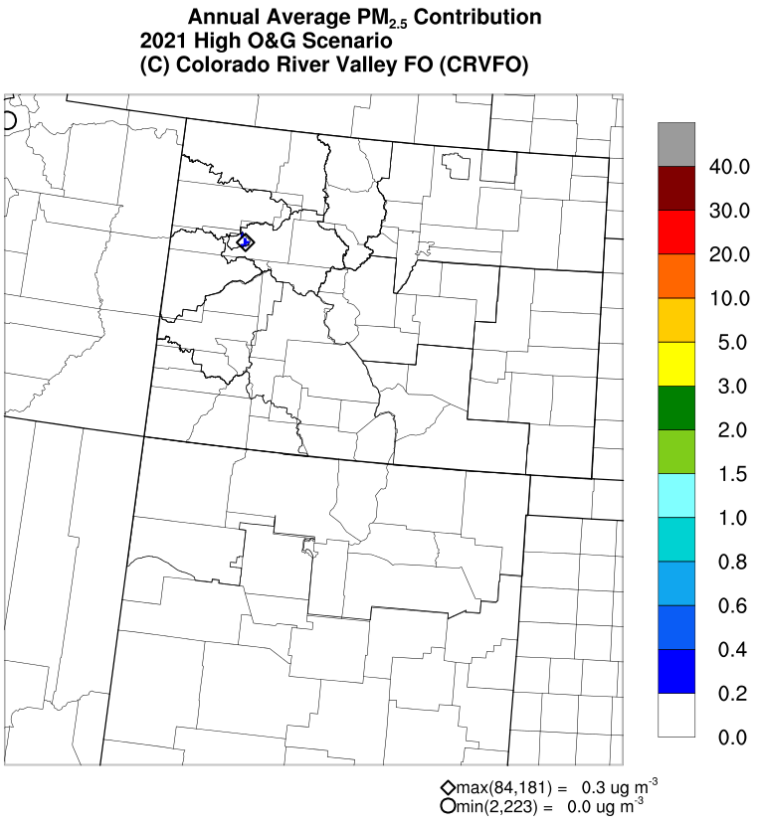
Source: CARMMS 2015.

Figure 4.2-7 CRVFO (Outside Roan) Contribution to the Annual Average NO_2 Concentration for the 2021 Low Scenario



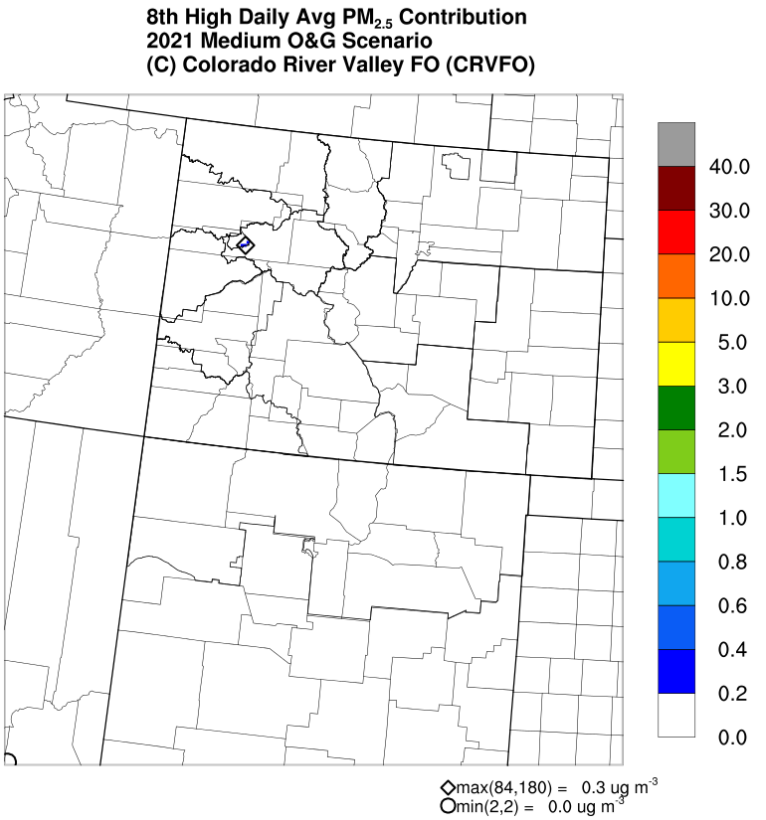
Source: CARMMS 2015.

Figure 4.2-8 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 High Scenario



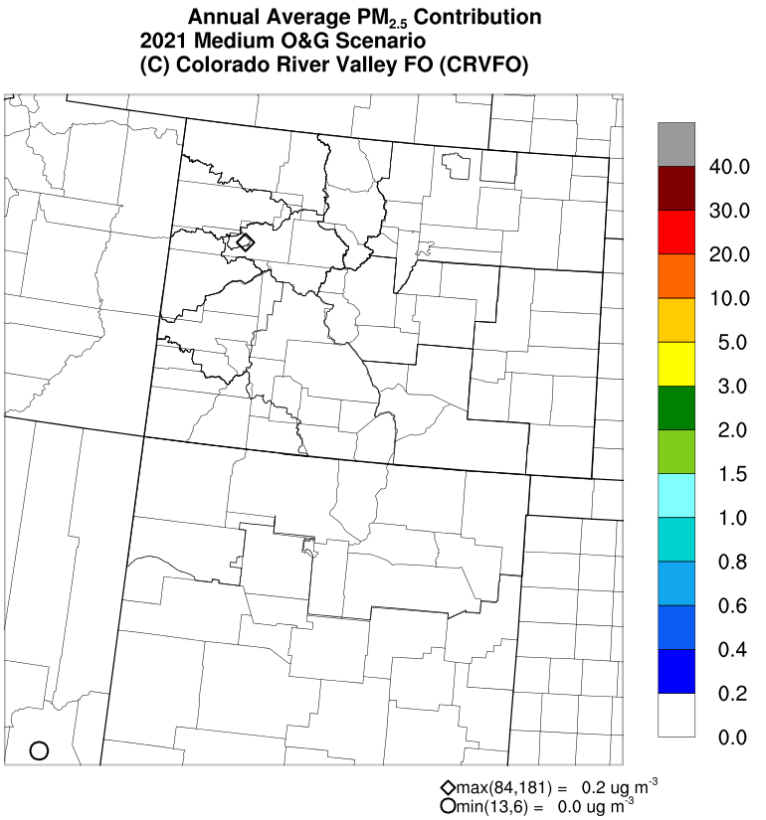
Source: CARMMS 2015.

Figure 4.2-9 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 High Scenario



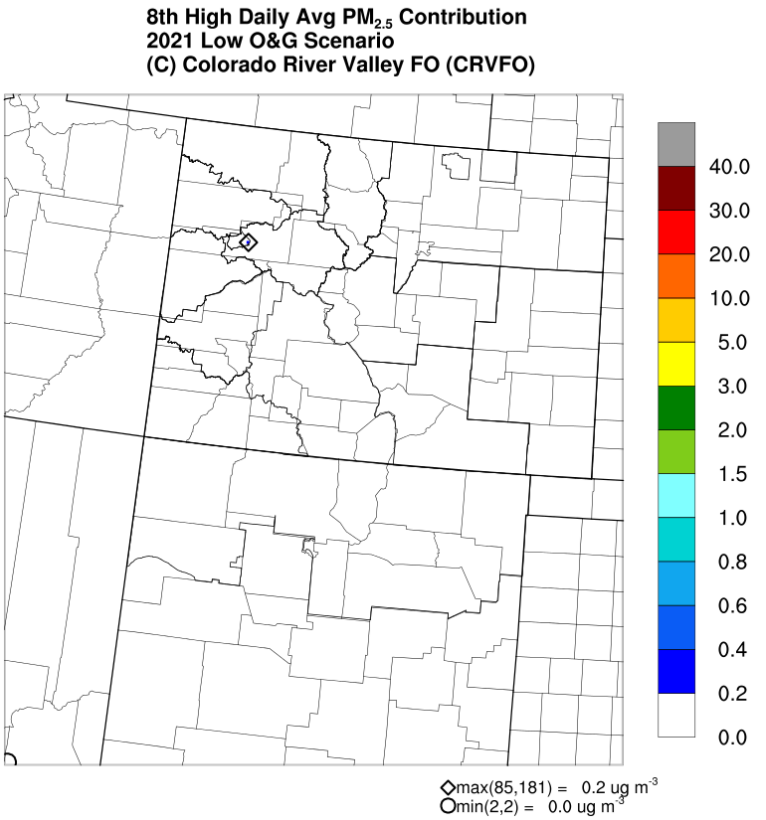
Source: CARMMS 2015.

Figure 4.2-10 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 Medium Scenario



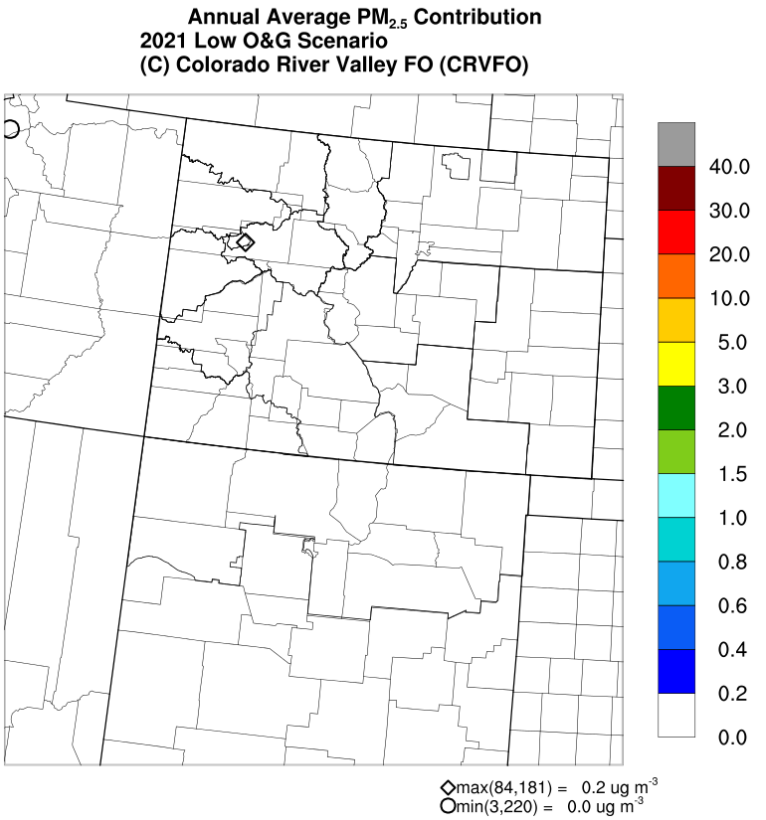
Source: CARMMS 2015.

Figure 4.2-11 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 Medium Scenario



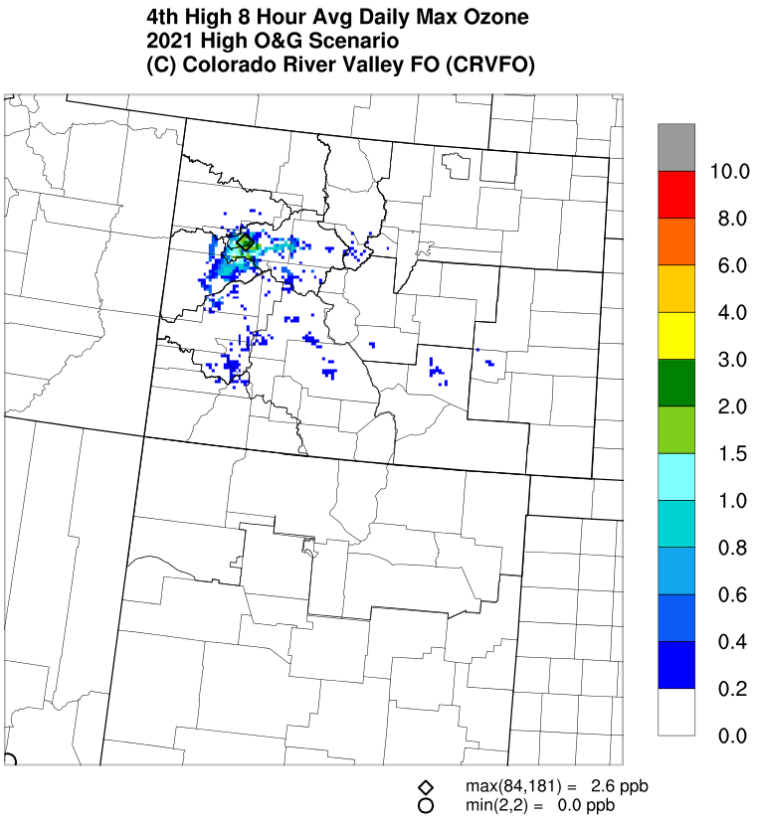
Source: CARMMS 2015.

Figure 4.2-12 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 Low Scenario



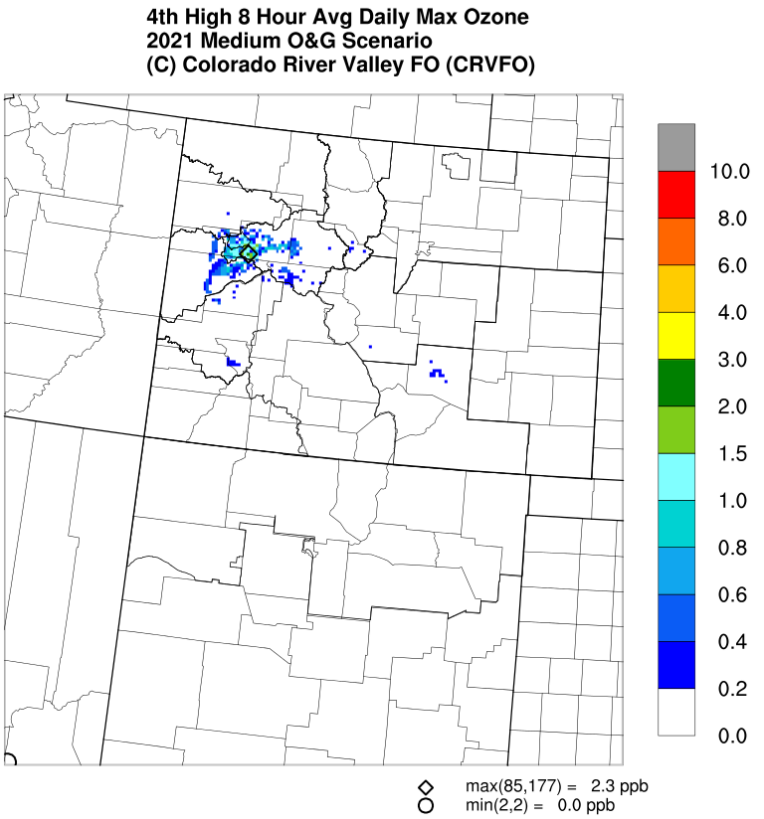
Source: CARMMS 2015.

Figure 4.2-13 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 Low Scenario



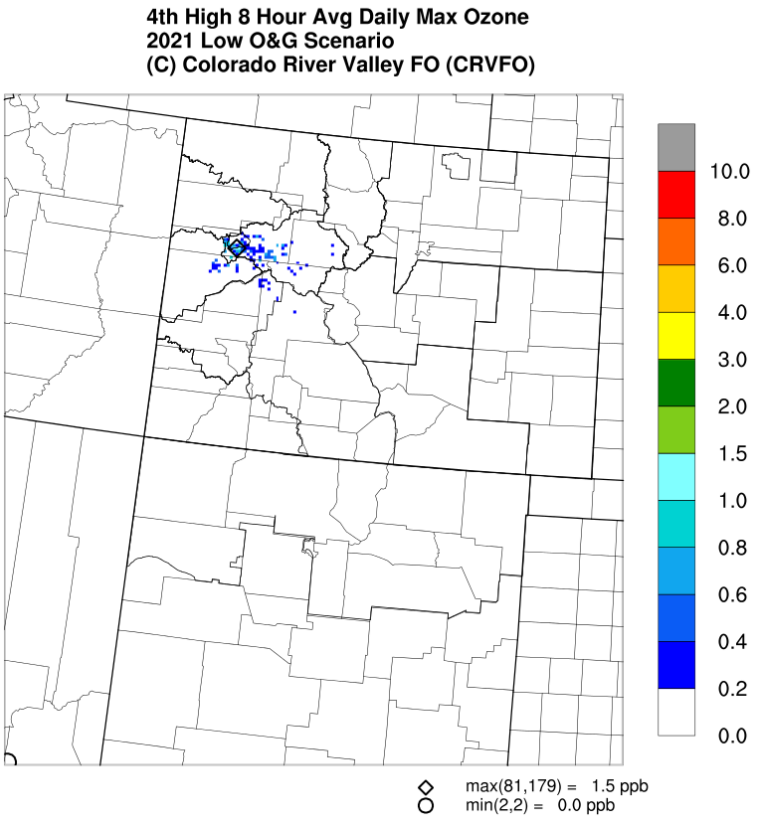
Source: CARMMS 2015.

Figure 4.2-14 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 High Scenario



Source: CARMMS 2015.

Figure 4.2-15 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 Medium Scenario



Source: CARMMS 2015.

Figure 4.2-16 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 Low Scenario

4.2.2.4 Summary of CARMMS CRVFO Outside the Roan Planning Area Specific Modeling Results

As described earlier, air pollutant emissions associated with the CARMMS high, medium, and low emissions scenarios are expected to approximate, but not equal potential air pollutant emissions that could occur from future oil and gas developed under the alternatives. In general, new projected federal oil and gas emissions from Alternatives 1 to 4 are expected to be slightly above the CARMMS low development scenario emissions representing CRVFO (outside RPPA) for the source group specific / apportionment analysis. Emissions from Alternative 4 are expected to be the closest to the low development scenario because of the reduced level of oil and gas development as a result of leases that would be cancelled to match the USFS draft decision. Future projected emissions from Alternatives 1, 2, and 3 are expected to be above the low scenario but below the high scenario as the process for management of exploration, development, and reclamation would continue under those leases. As noted above, the potential emissions associated with new oil and gas development for Alternatives1, 2, 3, and 4 would be bound by the oil and gas development rates represented in the CARMMS high and low scenarios. Alternative 5 it is expected to see the lowest level of emissions as all previously leases would be cancelled and all producing wells would have to be plugged and abandoned under this alternative. As previously described, the fraction of the total emissions modeled for the CRVFO outside the Roan Planning Area source group that are co-located with WRNF surface is approximately 11.35 percent. Based on this, it is reasonable to assume that a similar fraction of the CRVFO outside

the Roan Planning Area source group modeled impact contributions would be associated with new projected oil and gas development on WRNF surface (or underlying minerals) for CARMMS.

CARMMS modeling for the low, medium, and high emission scenarios for the CRVFO outside the Roan Planning Area show that there are no expected days that the projected new ear 2021 federal oil and gas emissions for any scenario would have a noticeable visibility change impact (approximately 0.5 dv) at any Class I or sensitive Class II area. The maximum modeled annual nitrogen deposition contributions for each scenario represent only a small fraction of the entire cumulative critical nitrogen deposition load of 2.3 kg/ha-yr value. The critical deposition load is a cumulative metric (annual deposition load threshold for all emissions sources) and is used for this assessment since future projected CRVFO outside the Roan Planning Area oil and gas development would be made up of multiple “projects” and a project-level deposition load threshold such as the Deposition Analysis Threshold (DAT) is not appropriate for comparing potential cumulative deposition. The maximum contributions to the fourth highest daily maximum 8-hour ozone concentrations are minimal with respect to the 70 ppb 8-hour ozone standard, and the maximum contributions to modeled 8-hour ozone exceedances (modeled values above former NAAQS that are primarily predicted to occur in urban areas for Colorado [see next cumulative impacts section for more information regarding cumulative predicted modeled exceedances]) are less than 1 ppb. The maximum contribution to the modeled eighth highest maximum 24-hour $PM_{2.5}$ concentration also is minimal with respect to the 35 µg/m^3 24-hour $PM_{2.5}$ standard and less than 1 µg/m^3. As described above, the maximum contributions to modeled exceedances used for this analysis are estimated with respect to cumulative modeled ozone 8-hour concentrations above the former ozone 8-hour Standard (75 ppb). It is reasonable to assume that CARMMS predicted RPPA future oil and gas maximum contributions above the new ozone 8-hour Standard (70 ppb) would be very similar in magnitude and maybe slightly higher than maximum ozone contributions with respect to the former ozone Standard. Regardless, the maximum RPPA contributions for grid cell cumulative concentrations above the new ozone 8-hour Standard (70 ppb) would not exceed the overall maximum contributions for the RPPA future oil and gas development (see first column of numerical values in **Table 4.2-5**). It should be noted that there is currently not an acceptable ozone contribution significance threshold that has been established for Federal Land Managers and NEPA assessments for planning-level or project-level projected future oil and gas development. The EPA’s Interstate Transport Rule one percent (of the ozone NAAQS) ozone impact significance threshold is applicable to an upwind state’s ozone contributions to an actual monitored non-attainment area exceedance of the ozone Standard in a downwind state, and is not directly applicable for projected future oil and gas development NEPA assessments and ozone impacts in current designated attainment areas.

Alternatives 1, 2, and 3 would pose the highest potential for impacts on air quality as these alternatives would allow for more oil and gas development on the leases, resulting in additional emissions during construction, drilling, completion, and production activities. New future oil and gas development under Alternative 4 would have lower air quality impacts than the Alternatives 1, 2, and 3 because it would modify or cancel the 65 leases, which would reduce the associated emissions. It is anticipated that the air quality impacts for future federal oil and gas under Alternative 5 would be the lowest of all alternatives as actions under this Alternative would plug and abandon current producing oil and wells. As previously described, current Colorado-based oil and gas development is tracking near CARMMS low oil and gas development pace, but it is reasonable to assume that new federal oil and gas emissions and impacts for the CARMMS high scenario would be more applicable for the Alternatives 1, 2, and 3 (if these leases were completely developed) and the new federal oil and gas emissions and impacts for the CARMMS low scenario would be more applicable for the Alternatives 4 and 5. As previously described, the CARMMS medium scenario assumes the same level of future oil and gas development as the CARMMS high scenario but accounts for additional emissions controls as described in Section 4.2.2.1. These additional controls would reduce the level of dust emissions for unpaved surface disturbance, NO_x emissions for development and production engines and VOC and HAPs emissions for production equipment and operations. The additional emissions controls by up to 20 percent relative to the CARMMS high scenario modeled impacts for CRVFO outside the Roan Planning Area.

The CARMMS CRVFO (outside RPPA) source apportionment results spatial plots show that the 8th high daily maximum 1-hour NO_2 contributions above 0.2 µg/m^3 are confined to northwest Colorado and the highest contributions (10.4 µg/m^3, 9.1 µg/m^3 and 6.6 µg/m^3 for high, medium and low scenarios, respectively) are found in western portions of CRVFO. The modeled contributions for all pollutants, rank and averaging times do not extend far outside CRVFO and adjacent field office boundaries and the spatial extent of the modeled impacts is reduced for the medium scenario and further reduced for the CARMMS low scenario. The maximum modeled CRVFO (outside RPPA) contribution to the 4th highest 8-hour average daily maximum ozone concentrations as well as for other pollutants for the CARMMS scenarios occur in the eastern portion of CRVFO (southeast portion of the RPPA) near the I-70 corridor. The geographic setting for this part of the CRVFO includes the steep dramatic face / terrain incline of the Roan Plateau and the broad bend in the valley for the I-70 corridor and Colorado River. It is apparent that the CARMMS modeling program (i.e., CAMx) captured this topography and realistically modeled the air pollutants being pooled and trapped up against the steep plateau face along the Colorado River Valley in this part of the CRVFO.

Overall, the information above shows that the predicted air quality impact contributions associated with the three CARMMS oil and gas development scenarios that encompass anticipated new federal oil and gas development in the CRVFO outside the Roan Planning Area post-year 2011 are minimal.

4.2.2.5 Cumulative CARMMS Modeling Results

Cumulative air quality impacts from the CARMMS high, medium, and low modeling scenarios for year 2021 results are presented in this section. Cumulative modeled impact changes from the base-case year 2008 to year 2021 also are discussed.

All other emissions sources (other than new Colorado-based oil and gas development) for the CARMMS year 2021 cumulative emissions inventory were modeled at the same emissions rates for the CARMMS high, medium, and low scenarios. New future Colorado federal and non-federal oil and gas was the only source category with varying development/emissions rates for the different CARMMS modeling scenarios. The number of new projected federal and non-federal oil and gas wells (i.e., oil and gas development rate) for the medium scenario was the same as for the high scenario with additional emissions controls (beyond current regulations) applied to future Colorado –based federal oil and gas. Projected federal and non-federal oil and gas future year emissions estimates for nearby states bordering Colorado (Utah, New Mexico and Wyoming) were obtained from latest studies for future oil and gas development in those states' fields and basins. As previously described, the CARMMS cumulative emissions inventory also includes non-oil and gas emission inventories encompassing biogenic (natural) emissions, electric generating units (EGUs), fires, agriculture and mobile sources; the non-oil and gas (and oil and gas outside the region) emissions estimates for CARMMS were developed by USEPA and updated for the 3SAQS projected year 2020 emissions inventory. Future year 2021 emissions inventories for Colorado based mining were developed specifically for CARMMS and were based on latest foreseeable mining projections.

Table 4.2-9 provides a full cumulative summary of visibility and nitrogen deposition impacts for all (i.e., "world-wide") emissions sources associated with the CARMMS modeling scenario for nearby Class I and sensitive Class II areas. As shown in the table, visibility and nitrogen deposition was modeled to improve from years 2008 to 2021 for all CARMMS scenarios.

In addition to the full cumulative impacts analysis, CARMMS includes "quasi"-cumulative emissions source groups that allow for analyses that focus on ozone and AQRV impact contributions of new future Colorado-wide federal and non-federal oil and gas (all combined Colorado areas). These quasi-cumulative impact contributions were determined by subtracting the contributions of new Colorado-based federal and non-federal oil and gas development. The CARMMS defines "Source Group R" as new Colorado-based federal oil and gas and mining, and "Source Group S" as combined new federal oil

and gas and mining development and new non-federal oil and gas development within the 13 Colorado BLM Planning Areas. The difference between Source Group R and S therefore is the new non-federal oil and gas component.

Table 4.2-8 CARMMS Full Cumulative Year 2021 Modeled AQRV Impacts at Select Class I / Sensitive Class II Areas

Class I / Sensitive Class II Areas	Best 20% Days Visibility Metric (dv) 2021 Improvement from 2008	Worst 20% Days Visibility Metric (dv) 2021 Improvement from 2008	Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr) 2021 High Improvement from 2008
High Development Scenario			
Black Canyon of the Gunnison	0.07	0.64	0.14
Colorado National Monument	0.09	0.68	0.57
Eagles Nest Wilderness	0.14	0.81	0.79
Flat Tops Wilderness	0.14	0.61	0.71
Maroon Bells – Snowmass Wilderness	0.16	0.77	0.80
Medium Development Scenario			
Black Canyon of the Gunnison	0.07	0.64	0.16
Colorado National Monument	0.10	0.69	0.57
Eagles Nest Wilderness	0.14	0.82	0.83
Flat Tops Wilderness	0.15	0.61	0.75
Maroon Bells – Snowmass Wilderness	0.17	0.78	0.84
Low Development Scenario			
Black Canyon of the Gunnison	0.12	0.74	0.26
Colorado National Monument	0.14	0.78	0.57
Eagles Nest Wilderness	0.16	0.85	0.98
Flat Tops Wilderness	0.20	0.68	0.96
Maroon Bells – Snowmass Wilderness	0.18	0.80	0.99

Note: Positive values mean overall improvement and deposition values are maximum for all grid cells making up the Class I area.

Source: CARMMS 2015.

The following highlights CARMMS predicted 8-hour ozone impact contributions with respect to the quasi-cumulative source groups:

- For the monitored area analysis, removing the contributions due to new Colorado –based federal oil and gas and mining (Source Group R) reduces the 2021 DVF at Rocky Flats North by 0.9 ppb to 78.6 ppb for the high scenario, by 0.3 ppb to 77.8 ppb for the low and by 0.8 ppb to 78.7 ppb for the medium scenario, which are still above the ozone NAAQS. However, when emissions from new Colorado-based non-federal oil and gas are removed in addition to the

federal oil and gas development (Source Group S), projected 2021 DVFs are 74.5, 75.8 and 74.5 ppb for the high, low and medium scenarios, respectively. Removing future non-federal oil and gas (Source Group S component) results in larger overall ozone reductions for the Colorado Front Range monitors likely reflecting the large amount of current and projected non-federal oil and gas development activity in the eastern Colorado DJ Basin.

- For the UAA, the CARMMS 2021 high, medium and low scenarios ozone DVF maximum reductions without Source Group R are 6.4, 5.6 and 2.8 ppb (respectively) and occur in the Piceance Basin. Removing Source Group S results in more reductions in the 2021 DVFs, especially in Weld County in the greater Denver area. There are predicted large reductions in 2021 DVFs in the Piceance and D-J Basins (Weld County) with the largest reductions being 12.8 ppb (high scenario), 8.5 ppb (low scenario) and 12.2 ppb (medium scenario) in the Piceance Basin of northwest Colorado.

Tables 4.2-10 through **4.2-12** show CARMMS AQRV visibility and nitrogen deposition impact contributions for Source Groups R and S at Flat Tops and Maroon Bells – Snowmass Wildernesses in northwest Colorado near the CRVFO.

Table 4.2-9 CARMMS Modeled Visibility Impacts at Flat Tops and Maroon Bells – Snowmass Wilderness Areas using FLAG 2010 Methodology

Sensitive Area	Source Group	Max Δdv	Number of Day	
			>1.0	>0.5
High Development Scenario				
Flat Tops WA	Group R	1.64	8	53
	Group S	1.84	13	100
Maroon Bells – Snowmass WA	Group R	1.21	1	27
	Group S	2.00	9	84
Medium Development Scenario				
Flat Tops WA	Group R	1.60	8	46
	Group S	1.80	13	87
Maroon Bells – Snowmass WA	Group R	1.04	1	16
	Group S	1.83	7	63
Low Development Scenario				
Flat Tops WA	Group R	1.33	6	28
	Group S	1.44	7	32
Maroon Bells – Snowmass WA	Group R	0.59	0	7
	Group S	1.00	0	12

Source: CARMMS 2015

Table 4.2-11 CARMMS Modeled Full Cumulative Visibility Impacts at Flat Tops and Maroon Bells – Snowmass Wilderness Areas using MATS Tool

Sensitive Area	Visibility Metric (dv)	2008 Base[1]	2021[1]	2021 without R	2021 without S
High Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.07	8.06	7.89
	Best 20%	0.69	0.55	0.53	0.41
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.91	7.89	7.84
	Best 20%	0.69	0.53	0.51	0.49
Medium Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.07	8.06	7.89
	Best 20%	0.69	0.54	0.53	0.41
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.90	7.89	7.85
	Best 20%	0.69	0.52	0.51	0.49
Low Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.00	7.99	7.91
	Best 20%	0.69	0.49	0.49	0.42
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.88	7.87	7.85
	Best 20%	0.69	0.51	0.51	0.50

[1] Full Cumulative results for 2008 Base and 2021 High, Medium and Low Scenarios.

Source: CARMMS 2015.

Table 4.2-12 CARMMS Modeled Nitrogen Deposition

Sensitive Area	Source Group	Annual N Deposition (kg N/ ha-yr)		
		2021 High	2021 Medium	2021 Low
Flat Tops WA	Group S	0.37	0.32	0.13
	Group R	0.21	0.17	0.04
Maroon Bells – Snowmass WA	Group S	0.31	0.27	0.10
	Group R	0.16	0.13	0.03

Maximum modeled source group contribution values at Class I area.

Source: CARMMS 2015

The following highlights CARMMS predicted AQRV impact contributions with respect to the quasi-cumulative source groups R and S:

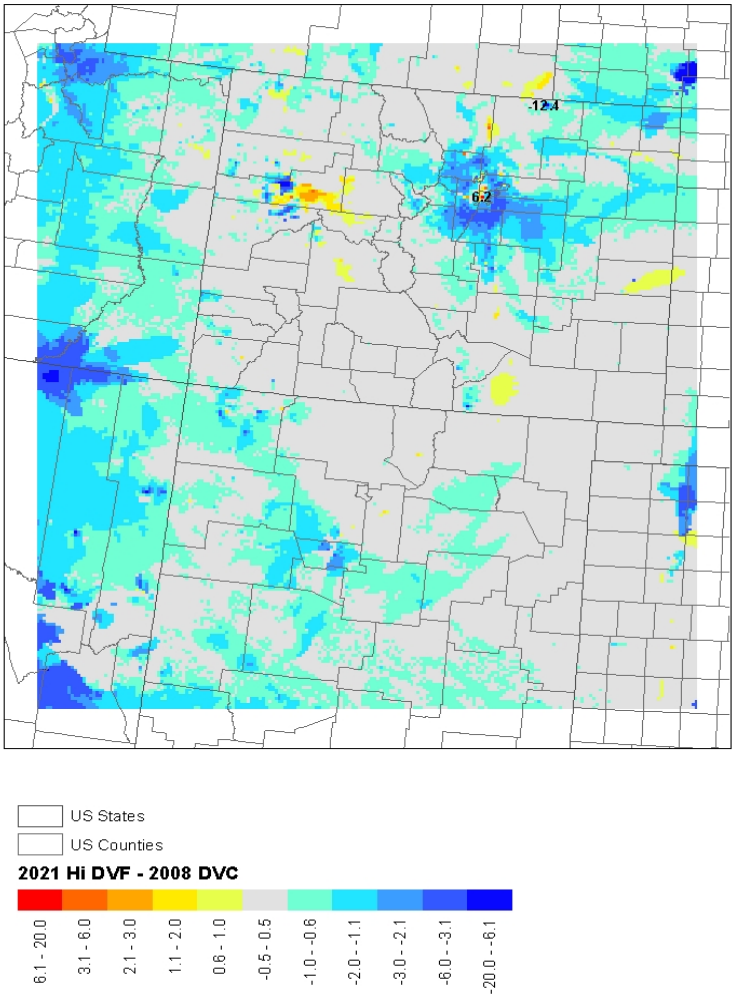
- For visibility impacts at Flat Tops Wilderness using FLAG 2010 Methodology (FLAG 2010), the number of days with significant visibility impacts for CARMMS high and medium scenarios almost double when adding in the new non-federal oil and gas component associated with Source Group S. The number of days with significant impacts and largest delta-dv are almost the same for the two source groups for the CARMMS low scenario.

- For visibility impacts at Flat Tops Wilderness using MATS cumulative analysis tool, removing the new non-federal oil and gas component associated with Source Group S gives a larger reduction response to the overall visibility metric compared to the federal oil and gas component (Source Group R) for all three CARMMS scenarios.
- For visibility impacts at Maroon Bells - Snowmass Wilderness using FLAG 2010 Methodology, it appears that the non-federal component Source Group S has a higher impact on visibility changes than Source Group R (federal only).
- For visibility impacts at Maroon Bells - Snowmass Wilderness using MATS cumulative analysis tool, removing the new non-federal oil and gas component associated with Source Group S gives an almost equal reduction response to the overall visibility metric compared to the federal oil and gas component (Source Group R) for all three CARMMS scenarios.
- For maximum nitrogen deposition at Flat Tops WA, the new federal oil and gas component is most of the annual nitrogen deposition for Source Group S (includes new federal and non-federal) when comparing Source Groups R and S. The additional emissions controls associated with CARMMS medium scenario reduce nitrogen deposition by about 20 percent of CARMMS high scenario levels at Flat Tops WA.
- For maximum nitrogen deposition at Maroon Bells - Snowmass WA, the new federal oil and gas component appears to be about half of the annual nitrogen deposition for Source Group S (includes new federal and non-federal) when comparing Source Groups R and S. The additional emissions controls associated with CARMMS medium scenario reduce nitrogen deposition by about 10 percent of CARMMS high scenario levels at Maroon Bells – Snowmass WA.

For full cumulative ozone design value projections at regional ozone monitoring sites for the CARMMS 2021 high development scenario, the maximum current year 8-hour DVC (baseline concentration centered on year 2008) is 82.0 ppb at the Rocky Flats North (CO_Jefferson_006) monitor, which is projected to be reduced to 79.5, 79.5 and 78.1 ppb for the CARMMS 2021 high, medium and low development scenarios, respectively. There are eight monitoring sites in the CARMMS 4-km domain with current year 2008 DVCs above the former ozone NAAQS (75 ppb) and CARMMS predictions show that there would be 17 monitoring sites with DVF for future year 2021 ozone concentration above the new ozone Standard (70 ppb) for the CARMMS 2021 High and Medium scenarios, and 16 monitoring sites with DVF above new ozone Standard for CARMMS Low scenario (note that there would be approximately 19 monitoring sites with year 2008 DVCs above the new ozone Standard [75ppb] and CARMMS predicts that there would only be two sites with year 2021 ozone concentration DVFs above the former ozone Standard [75 ppb] for all CARMMS scenarios). Even though there has recently been a new ozone Standard established since base year 2008, the cumulative ozone concentrations are predicted to decrease at air quality monitor locations throughout the Region. The CARMMS predicted average reductions in cumulative ozone concentrations (from base year 2008 to future year 2021) for all 37 Regional monitors in the CARMMS ozone analysis are 1.6 ppb, 1.6 ppb and 2.1 ppb for the CARMMS High, Medium and Low Scenarios, respectively. CARMMS predicts slight increases (< 1ppb) at only two Larimer County, Colorado based monitor locations for the CARMMS High and Medium Scenarios (no predicted increases at Regional monitors for the CARMMS Low Scenario).

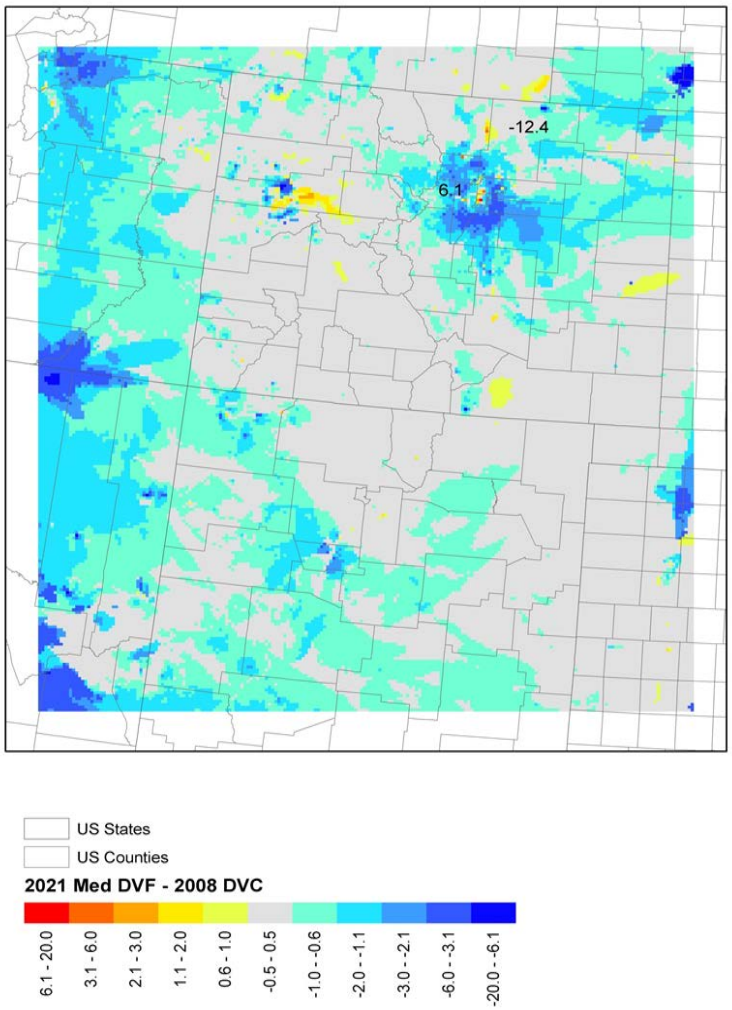
For the ozone design value projection unmonitored area analysis (UAA [analysis for areas with no monitors]), the geographical extent (i.e., size) of the overall area of ozone design value exceedances from 2008 to 2021 is reduced for all the CARMMS modeling scenarios with respect to the former ozone Standard of 75 ppb (former Standard used for UAA comparison since it is applicable for year 2008 ozone exceedance geographical extent). **Figures 4.2-17** through **4.2-19** show predicted ozone design value differences (2021 minus 2008) for the CARMMS high, medium, and low development scenarios, respectively. Also **Figures 4.2-20** through **4.2-22** show the 2021 modeled ozone design values for all scenarios. **Figure 4.2-17** shows CARMMS-predicted ozone reductions in the Denver and Salt Lake City areas for the high development modeling scenario. However, the CARMMS model also predicts areas in

which the future design values increase by approximately 5 ppb in portions of Garfield County, Colorado, near the WRNF leasing areas. The plots for the CARMMS high and medium scenarios show areas with predicted design future ozone concentration (DVF) increases in portions of Garfield County, Colorado near the CRVFO outside the Roan Planning Area. The CARMMS cumulative modeled impacts account for overall emissions increases and decreases from year 2008 to 2021 for all emissions source categories and a net increase in overall federal and non-federal oil and gas development / production in the region. Similar to the CRVFO (outside RPPA) source group / apportionment impacts, the portion of Garfield County where CARMMS cumulative output shows ozone increases is located along the I-70 corridor and Colorado River where substantial oil and gas development exists and new federal and non-federal development is projected to occur For the comparative analysis, it should be noted that the base case (2008) ozone design value (DVC) plot is presented in **Figure 3.2-8** in Chapter 3.0.



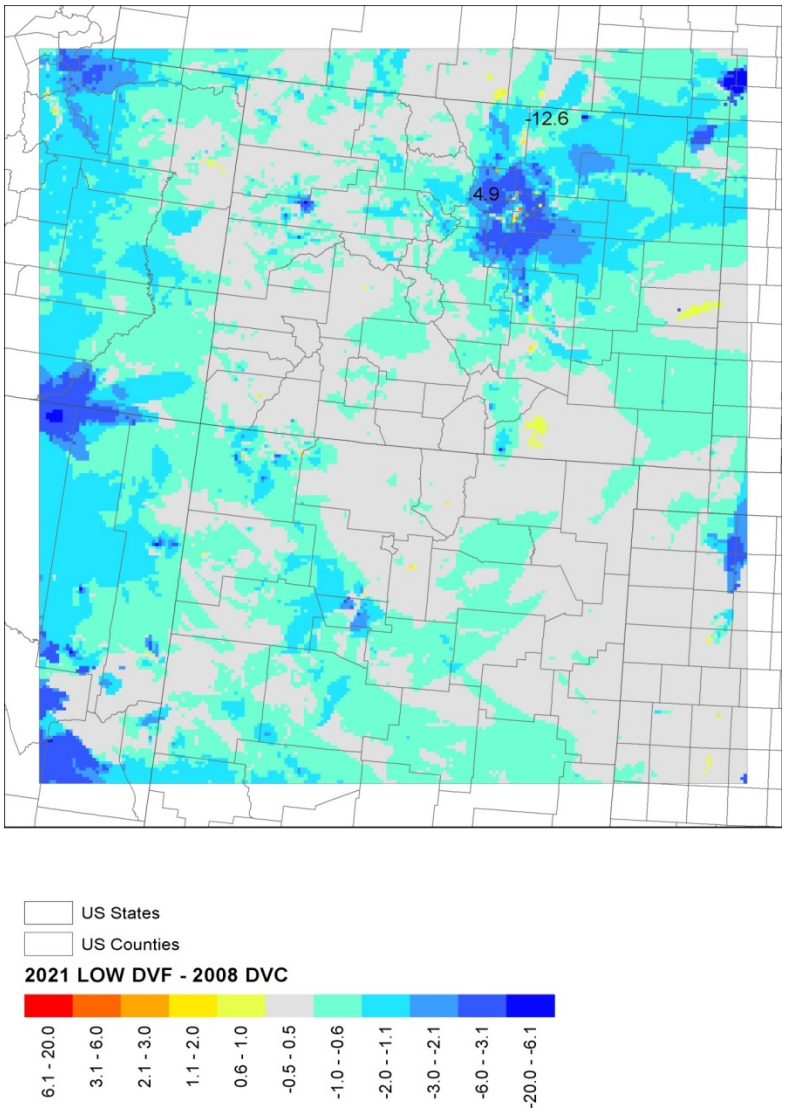
Source: CARMMS 2015.

Figure 4.2-17 Ozone Design Values Differences between the 2021 High Development Scenario and the 2008 Base Case



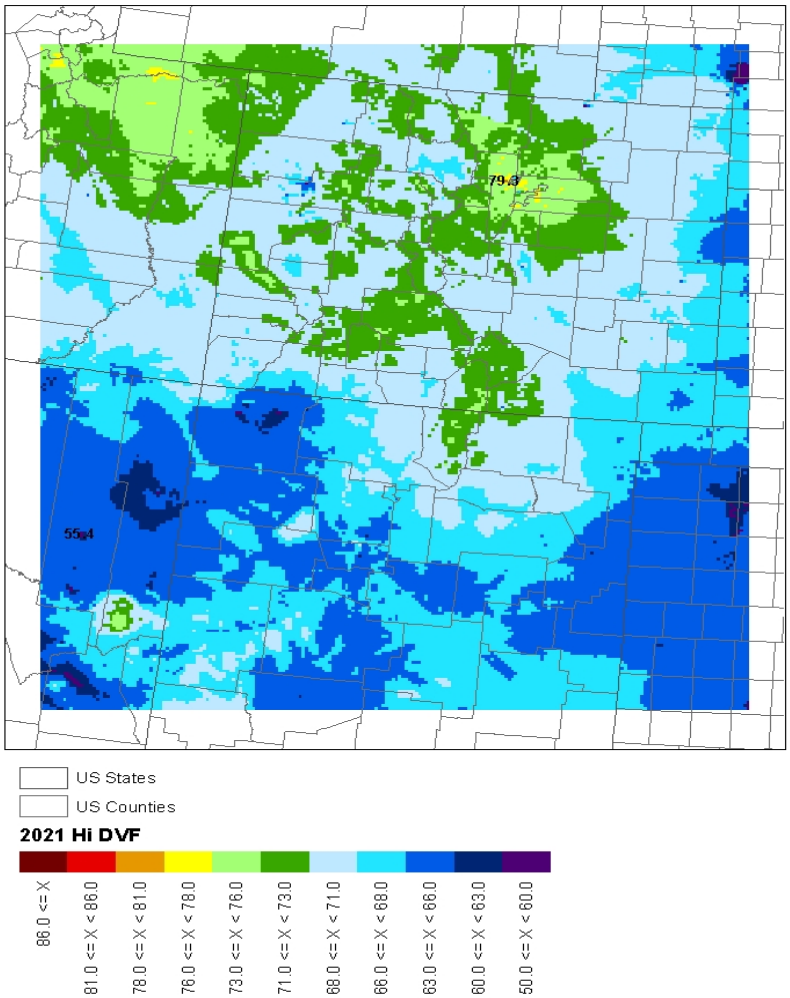
Source: CARMMS 2015.

Figure 4.2-18 Ozone Design Values Differences between the 2021 Medium Development Scenario and the 2008 Base Case



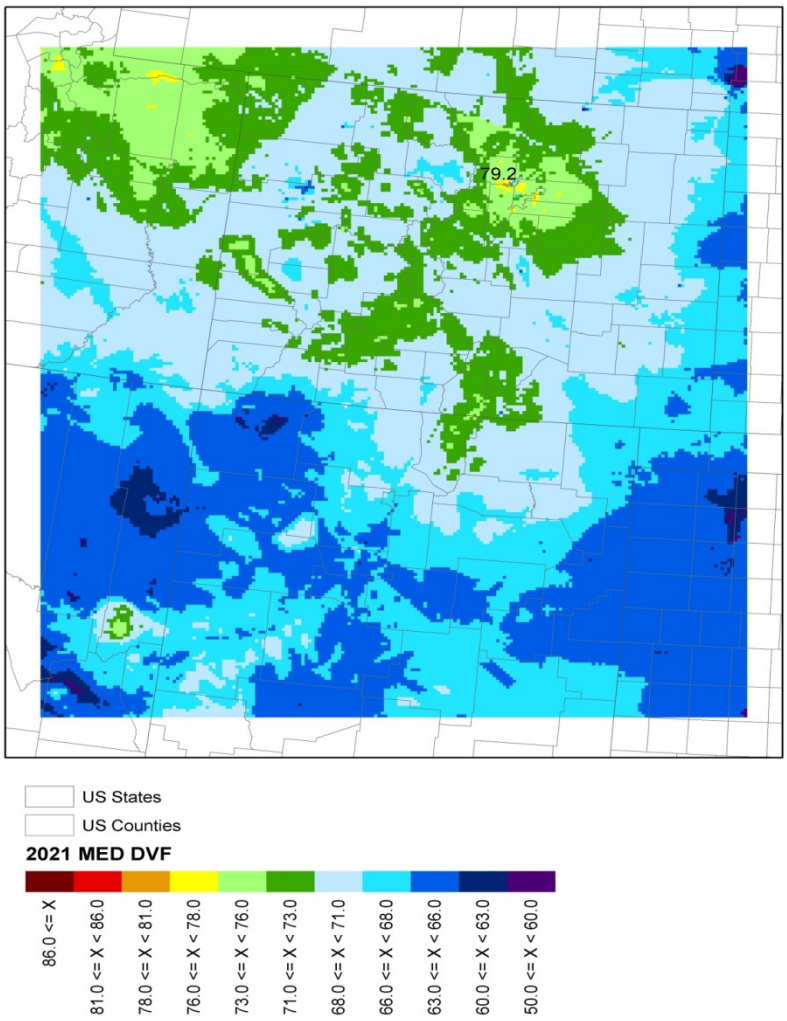
Source: CARMMS 2015.

Figure 4.2-19 Ozone Design Values Differences between the 2021 Low Development Scenario and the 2008 Base Case



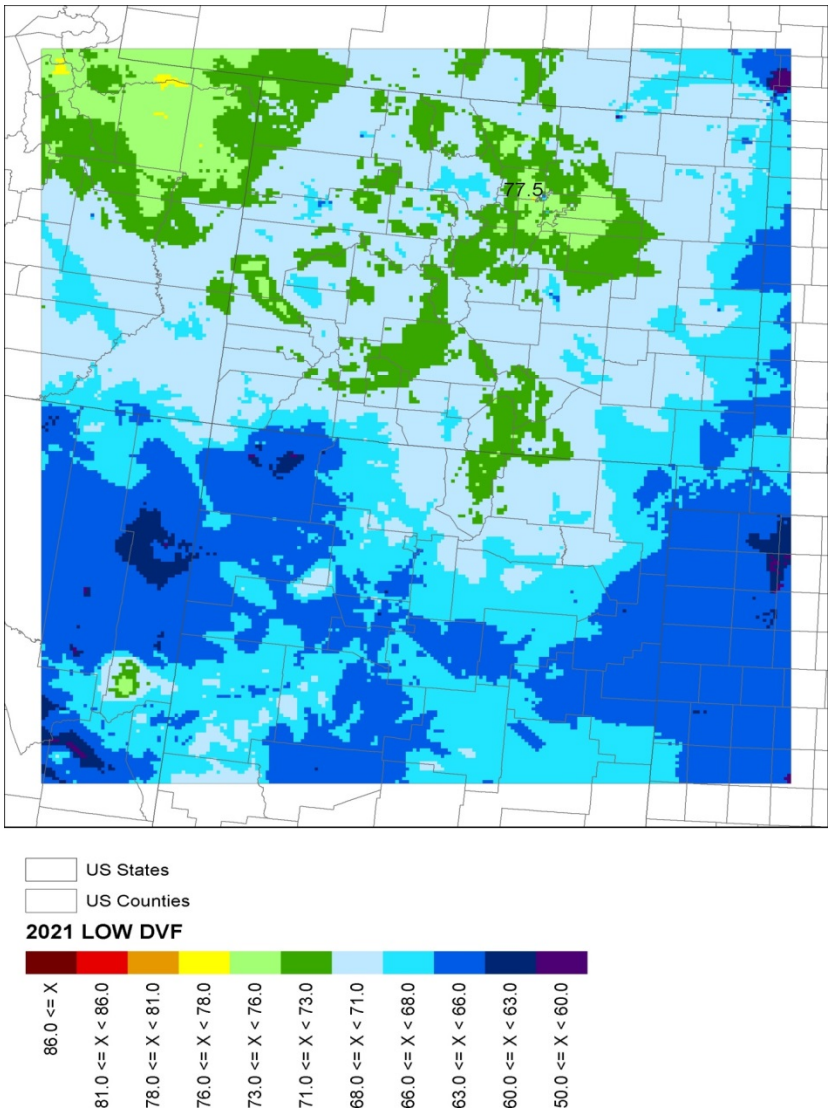
Source: CARMMS 2015.

Figure 4.2-20 CARMMS Modeled 2021 Ozone Design Value for the High Development Scenario



Source: CARMMS 2015.

Figure 4.2-21 CARMMS Modeled 2021 Ozone Design Value for the Medium Development Scenario

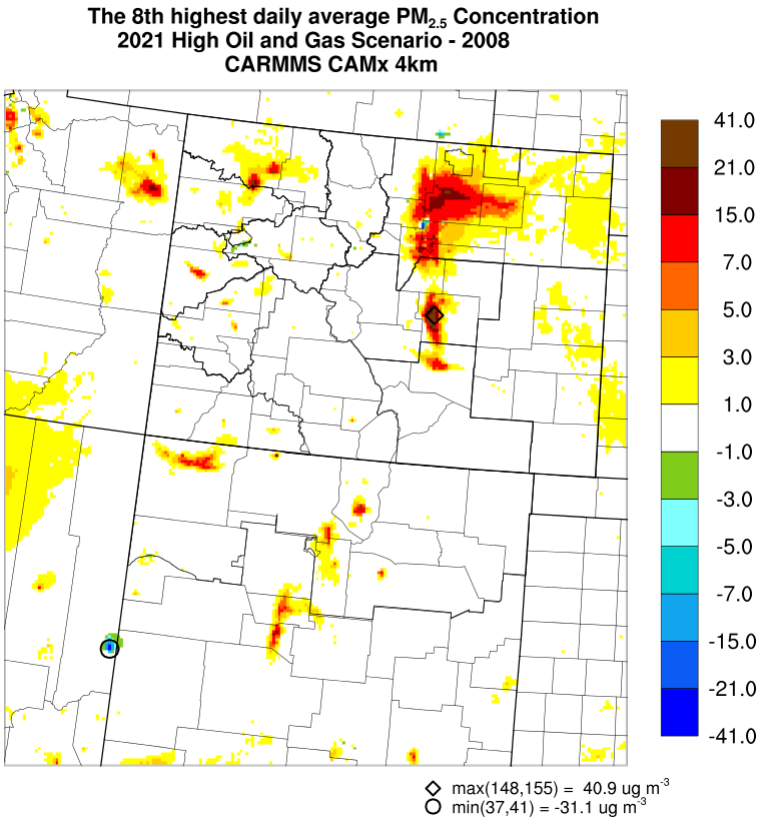


Source: CARMMS 2015.

Figure 4.2-22 CARMMS Modeled 2021 Ozone Design Value for the Low Development Scenario

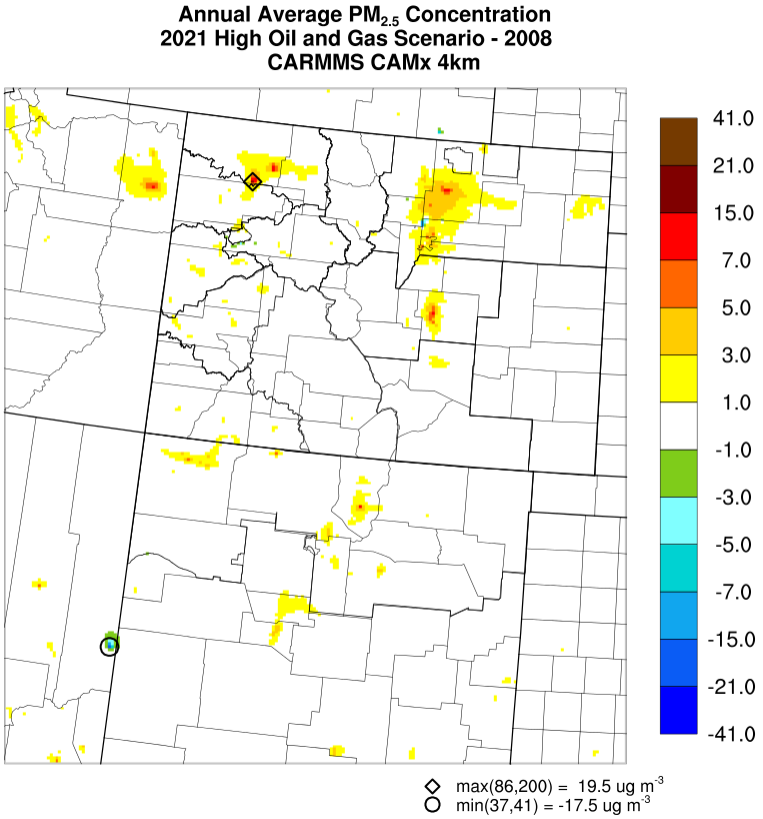
Figures 4.2-23 through **4.2-28** show CARMMS cumulative modeled differences in the 8th highest daily average and annual average $PM_{2.5}$ concentrations for the CARMMS high, medium and low scenarios. The differences are formed by subtracting the 2008 base case impacts from the 2021 scenario impacts. BLM determined through further analysis that the maximum modeled differences in eastern Colorado are primarily due to new non-federal oil and gas development in the Royal Gorge Field Office (RGFO) reflecting the large amount of current and projected non-federal oil and gas development activity in the eastern Colorado DJ Basin. The modeled differences are overestimated because future year 2021 unpaved road traffic and construction fugitive dust emissions were estimated for all new RGFO federal and non-federal oil and gas development for CARMMS, whereas the year 2008 WestJumpAQMS emissions inventory did not account for the same level of total oil- and gas-development-related traffic/construction fugitive dust per well / production. The amount of unpaved road travel for non-federal oil and gas development in the northern Denver metro area of the DJ Basin further contributes to the

overestimate of dust emissions because many of the primary roadways in that area are paved. With the exception of increases in $PM_{2.5}$ concentrations near large cities and future mining operations and non-federal oil and gas development and operations in northeast Colorado, the CARMMS high scenario full cumulative modeling results show no change in the 8th highest daily average $PM_{2.5}$ concentration in the region from years 2008 to 2021.



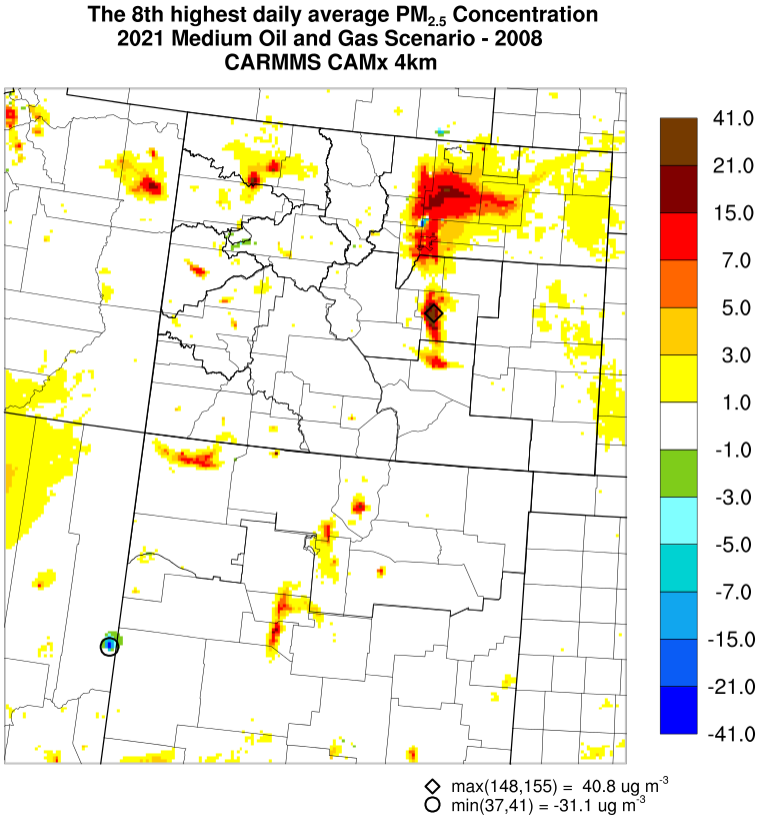
Source: CARMMS 2015.

Figure 4.2-23 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



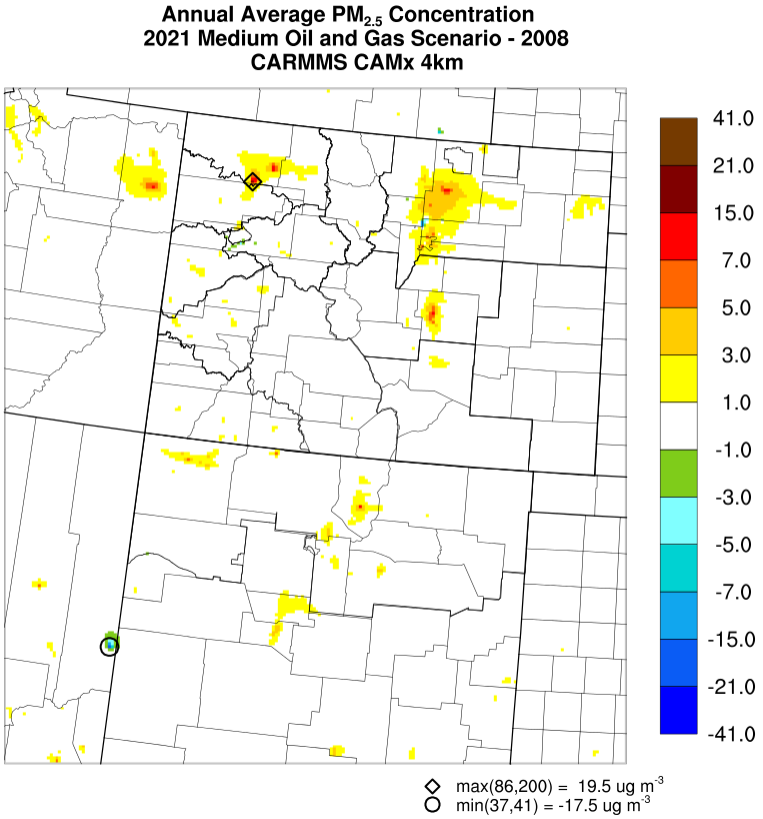
Source: CARMMS 2015.

Figure 4.2-24 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



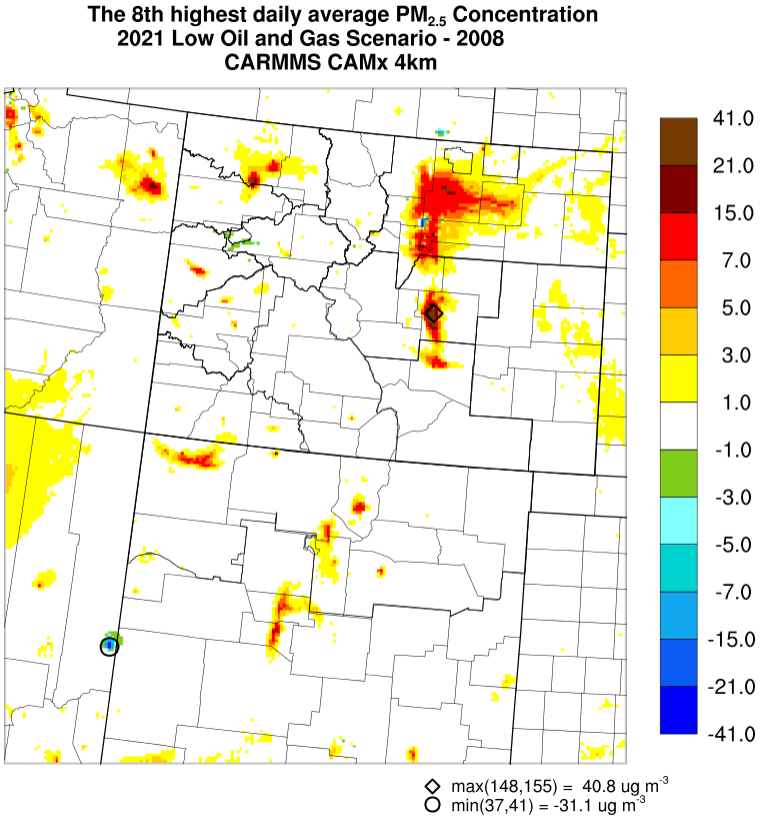
Source: CARMMS 2015.

Figure 4.2-25 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



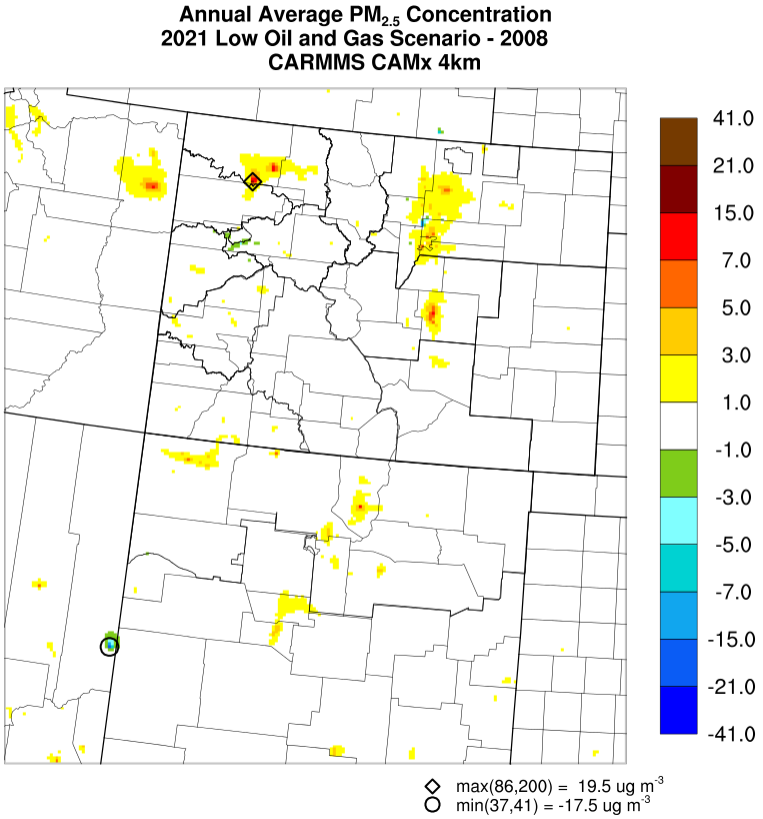
Source: CARMMS 2015.

Figure 4.2-26 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

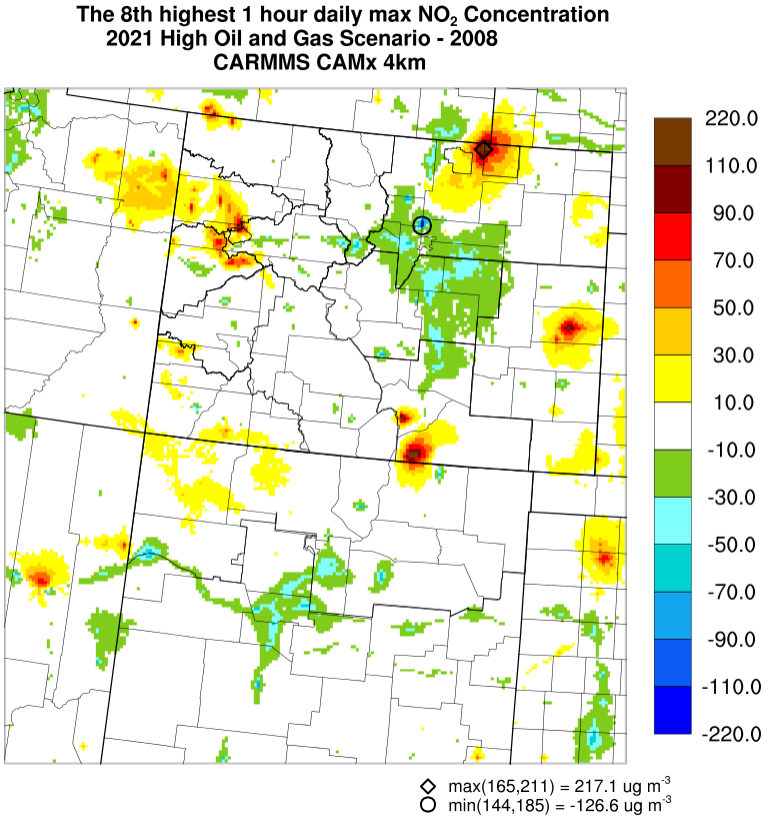
Figure 4.2-27 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

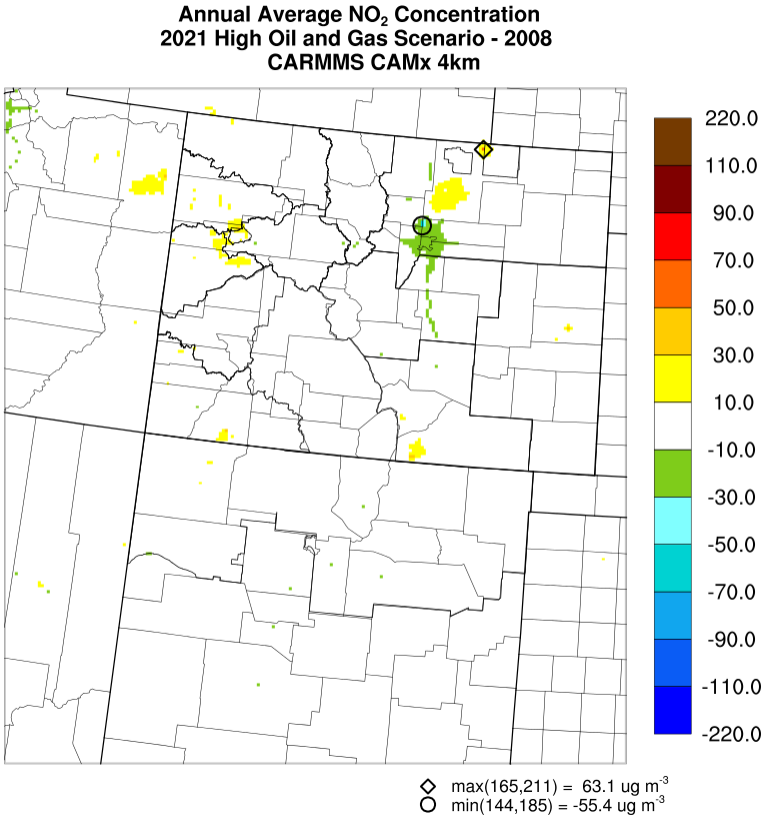
Figure 4.2-28 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case

Figures 4.2-29 through **4.2-34** show predicted differences in the 8th highest one-hour daily maximum NO_2 concentration and in the annual average NO_2 concentration for the high, medium, and low development scenarios. Similar to $PM_{2.5}$ discussed above, the modeled differences are formed by subtracting the 2008 base case from each 2021 development scenario (e.g., high, medium, and low). The differences in 1-hour NO_2 show reductions in the Denver area, slight increases in the oil and gas development areas at Uinta, Piceance and D-J Basins, and isolated large increases in northern, eastern, and southern Colorado and eastern Arizona and New Mexico. The net increases in the eastern / southeastern Colorado areas appear to be primarily attributed to non-federal oil and gas emissions and other large non-oil and gas related facility emissions that were permitted by CDPHE and came online since base year 2008.



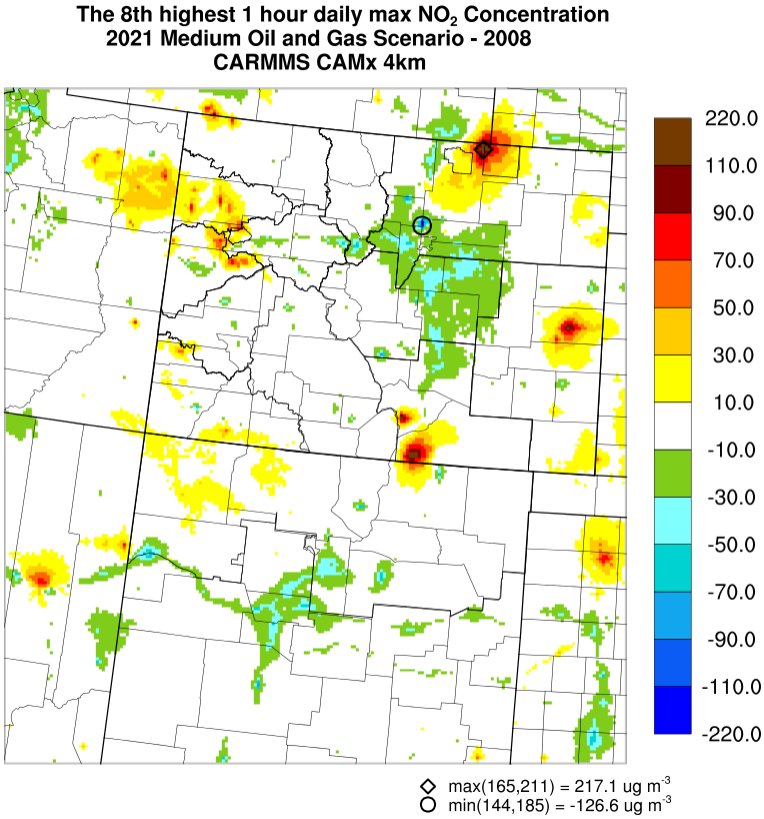
Source: CARMMS 2015.

Figure 4.2-29 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



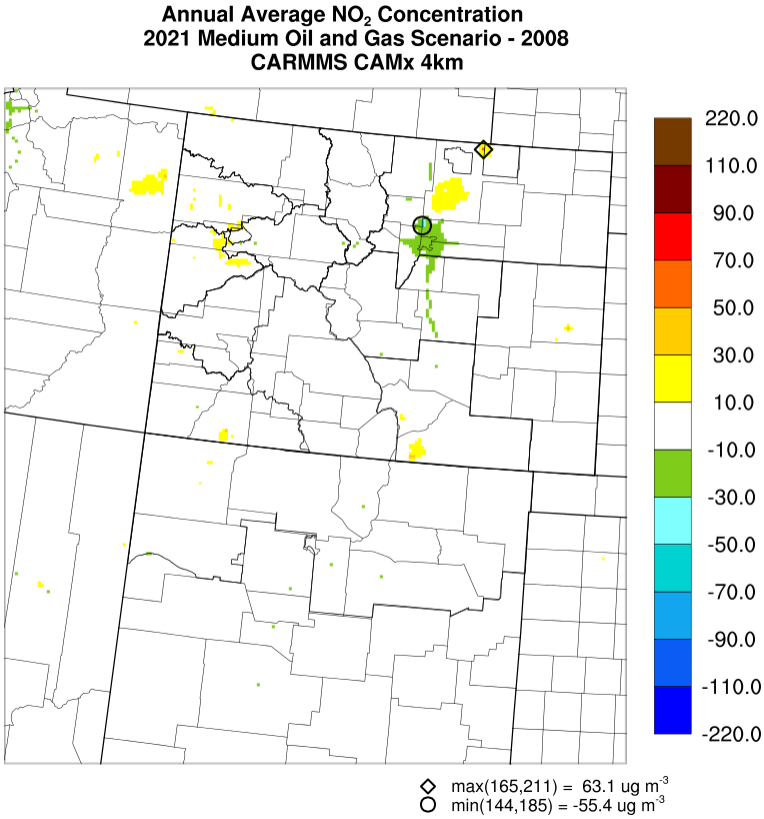
Source: CARMMS 2015.

Figure 4.2-30 Annual Average NO_2 Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



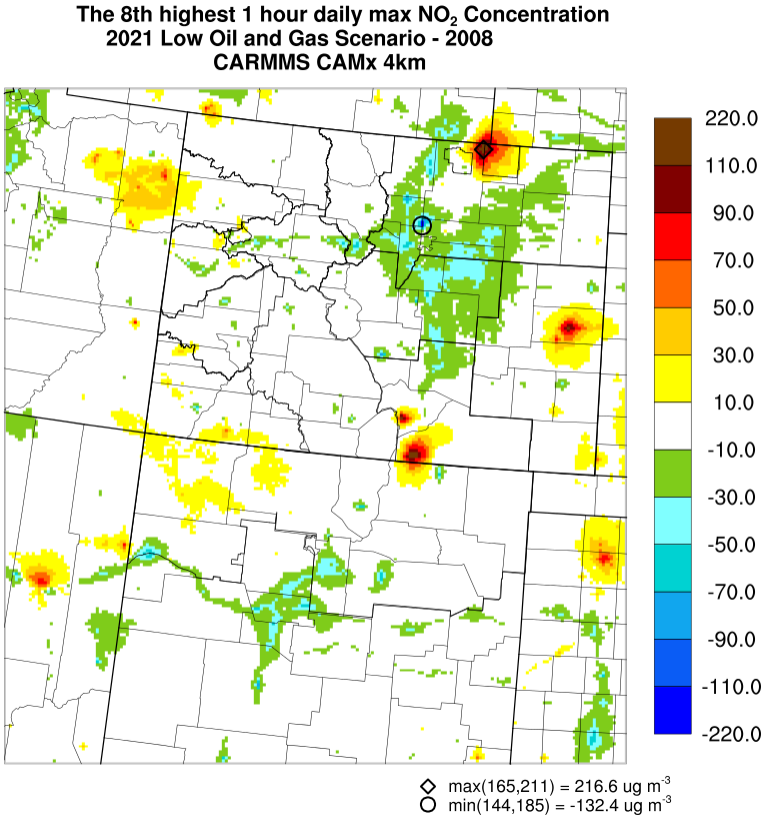
Source: CARMMS 2015.

Figure 4.2-31 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



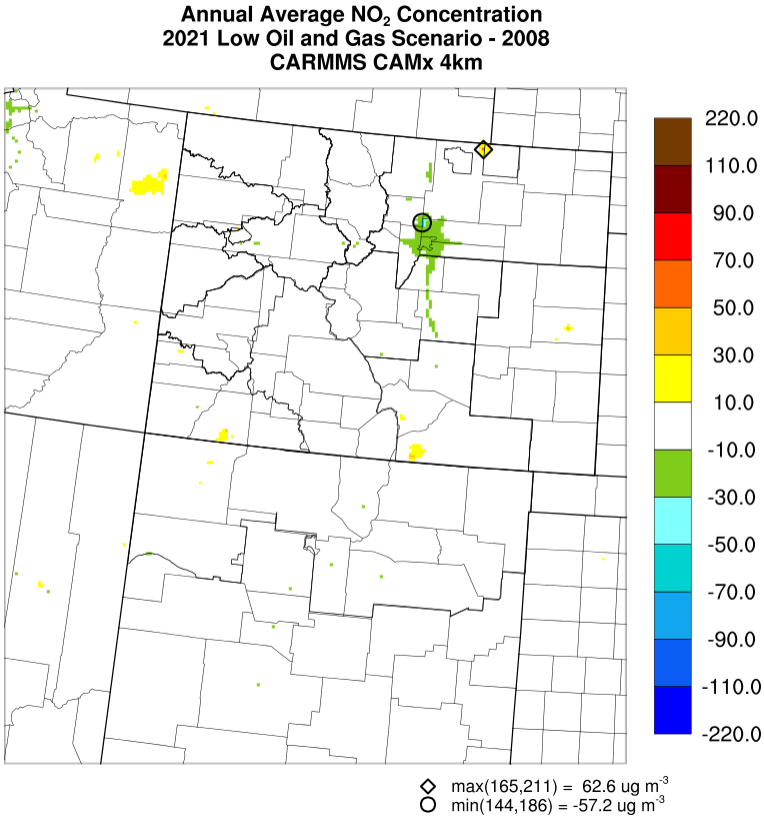
Source: CARMMS 2015.

Figure 4.2-32 Annual Average NO_2 Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

Figure 4.2-33 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

Figure 4.2-34 Annual Average NO_2 Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case

4.2.3 Project-Level Analysis and Near-Field Modeling Methodology

A project-specific near-field impact analysis was not performed because the scope of analysis for this EIS is regional and cumulative. BLM conducts project-specific near-field air quality impact analyses when reviewing oil and gas development proposals when detailed information for new oil and gas development timing and location and emissions source equipment and processes are known. BLM Colorado has recently developed an Instruction Memorandum (IM) to guide the adequacy, consistency, and efficiency of these analyses. The IM provides a standardized process and tools to enable field offices to assemble information necessary to analyze and disclose potential air resource impacts from oil and gas development activities. The IM requires that BLM Colorado staff follow a specific air quality analysis framework for proposed oil and gas development to determine the appropriate level of analysis and to track air pollutant emissions statewide. BLM follows a series of steps to conduct near-field air quality analyses. The first step is an evaluation of a proposed project's potential significance through development and evaluation of a project-level emission inventory. BLM field/district staff will use the BLM Colorado emissions inventory tool to complete the inventory. The tool also allows the BLM to consolidate results from projects across Colorado to provide additional analyses (e.g., a cumulative effects analysis). The second step is evaluation of the emission inventory, including assumptions and specifications for reasonableness and that the inventory is comprehensive to fully account for emissions-generating activities of the proposed action and reasonable alternatives. BLM then uses the project-level emission inventory to determine the appropriate method for conducting a near-field air quality impacts analysis.

The IM describes various analytical methods, including a dispersion screening tool, for considering near-field air-quality impacts and evaluating potential mitigation. The specific content of the IM and framework for conducting future project-specific air quality analyses can be found in a CARPP Appendix (http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carpp.html).

In general, individual projects will have temporary negative impacts on air quality that will mostly occur during the construction phase. Utilization of access roads, surface disturbances, and construction activities such as drilling, hydraulic fracturing, well completion, and equipment installation will all impact air quality by the generation of dust related to travel, transport, and general construction. Construction also will produce short-term emissions of criteria, hazardous, and GHG pollutants from vehicle and construction equipment exhausts. Once construction is complete, the daily activities at a site will be reduced to operational and maintenance checks that may be as frequent as a daily visit. Emissions will result from vehicle exhausts from the maintenance and process technician visits. Well pads can be expected to produce fugitive emissions of well gas, which contains mostly methane and a minor fraction of VOC. Fugitive emissions also may result from pressure-relief valves and working and breathing losses from any tanks located at the site, as well as any flanges, seals, valves, or other infrastructure connections used at the site. Liquid product load-out operations also will generate fugitive emissions of VOCs and vehicular emissions. Most operations will be subject to some portions of existing pollution control regulations and thus mitigate some or all of the expected fugitive emissions from flashing, load-outs, and leaks. Some control equipment, such as flares, will produce emissions of criteria, HAP, and GHG emissions via combustion.

4.2.3.1 Potential Near-field Impacts for the WRNF Alternatives

As previously described, a project-specific near-field impact analysis was not performed because the scope of analysis for this EIS is regional and cumulative, and project-specific near-field analyses will be completed when detailed information for future proposed actions is known. The limitations and restrictions for the various alternatives would ultimately dictate location and timing of future oil and gas development and associated emissions on the WRNF leases. **Figure 1-1** (Chapter 1.0) and **Table 2-7** (Chapter 2.0) show and describe the WRNF RFD zones (1-4) and potential number of wells for each Alternative and zone. Using this information, the following provides potential near-field air quality impacts that could occur for future oil and gas development under the Alternatives:

- Zone 1 leases are located in the western portion of the project area in the Colorado River Valley just east (approximately 5 miles) of De Beque and northwest (5 to 10 miles) of Molina and Collbran. For zone 1, the number of wells and well-pads are the same for Alternatives 1 and 2, and are the same for Alternatives 3 and 4. There are more projected new wells for Alternatives 3 and 4 than the other two Alternatives. This potentially means that there would be higher near-field air quality impacts for future oil and gas development under Alternatives 3 and 4 than for Alternatives 1 and 2. Future air quality impacts analyses would focus on impacts at existing ambient “sensitive” receptors (residences, businesses, schools, etc.) in the nearby communities. There are complex terrain features (mountain range and ridge) separating the communities of Molina and Collbran from Zone 1 leases and these terrain features would likely reduce the amount of air pollutant dispersion that would impact these communities. There would be no new federal oil and gas development under Alternative 5 for Zone 1 leases and therefore, no incremental air quality impact contributions for the absence of new oil and gas development.
- Zone 2 leases are located in the central portion of the project area and the Zone 2 leases closest to human populated areas (i.e., sensitive near-field receptors) are located approximately 5 miles southeast of Parachute, Colorado in the Colorado River Valley. Other Zone 2 leases are located further south in the project area and farther from sensitive receptors / populated communities. For the RFDS (Alternatives 1 through 4), this Zone could see the bulk of new oil and gas development for the WRNF 65 leases project area. As shown in **Table 2-7**, the number of new oil and gas wells and well-pads are the same for Alternatives 1 through 4 and much

lower for Alternative 5. For this reason, the level of potential air quality impacts would be similar for Alternatives 1 through 4. Depending on the level and location of future oil and gas development for the Zone 2 leases under Alternatives 1 through 4, a near-field modeling impacts analysis could be completed given the level of existing oil and gas in the Colorado River Valley; a refined future near-field impacts analysis would be much more probable should most of new oil and gas be developed on the Zone 2 northwest parcels in the Colorado River Valley.

- Zone 3 leases are located in the eastern portion of the project area and are located 5 to 10 miles west / southwest of Carbondale, Colorado. The level of potential new oil and gas development (well and well-pad counts) is similar for Alternatives 1 through 3 for Zone 3 and about one-third that level for Alternative 4. The level of oil and gas development for Alternative 5 for Zone 3 is almost negligible. There are complex terrain features (mountain range and ridge) separating Carbondale, Colorado from Zone 3 leases and these terrain features would likely reduce the amount of air pollutant dispersion that would impact this community. The level of future air quality impacts analysis greatly depends on where new oil and gas development occurs in Zone 3; a refined future near-field impacts analysis would be much more probable should most of new oil and gas be developed on the Zone 3 northern parcels closer to Carbondale, Colorado even though the complex terrain features suggest local unacceptable impacts would not extend over to this community.
- Zone 4 lease is located in the far north portion of the project area approximately 15 miles northwest of Meeker, Colorado. The level of potential new oil and gas development (well and well-pad counts) is similar for Alternatives 1 through 4 for Zone 4 and zero for Alternative 5. This Zone 4 parcel is located in remote area of WRNF and new oil and gas development on this lease would not likely result in significant poor air quality impacts to sensitive receptors (communities, etc.) given the level of potential new oil and gas development and location for this lease.

As described in Chapter 3.0, a recent air quality study estimated health risks attributable to exposure to air emissions from a natural gas development project in Garfield County, Colorado. The researchers found that residents living less than 0.5 mile from wells are at greater risk for health effects from natural gas development than are residents living at more than 0.5 mile from wells. No new oil and gas development on the WRNF 65 leases under any of the Alternatives would be located less than 4 miles from the populated communities described above.

Future air quality impacts analyses will give consideration to the type of well pad, its size, etc. that could have an effect on the amount of pollutants emitted. Generally larger pads with more wells would reduce the overall amount of dust (PM_{10} and $PM_{2.5}$) emissions but could increase and localize emissions of other pollutants near a well-pad because of increased drill and completion engines run times and production for a well-pad. Potential clustering of well development within the leases area could have higher localized (few kilometers) effects but lower overall impacts to the regional air quality. Clustered oil and gas development would reduce overall (total) pad and road construction related emissions and dust emissions associated with unpaved road traffic.

4.2.3.2 Protection / Mitigation Measures

As described in the CARPP, BLM tracks and assesses regional and cumulative impacts on an annual basis by comparing actual annual oil and gas development and emissions rates to modeled annual emissions rates and impacts. If actual oil and gas development and emissions are tracking at or exceeding those predicted in the CARMMS high scenario, or a future analysis, BLM may update its modeling to evaluate the potential for detrimental impacts on regional air quality for higher levels of oil and gas development, or may consider requiring the operators of future projects to use mitigation strategies contained such as those analyzed in the CARMMS medium emission scenario and described in the CARPP to reduce emissions. The current CARMMS regional analysis does not predict any

significant air quality impact contributions associated with new CRVFO (outside RPPA) federal oil and gas development, even under the high-development scenario, indicating that additional stipulations containing mitigation measures beyond the applicable state and federal requirements are not warranted under any of the alternatives. However, BLM may require particular mitigation measures as conditions of approval on a case-by-case basis, depending on the results of its project-specific analyses for future CRVFO oil and gas development.

It is anticipated that an operator would apply for either a Colorado APCD air permit for an oil and gas development site as a whole or cover individual equipment under one of Colorado's general permits for oil and gas operations. The state, as the regulatory authority for oil and gas actions, requires control of air pollutant emissions and has standards for compliance. The following highlights some of the State and Federal regulations / requirements that new CRVFO oil and gas development and operations would be subject to:

- Green completion for new hydraulically fractured natural gas wells (captures / controls VOCs, HAPs and methane)
- New pneumatic controllers must be at least low-bleed (captures / controls VOCs, HAPs and methane)
- New storage tanks with VOC emissions of 6 TPY or more have to reduce emissions by at least 95 percent (controls VOCs and HAPs)
- New well production facilities must be inspected for leaks 15-30 days after commencing operation and at least annually for facilities that emit more than 6 TPY of VOCs (potentially identifies losses of methane, and VOC and HAPs emissions).
- New glycol natural gas dehydrators with VOC emissions above 2 TPY have to control emissions by 95 percent (controls VOCs and HAPs).
- BMPs to minimize hydrocarbon emissions and the need for well venting during well maintenance and liquids unloading; records are required to be kept and made available for 2 years (reduces methane losses, and VOC and HAPs emissions)

Based on information presented in Chapter 2.0 (**Table 2-5**), the average number of wells per pad for new oil and gas development on the WRNF leases would be approximately 7 wells per pad. Using this information along with the CARMMS per well emissions rates for new CRVFO oil and gas wells, it is anticipated that new well facilities at full build-out will emit more than the emissions controls and monitoring requirement thresholds listed above. The actual emissions for new well-pad facilities will be realized when new oil and gas development occurs.

Previous BLM Colorado near-field air quality assessments for proposed oil and gas development activities in other parts of Colorado that focused on oil and gas related activities not routinely permitted / analyzed by the State suggested the need for the following air pollutant emissions controls measures; these equipment types and practices likely would be appropriate for future oil and gas projects in the CRVFO:

- Routine clean water application for at least 50% dust control for construction / development (i.e., drilling and completion) phase surface disturbance and unpaved road traffic;
- Tier-2 drilling / completion engine technology (or cleaner).

Any operator of future oil and gas development projects in the CRVFO must comply with applicable requirements, including conditions of approval designed to minimize air pollutant emissions and air quality impacts through good engineering, construction, and operating practices.

4.2.4 Greenhouse Gases and Climate Change

According to the U.S. Global Change Research Program, global warming is unequivocal, and the global warming that has occurred over the past 50 years is primarily human-caused. Standardized protocols designed to measure factors that may contribute to climate change, and to quantify climatic impacts, are presently unavailable. Moreover, specific levels of significance have not yet been established by regulatory agencies. Calculating the degree of impact any single emitter of GHGs may have on global climate, or on the changes to biotic and abiotic systems that accompany climate change is highly complex and predicting those impacts requires elaborate computer modeling programs and very large modeling platforms (i.e., computational power). Currently, no feasible and reliable tools exist to predict the impacts that GHG emissions from an individual project or collective GHG emissions from a planning area would have on the global, regional, or local climate. This analysis therefore compares total expected Planning Area GHG emissions with projected Colorado and U.S. GHG emissions. In addition, BLM discusses available information regarding expected changes to the global climatic system and the empirical evidence of climate change that has occurred to date.

The BLM acknowledges that climate change is happening and that it is affected by human activity. In this analysis, the BLM presents a qualitative discussion of the environmental effects of climate change and their socioeconomic consequences. Consistent with the revised CEQ draft guidance from December 2014, the BLM has used estimated GHG emissions associated with the proposed action as a reasonable proxy for the effects of climate change in this NEPA analysis. The BLM has placed those emissions in the context of relevant state emissions. The BLM also has acknowledged that climate science does not allow a precise connection between project-specific GHG emissions and specific environmental effects of climate change. This is consistent with the approach that federal courts have upheld when considering NEPA challenges to the following BLM federal coal leasing decisions: West Antelope II, 738 F.3d at 309; WildEarth Guardians v. BLM, Civ. Case No. 1:11-cv-1481 (RJL) (D.D.C. filed Mar. 31, 2014).

However, the BLM finds that including monetary estimates of the Social Cost of Carbon (SCC) in its NEPA analysis for this proposed action, which is not a rulemaking, would not be useful. There is no court case or existing guidance requiring the inclusion of SCC in the NEPA context. A federal Interagency Working Group on the Social Cost of Carbon (IWG), convened by the Office of Management and Budget, developed an SCC protocol for use in the context of federal agency rulemaking. The IWG issued estimates of the SCC, which reflect the monetary cost incurred by the emission of one additional metric ton of carbon dioxide (CO_2). Estimating SCC is challenging because it is intended to model effects at a global scale on the welfare of future generations caused by additional carbon emissions occurring in the present.

For this decision, there are several challenges involved in attempting to apply SCC to the analysis. For example:

- Given the global nature of climate change, estimating SCC of an individual decision requires assessing the impact of the project on the global market for the commodity in question.
- Monetizing only certain benefits or costs can lead to an unbalanced assessment. A regional economic impact analysis is often used to estimate impacts on economic activity, expressed as projected changes in employment, personal income, or economic output. Such estimates are not benefits or costs, and are not part of a benefit cost analysis.
- The SCC estimates developed by the IWG can only be applied to CO_2 emissions, not other GHG emissions such as methane. Again, monetizing only certain effects can lead to an unbalanced assessment.

BLM estimates that CRVFO outside the Roan Planning Area federal oil and gas related annual greenhouse gas emissions (including assumed end-use energy consumption CO_2 emissions) will contribute approximately 5,424,652 metric tons of CO_2(e) for the CARMMS low scenario;

7,776,632 metric tons of carbon dioxide equivalent CO_2(e) for the medium scenario; and 7,853,598 metric tons of carbon dioxide equivalent CO_2(e) for the high scenario to global GHG emissions in the maximum oil and gas production year (2021). However, the estimated CRVFO outside the Roan Planning Area oil and gas production rates estimated for purposes of CARMMS modeling have substantial uncertainty, as actual production rates could vary significantly in the future; thus the current prediction of the quantities of GHG emissions is similarly uncertain.

The Colorado Department of Public Health and Environment (CDPHE 2014) used the USEPA's State Inventory Tool to estimate future years GHG emissions inventories for Colorado. In year 2020, CDPHE estimates that Colorado's annual GHG emissions will be approximately 128,060,000 metric tons CO_2(e). The CARMMS high, medium and low emission scenarios' annual GHG emissions (excluding end-use energy consumption CO_2 emissions) for CRVFO (outside RPPA) year 2021 federal oil and gas production would represent about 0.91 percent, 0.85 percent and 0.71 percent of the state of Colorado's year 2020 annual GHG emissions, respectively. The estimated annual GHG emissions associated with the construction and operation of CRVFO (outside RPPA) federal wells for the three CARMMS scenarios thus are expected to be an extremely small component of the state's projected year 2021 GHG emission inventory.

For additional context, USEPA has recently modeled global climate change impacts from a source emitting 20 percent more GHGs than a 1,500MW coal-fired steam electric generating plant (approximately 14,132,586 metric tons per year of CO_2, 273.6 metric tons per year of nitrous oxide, and 136.8 metric tons per year of methane). The results ranged from a 0.00022 to 0.00035 degrees Celsius change in mean global temperature occurring approximately 50 years after the facility begins operation. The modeled changes are extremely small, and any downsizing of these results from the global scale would produce greater uncertainty in the predictions. USEPA concluded that even assuming such an increase in temperature could be downscaled to a particular location when considering impacts to endangered species habitat, it "would be too small to physically measure or detect" (Meyers 2008). Because the potential emissions (including assumed end-use energy consumption CO2 emissions) from future federal oil and gas development / operations in the CRVFO (outside RPPA) would be a fraction (approximately 60 percent) of the USEPA's modeled source and would be shorter in duration, BLM concludes that the projected annual CRVFO (outside RPPA) federal oil and gas related emissions related impacts on the climate would be minimal.

The following predictions were made by the USEPA for the Mountain West and Great Plains region with respect to climate change associated with cumulative (i.e., World-wide) GHG emissions:

- The region will experience warmer temperatures with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations.
- Earlier snowmelt means that peak stream flow will be earlier, weeks before the peak needs of ranchers, farmers, recreationists, and others. In late summer, rivers, lakes, and reservoirs will be drier.
- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Crop and livestock production patterns could shift northward; less soil moisture due to increased evaporation may increase irrigation needs.
- Drier conditions will reduce the range and health of ponderosa and lodge pole pine forests, and increase the susceptibility to fire.
- Grasslands and rangelands could expand into previously forested areas.
- Ecosystems will be stressed and wildlife such as the mountain line, black bear, long-nose sucker, marten, and bald eagle could be further stressed.

If these predictions are realized, as mounting evidence suggests is already occurring, there could be further impacts to resources within the region. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils. Warmer temperatures with decreased snowfall could have an impact on the ability of certain plants to sustain themselves within its current range. An increased length of the growing season in higher elevations could lead to a corresponding variation in vegetation and change in species composition. These types of changes would be most significant for special status plants that typically occupy a very specific ecological niche. Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened or endangered plants may be accelerated. Invasive plant species would be more likely to out-compete native species.

Increases in winter temperatures in the mountains could have impacts on traditional big game migration patterns. Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Warmer winters with less snow would impact the Canada lynx by removing a competitive advantage it has over other mountain predators. Earlier snowmelt also could impact cold water fish species that occupy streams throughout the planning area. Climate change could affect seasonal frequency of flooding and alteration of floodplains, which could alter riparian conditions. More frequent and severe droughts would have impacts on many wildlife species throughout the region as well as vegetative composition and availability of livestock forage in some areas. Climate change could increase the growing season within the region, however, which could result in more forage production provided there is sufficient precipitation. Drier conditions could have severe impacts on forests and woodlands. This could leave these forests and woodlands more susceptible to insect damage and at higher risk of catastrophic wildfires. Increased fire activity and intensity would increase greenhouse gas emissions.

4.3 Geology, Minerals, and Paleontology

4.3.1 Analysis Assumptions and Approach to Analysis

4.3.1.1 Analysis Area

The analysis area for geological, mineral, and paleontological resources consists of the individual lease tracts within the zones.

4.3.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for geology, minerals, and paleontological resources were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Scoping issues for geological, mineral, and paleontological resources include:

- The potential for landslides and seismic activity.
- How geology affects the potential for gas and liquid migration from drilling, hydraulic fracturing, injection of produced water, or other reasonably foreseeable activities.
- Potential for impacts to important paleontological resources from reasonably foreseeable development and how impacts can be mitigated.

4.3.1.3 Assumptions

There is a general assumption that operators would comply with federal and state laws, regulations, and permits when developing leases for oil and gas production. It also is assumed that site-specific environmental analysis would occur after an APD is submitted by the operator. At that time, when locations of facilities are known, the BLM may reasonably relocate facilities or add COAs to protect resource values and minimize potential hazards.

Assumptions to be used in the analysis of impacts to geologic hazards include the following:

- Active faults and seismic hazards may pose a risk to future infrastructure and facilities.
- There is no hazard model for induced seismicity due to oil and gas operations (Petersen et al. 2015a).
- Landslides and mass movements are a documented and present hazard not necessarily related to oil and gas development.

Assumptions to be used in the analysis of impacts to mineral resources include the following:

- Existing mineral resource recovery estimates are reasonable.
- Expected mineral resource recovery activity includes development of coalbed natural gas.
- Historically, oil exploration and production has been minimal in the analysis area, so the discussion focuses on gas development and production.
- Mineral development activities within the 65 leases in the analysis area would need to be compliant with the WRNF Land and Resource Management Plan (LRMP) (USFS 2002a).

- Production numbers are based on a 20-year well life and assume a negligible decline over the well life.

Analysis of impacts to paleontological resources is based on the following assumptions:

- Bedrock formations in the analysis area have medium to high potential (Potential Fossil Yield Classification [PFYC] ranks 3 and 5) to contain scientifically valuable fossils.
- Ground-disturbing activities pose a risk to fossil resources.
- There may a lesser risk of adverse impacts in areas with thick alluvium or grassland groundcover; higher risk areas are likely to occur on rock outcrops or bedrock with thin surficial cover.

4.3.1.4 Impact Indicators

Impact indicators for geological, mineral, and paleontological resources include the following:

- Extent of areas of geological instability and steep slopes covered by specific stipulations and general stipulation types required by each alternative.
- Number of proposed wells and projected production under each alternative.
- Potential for disturbance of areas associated with medium to high (PFYC ranks 3 and 5) fossil potential bedrock by alternative and by zone.

4.3.1.5 Methods of Analysis

For the analysis of geological hazards, the methodology includes the following:

- Review information and stipulations concerning landslides and slope instability.
- Compare each alternative in terms of the level of hazard protection and reduction of risk when resource-specific stipulations are implemented.
- Review information and natural and induced seismicity.

Methods of analysis for mineral resources include the following:

- Review information on mineral resource occurrence and the RFDS to determine the nature and extent of potential impacts and a relative comparison of development by alternative.
- Classify each alternative in terms of greater or lesser potential impact to the development of mineral resources.

Methods of analysis for paleontological resources include the following:

- Review stipulations and protection measures and compare the alternatives in terms of protection of the potential resource.
- Identify stipulations for other resources that may be protective of paleontological resources and a relative comparison of PFYC 3 and 5 areas that may be affected by development under each alternative.

4.3.2 Stipulations Providing Coverage of Geological, Mineral, and Paleontological Resources

4.3.2.1 Geological Hazards

Landslides

Given the widespread existence of landslides in the analysis area, lease stipulations limiting oil and gas activities on steep slopes or where there is an identified geologic hazard have been developed. The stipulations are meant to restrict or eliminate activities in areas of steep slopes to minimize slope failure, degradation of surface runoff, and impairment of soil productivity (USFS 2014a).

The stipulations for Alternatives 1 and 2 are derived from the WNRF and GMUGNF 1993 Oil and Gas Leasing Final EISs (USFS 1993a,b).

The stipulations for steep slopes for Alternatives 1 and 2 are divided into 2 categories: controlled surface use (CSU) for moderate slopes (40 to 60 percent) and NSO for slopes greater than 60 percent. There also are GMUGNF stipulations, a CSU for moderate slopes (40 to 60 percent) and a NSO for high hazard or slopes greater than 60 percent.

In addition to the stipulations for steep slopes, there are GMUGNF NSO and CSU stipulations for geologic hazards. The CSU stipulation is for moderate geologic hazards to “include stabilized earthflows, stabilized mudflows, stabilized landslides; slopes adjacent to failed slopes or active earthflows, mudflows or landslides and avalanche chutes; areas of rockfall; flash flood zones; and areas with potential mining related problems (i.e., subsidence, acid drainage)” (USFS 1993b). The NSO stipulation is for areas of high geologic hazard that “are characterized by active mudflows, active earthflows, active landslides and areas prone to avalanche” (USFS 1993b).

The stipulations to reduce risks from landslides and other geological hazards for Alternatives 3 and 4 are more restrictive than for Alternatives 1 and 2. Under Alternatives 3 and 4, the following stipulations would provide coverage to areas with geological hazards or steep slopes:

- NSO
  - High Geologic Hazard, GMUGNF
  - Severe or High Landscape Stability Hazards
  - Slope Greater than 50 percent
- CSU
  - 40 to 60 percent Slope, GMUGNF
  - Moderate Geologic Hazard, GMUGNF
  - Moderately High Landscape Stability Hazards
  - Slopes 30 to 50 percent

The steep slope stipulations were developed for the purpose of leasing availability analysis and may not accurately represent site conditions which only site-specific soil and geological surveys can determine. The stipulations developed to address landscape stability hazards were developed to avoid areas with site stability risks to prevent mass movements and slope failure like landslides (USFS 2014a, Appendix A).

Seismicity

None of the alternatives have stipulations or other protection measure regarding natural or induced seismicity.

4.3.2.2 Mineral Resources

There are no stipulations designed to protect oil and gas operations, but the stipulations would control the locations of the facilities. The standard lease terms, state and federal rules, BMPs, and Forest management decisions regulate all phases of oil and gas operations from the location of wells and facilities, drilling and well construction and completion, and measurement of product.

4.3.2.3 Paleontological Resources

There are no specific stipulations for the protection of fossil resources under Alternatives 1 and 2. The WNRF 1993 Oil and Gas Leasing Final EIS (USFS 1993a) includes protection of paleontological resources through a NSO stipulation designed to protect historical, archaeological, and paleontological resources. However, the stipulation has not been used to protect paleontological resources in the analysis area. Alternatives 3 and 4 provide a CSU stipulation for the protection of paleontological resources. The stipulation is consistent with the 2014 Oil and Gas Leasing Final EIS (USFS 2014a) and calls for the inventory of paleontological resources by a qualified paleontologist prior to ground disturbing activities. As described in the WRNF Oil and Gas Leasing Final EIS (USFS 2014a), the old NSO stipulation may have been too restrictive and with appropriate mitigation, the resource can be properly conserved through other means such as COAs. There is no need for protective stipulations conditions under Alternative 5 because all leases would be cancelled.

4.3.3 Impacts Common to All Alternatives

4.3.3.1 Geological Hazards

Landslides

The major geologic hazard in the analysis area is the potential for landslides and unstable slopes and hazards that can be magnified by surface-disturbing activities. Not only do natural conditions contribute to the hazard, but grading and excavation provide for conditions of instability and may contribute to diversion of runoff which also may increase the hazard. Landslides can damage roads, pipelines, and production facilities, contribute to spills of hazardous materials, and potentially cause the loss of life as in the West Salt Creek slide.

Caves and Karsts

As noted in Chapter 3.0, there are no caves in the analysis area and the formations that are susceptible to karst are too deep to be of concern for the formation of karst hazards.

Natural Seismicity

Seismic hazard increases from west to east from Zone 1 to Zone 3 with the highest potential accelerations in the Zone 3 leases in the vicinity of the active faults identified in Section 3.3.3.4. Horizontal ground acceleration may cause severe damage to poorly built masonry structures while engineered and well-built structures would have slight to moderate damage (Bolt 1993). Design and construction of natural gas production facilities and infrastructure in the vicinity of the active fault zone should be in accordance with seismic building standards.

Induced Seismicity

The induced seismicity that would be of concern for this analysis would involve underground injection of waste water and hydraulic fracturing. Currently the U.S. Geological Survey (USGS) is conducting a hazards assessment to determine the magnitude of the induced seismicity and how to address the risk where injection of waste water from oil and gas operations is suspected as the cause of increasingly frequent earthquakes in the Mid-continent and other selected areas of the United States. Although Rangely Field in the northern Piceance Basin has been identified in the past as a location of induced seismicity due to injection of fluid for secondary oil recovery, there has been little or sporadic seismic

activity since the USGS conducted testing in the 1970s (Petersen et al. 2015b). No other assessment areas were identified in the Piceance Basin. Other assessment areas in Colorado are located in the Raton Basin, the Denver-Julesburg Basin, and the Paradox Basin. Since no other hazard assessment areas have been identified, there is probably a low risk of induced seismicity in the analysis area. As the USGS continues to research the problem, it may be possible to better define the hazard within a given local area where oil and gas activities are taking place.

Regarding induced seismicity and hydraulic fracturing, the National Research Council maintains that injection of waste water poses more potential concern while hydraulic fracturing as presently conducted for production of hydrocarbons from shale poses only a slight risk (Dillon and Clarke 2015).

Although hydraulic fracturing is a source of induced seismicity in the strict definition of the term, the magnitude of induced seismicity due to hydraulic fracturing is quite small and is referred to as “micro-seismicity.” Oil and gas operators and oilfield hydraulic fracturing service companies use micro-seismicity to measure and monitor the direction and growth of fractures in order to assess the efficiency and efficacy of fracturing operations. Thousands of measurements from various shale gas basins indicated that the magnitudes are typically less than -2.5 and average -3.0 (Warpinski et al. 2012). Magnitudes of 1.0 or less are not felt by people so typical induced seismicity generated by hydraulic fracturing would not be perceived (Maxwell 2013).

4.3.3.2 Mineral Resources

With the exception of Alternative 4 (25 leases to be canceled) Alternative 5, maintaining currently held by production leases and allowing oil and gas activities on other issued undeveloped leases, would allow for the development of oil and gas resources and the associated beneficial economic and national security benefits.

4.3.3.3 Paleontological Resources

Ground-disturbing activities have the potential to cause the loss or damage to significant paleontological resources. Other effects to paleontological resources could occur by allowing greater access to fossil-bearing formations and localities.

4.3.3.4 Impacts Identified in the WRNF Final EIS

The WRNF Final EIS (USFS 2014a) goes through a lengthy review of the issues and evidence related to water usage from all stages of gas well drilling and completion, as well as induced seismicity of hydraulic fracturing (USFS 2014a, p. 143 – 150). The Final EIS states that the leasing of available lands for mineral extraction does not involve direct effects on geology and minerals, but that an indirect effect of leasing is that development would result in the eventual irretrievable extraction of fluid minerals (USFS 2014a, p.151). For more detail on the constituents commonly used in hydraulic fracturing, see Table 37 on page 148 of the WRNF Final EIS (USFS 2014a). The WRNF Final EIS uses the same RFDS (USFS 2010a) that is used in this EIS with similar basic assumptions for production. It concludes that alternatives with increased NSO stipulations and areas designated as closed to leasing would reduce the total production from federal minerals within the Forest (USFS 2014a, p. 152).

The Final EIS concludes that future development of oi land gas is not expected to affect development of locatable and other leasable minerals and would not affect landforms due to the small scale of development projected for the WRNF (USFS 2014a, p. 153).

The WRNF Final EIS recognizes that surface occupancy for fluid mineral development is possible in areas bearing important paleontological resources, but that pre-development site assessments and mitigation measures implemented prior to ground disturbance would conserve significant paleontological resources effectively. For those areas with PFYC 3 or higher, surveys would be required under the CSU

stipulation proposed in the WRNF Final EIS (USFS 2014a, p. 177) and carried forward for evaluation in Alternatives 3 and 4 of this EIS. Should important resources be found, the Final EIS recommends moving the location of disturbance, mitigating the site prior to construction, and monitoring or salvage efforts (USFS 2014a, p. 177). The WRNF Final EIS acknowledges that ground-disturbing activities associated with fluid mineral development may adversely affect paleontological resources, but also may make new discoveries that can expand knowledge but also may expose the fossils to recreational collectors (USFS 2014a, p. 179).

4.3.4 Impacts by Alternative

The following provides a comparison that the different alternatives would have on geological, mineral, and paleontological resources. The major issues of concern regard geologic hazards, natural gas production, and potential loss of scientifically significant or important fossils. The use of the word "significant" with regard to paleontological resources does not refer to the degree of impact, but to the potential value of the resources.

4.3.4.1 Alternative 1 (No Action Alternative)

<u>Geological Hazards</u>

Stipulation Coverage

Table 4.3-1 compares geologic and slope hazards stipulations to coverage provided by all stipulations. It should be noted that the slope stability stipulations are not directly comparable over all the alternatives as described above. Also, the area covered by a steep slope stipulation is limited by its very definition and development is limited by the physical attributes of the terrain. Management through stipulations is based on limiting surface disturbance on 40 to 60 percent slopes and slopes greater than 60 percent and in areas where there are identified geologic hazards. For 40 to 60 percent slopes, the CSU stipulation would be implemented to reduce the risk of landslides, protect infrastructure, and prevent impairment to soil and water resources by moving infrastructure away from steep areas (USFS 2014a, 1993a). For slopes greater than 60 percent, a NSO stipulation would be implemented to minimize susceptibility to geological hazards if CSU or standard lease terms are not adequate to provide the protection needed.

For all categories of slope and geologic hazard stipulations, protection from the hazards would rely to a great degree on implementation of CSU and NSO stipulations for other resources.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Table 4.3-1 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 1 to All Stipulations

Stipulation	Zone	Zone (acres)	Resource-specific Stipulations (% of Zone)	All CSU (% of Zone)	All NSO (% of Zone)
NSO High Geological Hazards	1	10,114	—	—	100
	2	24,930	0.3	5	39
	3	42,767	-	8	8
	4	2,562	—	—	3
NSO Steep Slopes (greater than 60 percent)	1	10,114	57	—	100
	2	24,938	34	5	39
	3	42,767	6	8	8
	4	2,562	3	—	3
CSU Moderate Geologic Hazards	1	10,114	—	—	100
	2	24,938	2	5	39
	3	42,767	0.1	8	8
	4	2,562	—	—	3
CSU Moderate Slopes (40 to 60 percent)	1	10,114	—	—	100
	2	24,938	0.1	5	39
	3	42,767	—	8	39
	4	2,562	—	—	3

Note: Stipulation boundaries overlap so cannot be totaled.

Mineral Resources

An estimated total of 593 billion cubic feet (Bcf) of gas would be produced, a reduction of 28 Bcf in the estimated amount of natural gas that could be recovered if there were no stipulations and activities are conducted under standard lease terms through implementation of the unconstrained RFDS. Liquid hydrocarbon (oil) production is not considered in the analysis because it comprises a small fraction of the commodity produced in the analysis area. Liquid/gas ratio range from 10 barrels per million cubic feet (MMcf) of gas at Mamm Creek Field to 1 barrel per MMcf or less at Parachute and Grand Valley Fields (Cumella et al. 2014).

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

In the absence of any stipulations developed specifically for paleontological resources, **Table 4.3-2** indicates how implementation of all other stipulations could provide coverage of paleontological resources under Alternative 1. In Zone 1, the total NSO acres covers most of the zone, which consists of PFYC 3 and 5 classifications, and would possibly provide the most complete coverage assuming the stipulations are implemented. The stipulations in the other zones would offer lesser degrees of coverage. However, the PFYC ranking itself would provide some measure of protection in all areas because the ranking indicates the level of management that is required to protect the resource (USFS 1999) in compliance with Forest Service management plans.

Table 4.3-2 Potential Fossil Yield Class and All Stipulations Under Alternative 1

Zone	Zone (acres)	Stipulation	% of PFYC 3	% of PFYC 5
			All Stipulations	All Stipulations
1	10,114	NSO	100	100
2	24,938	NSO	79	23
		CSU	3	6
3	42,767	NSO	1	9
		CSU	0	9
4	2,562	NSO	3	0

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.2 Alternative 2

Geological Hazards

Stipulation Coverage

Under Alternative 2, the stipulations are similar to Alternative 1 in that there are none designed specifically to cover steep slopes in Zones 1, 3, and 4 while Zone 2 has a small amount of acreage under the moderate slope CSU stipulation (see **Table 4.3-1**). Compared to Alternative 1, Zone 3 has more acreage with geological hazards and steep slopes assigned to the NSO stipulation on greater than 60 percent slopes and more overall acreage of NSO and CSU for other resources. The increased NSO coverage of lands with geological hazards or steep slopes is entirely within Zone 3, with 7 percent covered by the NSO on slopes over 60 percent, 10 percent covered by all CSU stipulations, and 19 percent covered by all NSO stipulations. The coverage of lands with geological hazards or steep slopes within Zones 1, 2, and 4 would be the same as described for Alternative 1 in **Table 4.3-1**.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

The gas production projected under Alternative 2 would be the same as described for Alternative 1.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

Similar to Alternative 1, in the absence of any stipulations developed specifically for paleontological resources, **Table 4.3-3** indicates how implementation of all other stipulations could provide coverage of important paleontological resources under Alternative 2. In Zone 1, the total NSO acres covers most of the zone, which consists of PFYC 3 and 5 classifications, and would possibly provide the most complete coverage assuming the stipulations are implemented. The stipulations in the other zones would offer lesser degrees of coverage. However, the PFYC ranking itself would provide some measure of protection in all areas because the ranking indicates the level of management that is required to protect the resource (USFS 1999) in compliance with Forest Service management plans.

Table 4.3-3 Potential Fossil Yield Class and All Stipulations Under Alternative 2

Zone	Zone (acres)	Stipulation	% of PFYC 3 All Stipulations	% of PFYC 5 All Stipulations
1	10,114	NSO	100	100
2	24,938	NSO	79	23
		CSU	3	6
3	42,767	NSO	1	10
		CSU	0	11
4	2,562	NSO	3	0

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.3 Alternative 3

Geological Hazards

Stipulation Coverage

As shown on **Table 4.3-4**, the coverage of both NSO and CSU stipulations designed to minimize adverse impacts to steep slopes and areas with landscape stability or geologic hazards is much less than NSO and CSU percentage of all the stipulations. It is possible that other stipulations (especially NSO) could provide coverage to protect sensitive locations from geologic hazards and development on steep slopes should they be implemented.

Table 4.3-4 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 3 to All Stipulations

Stipulation	Zone	% of Zone with Stipulation
NSO Steep Slopes (greater than 50 percent)	1	22
	2	7
	3	2
	4	2
NSO Severe or High Landscape Stability Hazards	1	23
	2	7
	3	2
	4	1
NSO High Geologic Hazard, GMUGNF	1	0
	2	0.3
	3	0
	4	0
CSU 40 – 60 percent Slope, GMUGNF	1	0.3
	2	0
	3	0
	4	0
CSU Moderate Slopes (30 to 50 percent)	1	29
	2	34
	3	20
	4	6
CSU Moderately High Landscape Stability Hazards	1	0.6
	2	3
	3	0.3
	4	0.3
CSU Moderate Geologic Hazard, GMUGNF	1	0
	2	2
	3	0.1
	4	0

Table 4.3-4 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 3 to All Stipulations

Stipulation	Zone	% of Zone with Stipulation
All NSO	1	100
	2	100
	3	100
	4	100
All CSU	1	100
	2	87
	3	86
	4	100

Note: Stipulation boundaries overlap so cannot be totaled.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

Under Alternative 3, an estimated total of 590 Bcf of gas would be produced, a reduction of 31 Bcf in the estimated amount of natural gas that could be recovered if there were no constraints and activities would be conducted under standard lease terms, as projected in the RFDS.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

The CSU stipulation designed to protect paleontological resources under Alternative 3 would effectively cover most of the high-value paleontological resources in all zones, as shown on **Table 4.3-5**. The CSU stipulation for paleontological resources combined with compliance of federal laws and Forest Service management would provide reasonable protection without having to rely on stipulations designed to minimize the impacts of other resources.

Table 4.3-5 Coverage by CSU Paleontological Resources Stipulation under Alternative 3

Zone	Zone (acres)	% of PFYC 3	% of PFYC 5	% of PFYC 3	% of PFYC 5	% of PFYC 3	% of PFYC 5
		Resource-specific Stipulation		All CSU		All NSO	
1	10,114	100	90	100	100	100	100
2	24,938	97	95	100	100	90	85
3	42,767	100	100	100	100	4	31
4	2,562	100	100	100	100	92	94

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.4 Alternative 4 (Proposed Action)

Geological Hazards

Stipulation Coverage

The coverage of resource-specific stipulations is similar to that shown in **Table 4-3-6** with the exception of Zone 3. In Zone 3, approximately 67 percent of the zone would be closed to leasing, so no development would occur in this area and no stipulations would be required to limit surface disturbance on steep slopes and areas with geologic hazards.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

Under Alternative 4, an estimated total of 550 Bcf of gas would be produced, a reduction of 31 Bcf in the estimated amount of natural gas that could be recovered if there were no constraints and activities were conducted under standard lease terms, as projected in the RFDS.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of limiting the recovery of natural gas resources. Under Alternative 4, this limitation on future gas development would be greater because all or part of 25 existing leases would be canceled. Where a portion of the lease would be designated as closed to leasing, the lease boundaries would be contracted to the remaining area outside of the boundaries identified as closed to future leasing in the WRNF 2014 Draft Record of Decision (ROD). In some cases, where the lease area would be reduced to a few acres, it may not be feasible for the lessee to keep the lease. However, that decision would be left up to each lessee if this alternative were selected.

Paleontological Resources

Stipulation Coverage

Similar to Alternative 3, the CSU stipulation for paleontological resources for Alternative 4 in Zones 1, 2, and 4 effectively covers the lease areas, as shown on **Table 4.3-5**. In Zone 3, 95 percent of the PYFC 3 area and 64 percent of the PYFC 5 area would be located in the leases to be cancelled because they would be designated as closed to leasing. While this would reduce the extent of NSO and CSU stipulations, this designation would not allow any future oil and gas development, and therefore would provide greater protection from disturbance for important fossil formations.

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.5 Alternative 5

Geological Hazards

Under Alternative 5, all leases would be cancelled, but reclamation would be conducted in compliance with Forest Service policy and guidance in a manner that would not increase the hazards on steep and unstable slopes or leave conditions that would lead to long-term instability or hazard.

Mineral Resources

As of February 2015, active producing wells on the subject leases had cumulatively produced approximately 27.6 Bcf of gas, and 1.2 million barrels of water (COGCC 2015c). The current 75 active gas wells have an estimated ultimate recovery of 1.2 Bcf of gas per well. Cancellation of the leases and plugging of the wells would result in a resource loss of an estimated 45 Bcf of gas. In that event, no taxes or royalties would accrue to federal and state agencies and also losses jobs involved with the production of the wells. Economic impacts are described in detail in Section 4.17.

Paleontological Resources

Under Alternative 5, all leases would be cancelled, but reclamation and ground-disturbing activities would take place over the short term. Although much of the reclamation activities would take place on previously disturbed ground, there is always the possibility for activities to infringe on undisturbed areas. Therefore, protection measures for fossil resources would be necessary until reclamation activities are complete.

4.3.4.6 Impact Summary

Geologic Hazards

Alternatives 1 and 2 provide similar coverage of areas with steep slopes by stipulations that would minimize geological hazards, with slightly more coverage under Alternative 2 due to some additional acreage of NSO and CSU stipulations. Under Alternatives 3 and 4, coverage of areas with geological hazards would be similar, with more coverage in the Zone 3 leases that would be close under Alternative 4.

Mineral Resources

Table 4.3-6 displays the effect of stipulations on gas production. The gas production in the unconstrained category is that production that would be estimated to occur if gas drilling and production took place under standard lease terms, as projected by the unconstrained RFDS. Alternatives 1 and 2 would result in a reduction of 28 MMcf of gas production compared to the RFDS, and Alternatives 3 and 4 would reduce production to 590 and 550 Bcf of gas, respectively, a reduction of 31 and 71 Bcf compared to the unconstrained RFDS.

Table 4.3-6 Gas Production by Alternative (all zones)

Commodity	Unit	RFDS (Unconstrained)	Alternatives 1 and 2	Alternative 3	Alternative 4	Alternative 5
Gas	Bcf	621	593	590	550	0

Paleontological Resources

The reliance on the PFYC system management objectives and stipulations of other resources under Alternatives 1 and 2 would not provide as great a degree of coverage as the CSU stipulation for paleontological resources under Alternatives 3 and 4.

There would be no stipulations for the protection of fossil resources for Alternative 5 other than the Forest Service management guidance under the PFYC system.

4.3.5 Cumulative Impacts

4.3.5.1 Cumulative Impacts Analysis Area

The CIAA for geology, minerals, and paleontological resources is the 65 existing leases.

4.3.5.2 Past, Present and Reasonably Foreseeable Future Actions

The past and present actions described in Section 4.1, in particular those involved in surface-disturbing activities and fluid mineral development, have contributed to the current conditions described in Section 3.3. There are 454 acres of identified surface disturbance within the CIAA (see Section 4.1 and **Appendix B**.

There are no additional oil and gas developments or other surface disturbing RFFAs proposed within the CIAA. There are approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments within the CIAA. This is 7 percent of the CIAA.

4.3.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Geologic Hazards

The incremental effects of all of the alternatives are difficult to quantify because of varying site conditions and unknown construction locations. However, given implementation of stipulations that would ensure appropriate design or avoidance of unstable areas in compliance with Forest Service guidance, geologic hazards are not expected to contribute to cumulative impacts in the CIAA area.

Mineral Resources

In the unconstrained production case, the amount of estimated gas production represents a small, but not unimportant increment of the total mean undiscovered oil and gas resource of 21 trillion cubic feet of gas in the Piceance Basin. Since 1999, Mamm Creek alone has produced about 1.4 trillion cubic feet of gas (COGCC 2015c). Given that context, the production differential between 0.07 trillion cubic feet of gas (the difference between the unconstrained RFD and Alternative 4), does not represent an unreasonable reduction in the overall resource base, but could represent a tangible loss in terms of revenue in production royalties, property taxes and jobs. If all leases were cancelled as in Alternative 5, it could represent an adverse impact in terms of lost revenue, especially for a smaller well operator.

Paleontological Resources

Cumulative impacts to paleontological resources would result from surface disturbance related to industrial developments (mainly oil and gas) including unauthorized collection, and natural or accelerated erosion processes in the CIAA. With the implementation of the appropriate stipulations, the projected oil and gas development resulting from leasing, when added to past and present actions and RFFAs, would not be expected to significantly contribute to adverse cumulative impacts to paleontological resources in the CIAA. There is little difference to paleontological resources between the cumulative impacts of the five alternatives.

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4.4 Soils

4.4.1 Analysis Assumptions and Approach to Analysis

4.4.1.1 Analysis Area

The analysis area for soil resources and the CIAA consists of the 65 leases within the 4 zones.

4.4.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for soils were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- Surface disturbance on erodible soils could result in increased sedimentation that may degrade water quality.
- Development could exacerbate unstable soil conditions in the Thompson Creek drainage area due to the soft sedimentary rocks and erodible Cretaceous shales.
- Development has already destabilized slopes and altered channels which contribute to excessive sedimentation threatening aquatic species.
- Dust storms have increased in frequency and strength associated with development by the oil and gas industry in Colorado and Utah.
- Surface disturbance results in dust deposition on the snow.

4.4.1.3 Assumptions

Analysis was based on the following assumptions:

- Any surface disturbance has the potential to degrade soil quality and productivity because it disrupts nutrient cycling, can affect soil permeability, and exposes the bare soil to the erosive forces of wind and water until revegetation or other ground cover is established.
- Bare soil (without vegetation or other surface cover) with a surface layer that has been altered from its natural condition is more susceptible to accelerated wind and water erosion than undisturbed soil. Erosion from disturbed areas would be minimal once vegetation is reestablished. Successful establishment of vegetation generally takes a minimum of 3 to 5 years, depending on soil and precipitation, and requires monitoring during this time.

4.4.1.4 Impact Indicators Used for Analysis

Soil resource impact indicators are listed below:

- Acres of initial surface disturbance and long-term disturbance by alternative and by zone;
- Acres of soils covered/not covered by NSO and CSU stipulations by alternative and by zone; and
- Acres of erodible soils covered/not covered by NSO and CSU stipulations, by alternative and by zone.

The risk of impacts to aquatic species related to sedimentation is discussed in Section 4.8, Aquatic Resources. Fugitive dust emissions are assessed in Section 4.2, Air Quality.

4.4.2 Stipulations Providing Coverage to Soils

Leased lands with NSO stipulations preclude infrastructure for oil and gas production such as well pads, buildings, tanks, and drilling equipment. NSO stipulations result in no ground disturbance for oil and gas activities within that lease. Soil resource-related NSO stipulations occur on steep slopes (greater than 50 to 60 percent), areas with severe landscape stability hazards, and areas of high geologic hazard within the GMUGNF.

CSU stipulations are designed to help minimize impacts to resources by increasing the flexibility to place the oil and gas associated facilities in locations that would have less impact. Soil resource-related CSU stipulations include areas of highly erodible soils, slopes of 40 to 60 percent within the GMUGNF, slopes of 30 to 50 percent within the WRNF, areas with moderately high landscape stability hazards, and areas with moderate geologic hazards within the GMUGNF.

Table 4.4-1 identifies the NSO and CSU stipulations under Alternatives 1 through 4 that would minimize potential adverse impacts of oil and gas development on soil resources. A full description of these stipulations is included in Appendix A of the 2014 WRNF Final EIS for Oil and Gas Leasing (USFS 2014a). Alternative 5 would cancel all leases and result in plugging, abandoning, and reclaiming disturbed areas; therefore, no stipulations would be applied under this alternative.

Table 4.4-1 NSO and CSU Stipulations That Minimize Impacts to Soil Resources

Stipulation	Alts 1 and 2[1]	Alts 3 and 4[1]
NSO		
Slopes Greater than 60%	X	
Slopes over 50%		X
Severe or High Landscape Stability Hazards		X
Slopes Greater than 60%—GMUGNF[2]	X	X
High Geologic Hazard—GMUGNF[2]	X	X
CSU		
Slopes 40 to 60%—GMUGNF[2]	X	X
Slopes 30 to 50%		X
Highly Erodible Soils		X
Moderate Geologic Hazard—GMUGNF[2]	X	X
Moderately High Landscape Stability Hazards		X

[1] Alternatives 1 and 2 have the same stipulations related to soils. Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

[2] The lease area includes a small portion of the GMUGNF, on which GMUGNF-specific stipulations would apply. These stipulations cover about 1 percent of the analysis area. No changes to these stipulations are being considered in the Proposed Action and alternatives; therefore, they are not reported in the subsequent tables (but are noted in table footnotes).

There are other NSO and CSU stipulations that are not designed to specifically protect soil resources but might minimize adverse impacts to soils if they were implemented. However, these stipulations are not designed for protection of soils and may not be implemented if, for instance, the resource does not exist within the boundaries of a lease based on field surveys. An operator can get an exception, modification, or waiver if the conditions on the ground, determined through subsequent environmental analysis, demonstrate that the reason for establishment of a stipulation no longer is pertinent.

4.4.3 Impacts Common to All Alternatives

Reasonably foreseeable development of oil and gas leases would result in surface disturbance to soil resources outside of the areas with NSO stipulations. NSO and CSU stipulations would help to minimize impacts to soils in steep and hazardous terrain that are susceptible to water erosion. However, soils with other limitations such as wind erodible, droughty, compaction prone, or soils with chemical constraints that may limit reclamation success (e.g., very low or high pH, soils that are saline or sodic, and soils high in heavy metals) may be disturbed by development, unless covered by other stipulations.

There would be adverse impacts to the existing quality of native soils from surface disturbance resulting from oil and gas development. Topsoil excavation, transport, storage, and redistribution would modify existing soil structure, generating changes to soils such as aeration and permeability that are likely to adversely affect soil productivity. The mixing of textural zones may create adverse chemical and physical impacts to soil quality and the existing microbial populations would likely decrease during stockpiling and storage. Due to these probable effects, the initial soil quality of reconstructed seedbeds and root zones would be less than that of the existing soil resources.

Impacts to soil resources during construction and operation activities may include:

- Soil compaction from construction equipment and operations traffic;
- Accelerated runoff and erosion due to an increase in bulk density and loss of vegetative cover;
- An increase in erosion and sedimentation while soils are unstable;
- Possible mixing of topsoil and subsoil from construction of roads and pads;
- Alterations of soil structure; and
- Changes to long-term soil productivity and soil quality from soil mixing and from long-term conversion of productive soils to well pads and roads resulting in a decline in nutrient cycling.

Impacts to soil resources during reclamation activities may include:

- Possible soil mixing during decompaction of soils and when topsoil piles are redistributed;
- An increase in runoff and erosion while soils are bare;
- An increase in wind erosion while soils are unstable;
- Alterations of soil structure as soils are redistributed; and
- Changes to soil quality, as soils are redistributed.

<u>Impacts Identified in the WRNF Final EIS</u>

Soil resources would be protected from impacts resulting from oil and gas activities where there are NSO stipulations, with protection to a lesser degree through applied CSU stipulations (USFS 2014a, p. 163 - 164). There would be no direct impacts to soil resources resulting from making lands available for oil and gas leasing. Any potential future impacts would be indirect effects resulting from the lands being leased, especially where erodible soils are disturbed (USFS 2014a, p. 165 – 167).

4.4.4 Impacts by Alternative

Table 4.4-2 provides a summary of the stipulations that would serve to protect soils susceptible to water erosion under Alternatives 1 through 4. This information is referenced in the following sections.

Alternative 5 would cancel all leases and result in plugging, abandoning, and reclaiming disturbed areas; therefore no stipulations would be applied to this alternative.

4.4.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

The impacts to soil resources that generally would be anticipated are described in Section 4.4.3. Under Alternative 1, one NSO stipulation within the WRNF is designated specifically to protect soil resources by avoiding surface disturbance on slopes over 60 percent. NSO stipulations designed to protect other surface resources also would serve to minimize impacts to soils if they are implemented without exception, waiver, or modification. **Table 4.4-6** discloses the percentage of soils covered by resource-specific NSO and CSU stipulations. The percentage of all soils protected by NSO stipulations is listed in the last column of **Table 4.4-2**. With consideration of all NSOs, 100 percent of the soils in Zone 1, 39 percent of soils in Zone 2, 8 percent of soils in Zone 3, and 3 percent of soils in Zone 4 would be precluded from surface disturbance.

Table 4.4-3 presents a summary of the acreages of water erodible soils protected by NSO and CSU stipulations. The NSO stipulation for slopes greater than 60 percent would protect approximately 99 percent of the water erodible soils in Zone 1, 34 percent of water erodible soils in Zone 2, 2 percent of water erodible soils in Zone 3, and 1 percent of water erodible soils in Zone 4 (**Table 4.4-3**). Additionally CSU stipulations for 40-to-60 percent slopes and moderate geologic hazards may offer protection to approximately 1 percent of water erodible soils in Zone 2. In Zone 3, the CSU stipulation designed to cover areas of moderate geologic hazard in the GMUGNF would minimize impacts to less than 1 percent of water erodible soils. As shown in the last column of **Tables 4.4-2** and **4.4-3**., more soils would be protected by other NSO stipulations in Zones 1, 2, and 3 than only those designed to protect soils.

Table 4.4-2 All Soils Covered by Stipulations under Alternative 1

Zone	Total Area (Acres)	Slopes Greater than 60% (% of Zone)[1]	All NSOs (% of Zone)
1	10,114	57	100
2	24,938	34	40
3	42,767	6	3
4	2,562	3	1

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-3 Water Erodible Soils Covered by Stipulations under Alternative 1

Zone	Water Erodible Soils (acres and % of Zone)	Slopes Greater than 60% (% of Water Erodible Soils)[1]	All NSOs (% of Water Erodible Soils)
1	1,311 (13%)	99	100
2	7,309 (29%)	34	40
3	12,565 (29%)	2	3
4	1,176 (46%)	1	1

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40 to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 893 acres of initial surface disturbance resulting from development of 416 gas wells on 60 pads would affect soils. While NSO stipulations would minimize adverse impacts in some areas of water erodible soils, there would be the potential for impacts to these soils where surface disturbance is allowed either off-lease or per waiver, exception, or modification. Surface disturbance would be completely precluded in water erodible soils in Zone 1. There is potential for oil and gas development to occur on 60 percent of water erodible soils in Zone 2, and 97 percent of water erodible soils in Zones 3, and 99 percent of water erodible soils in Zone 4. Development of the RFDS would result in initial surface disturbance of approximately 684, 111, and 21 acres within Zones 2, 3, and 4, respectively.

Where water erodible soils are disturbed, it would be important to ensure that vegetation or other stabilization is established quickly to minimize accelerated erosion and offsite sedimentation.

4.4.4.2 Alternative 2

Stipulation Coverage

Under Alternative 2, the level of coverage to minimize adverse effects on soil resources would be similar to Alternative 1 except Alternative 2 would add stipulations to 8 leases. This would add slightly more protection to soils in Zone 3, as shown in **Table 4.4-4** and **Table 4.4-5**.

Table 4.4-4 All Soils Covered by Stipulations under Alternative 2

Zone	Total Area (acres)	Slopes Greater than 60%: WRNF (% of Zone)[1]	All NSOs (% of Zone)
1	10,114	57	100
2	24,938	34	39
3	42,767	7	9
4	2,562	3	3

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-5 Water Erodible Soils Covered by Stipulations under Alternative 2

Zone	Water Erodible Soils (acres & % of Zone)	Slopes Greater than 60% (% of Water Erodible Soils)[1]	All NSOs (% of Water Erodible Soils)
1	1,311 (13)	99	100
2	7,309 (29)	34	40
3	12,565 (29)	4	4
4	1,176 (46)	1	1

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

Projected future oil and gas development would be similar to that described under Alternative 1, with the same amount of short-term and long-term surface disturbance. Due to some increased acreage of NSO stipulations (see **Table 4.4-4**), there would be a slight increase in the coverage of water erodible soils due to the small increase in limitations on surface disturbance from NSO stipulations, resulting in slightly fewer potential adverse impacts to water erodible soils.

4.4.4.3 Alternative 3

Stipulation Coverage

The impacts to soil resources that generally would be anticipated are described in Section 4.4.3. Under Alternative 3, NSO stipulations designated to minimize impacts to soil resources include those that limit surface disturbance on slopes greater than 50 to 60 percent and locations with severe or high landscape stability hazards. **Table 4.4-6** discloses the percentage of soils covered by resource-specific NSO and CSU stipulations. The percentage of soils protected by NSO stipulations is listed in the last column of **Table 4.4-6**. With consideration of all NSOs, 100 percent of the soils in Zone 1, 87 percent of soils in Zone 2, 86 percent of soils in Zone 3, and 92 percent of soils in Zone 4 would be precluded from surface disturbance.

The resource-specific NSO stipulations would cover approximately 2 percent of water erodible soils in Zone 1, 6 percent in Zone 2, 1 percent in Zone 3, and 1 percent in Zone 4. The CSU stipulations within the analysis area that are specific to soils include those on 30 to 50 percent slopes, highly erodible soils, areas with moderately high landscape stability hazards within the WRNF, locations with moderate geologic hazards within the GMUGNF, and 40 to 60 percent slopes within the GMUGNF. The resource-specific CSU stipulations would minimize surface disturbance within each of the zones, but may overlap in some locations.

NSO stipulations designed to protect other surface resources also would serve to minimize adverse impacts on soils (including erodible soils) if they are implemented without exception, waiver, or modification. As shown in the last column of the summary tables (**Tables 4.4-6** and **4.4-7**), more water erodible soils would be covered by other NSO stipulations in all zones than would be covered by those resource-specific NSO stipulations designed to protect soils. It is anticipated that there would be more development from locations off the leases due to the greater extent of NSOs under this alternative, compared to Alternatives 1 and 2. This would result in off-lease surface disturbance should the leases be developed, but the off-lease impacts to soils would be evaluated at the APD stage of permitting when site-specific locations are known and evaluations are completed.

Table 4.4-6 All Soils Covered by Stipulations under Alternative 3

Zone	Total Area (acres)	Resource-specific NSO Stipulations (% of Zone)		Resource-specific CSU Stipulations (% of Zone)			All NSOs (% of Zone)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50 %	
1	10,114	23	22	1	18	29	100
2	24,938	7	7	3	72	34	87
3	42,767	2	2	<1	57	20	86
4	2,562	1	2	<1	46	6	92

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-7 Water Erodible Soils Covered by Stipulations under Alternative 3

Zone	Water Erodible Soils (acres and % of Zone)	Resource-specific NSO Stipulations (% of Water Erodible Soils)		Resource-specific CSU Stipulations (% of Water Erodible Soils)			All NSOs (% of Water Erodible Soils)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50%	
1	1,311 (13%)	2	3	2	78	23	100
2	7,309 (29%)	6	6	3	79	40	80
3	12,565 (29%)	1	1	<1	79	13	85
4	1,176 (46%)	0	1	1	100	4	99

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 886 acres of initial surface disturbance resulting from development of 413 gas wells on 59 pads would affect soils. While NSO stipulations would protect some areas of water erodible soils, there would be the potential for alterations of these soils where surface disturbance would be allowed. Surface disturbance would be completely precluded in Zone 1. Based on the combination of NSO stipulations that are likely to minimize disturbance of water erodible soils under Alternative 3, there is potential for oil and gas development to occur within water erodible soils on 20 percent in Zone 2, and 15 percent in Zones 3, and 1 percent in Zone 4. Development of the RFDS would result in initial surface disturbance of approximately 684, 104, and 21 acres within Zones 2, 3, and 4, respectively. Where water erodible soils are disturbed, it would be important to ensure that vegetation or other stabilization is established quickly to minimize accelerated erosion and offsite sedimentation.

Under Alternative 3, there would be more extensive protection of erodible soils due to the larger acreage of NSO stipulations that would completely eliminate surface disturbance within the analysis area, as well as increased acreage of CSU stipulations that would require avoidance of erodible soils by surface disturbing activities. Less erodible soils would be disturbed within the analysis area, compared to Alternatives 1 and 2. However, due to the increase in NSO acreage under this alternative, it is likely that more off-lease development would occur. Depending on the surface manager at the off-lease location, there may be different constraints implemented for oil and gas development, but this would not be known until site-specific APDs are submitted.

4.4.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Under Alternative 4, the types and extent of projected surface disturbance and resulting impacts to soils would be similar to that described for Alternative 3, except in Zone 3 (**Table 4.4-8** and **Table 4.4-9**). In Zone 3, all or part of 25 leases would be cancelled and much of the surrounding area would be closed to future leasing. The lease cancellation and remaining area closed to leasing would eliminate the possibility of surface disturbance within the analysis area and off-lease. Therefore, while there would be fewer acres of NSO stipulations in Zone 3, there would be greater limitations on oil and gas development due to the cancellation of leases and the surrounding area that would be closed to leasing.

Table 4.4-8 All Soils Covered by Stipulations under Alternative 4

Zone	Total Area (acres)	Resource-specific NSO Stipulations (% of Zone)		Resource-specific CSU Stipulations (% of Zone)			All NSOs (% of Zone)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50 %	
1	10,114	23	22	1	18	29	100
2	24,938	7	7	3	72	34	87
3	42,767	0	0	0	23	4	95
4	2,562	1	2	0	46	6	92

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-9 Water Erodible Soils Covered by Stipulations under Alternative 4

Zone	Water Erodible Soils (acres and % of Zone)	Resource-specific NSO Stipulations (% of Water Erodible Soils)		Resource-specific CSU Stipulations (% of Water Erodible Soils)			All NSOs (% of Water Erodible Soils)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50%	
1	1,311 (13)	2	3	2	78	23	100
2	7,309 (29)	6	6	3	79	40	80
3	12,565 (29)	<1	<1	0	40	4	87
4	1,176 (46)	0	1	1	100	4	99

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 821 acres of initial surface disturbance resulting from development of 383 gas wells on 54 pads would affect soils. While NSO stipulations and the areas closed to leasing would cover some areas of water erodible soils, there is the potential for alterations of these soils where surface disturbance would be allowed either off-lease or per waiver, exception, or modification. Based on the combination of NSO and CSU stipulations with the areas that would be closed to leasing, there would be more coverage of erodible soils to minimize impacts both within the analysis area and off-lease. The designation of areas that are closed to leasing would eliminate future oil and gas development in Zone 3 within the leases to be cancelled and off those leases. The potential for development within Zones 1, 2, and 4 would be the same as Alternative 2. In Zone 3, there is potential for oil and gas development to occur on 3 percent of water erodible soils. Development of the RFDS would result in initial surface disturbance of approximately 39 acres within Zone 3.

4.4.4.5 Alternative 5

Stipulation Coverage

This alternative would not be subject to any stipulations because all the leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Under Alternative 5, all of the previously issued leases would be cancelled so there would be no reasonably foreseeable oil and gas development. The impacts associated with Alternative 5 would include any surface disturbance to soils resulting from plugging and abandoning the existing 75 wells, the removal of all ancillary equipment, and decommissioning and reclaiming all disturbed areas. Most of the areas to be disturbed have already been disturbed previously to construct the well pads and other facilities. Over time, as areas achieve reclamation and revegetation success, the soil productivity would increase compared to bare disturbed soils.

4.4.4.6 Summary of Impacts

While the acreage of surface disturbance associated with projected oil and gas development would be similar under Alternatives 1 through 4, Alternative 4 would have a lesser risk of impacts to soils based on lease stipulations, modifications, and cancellations. Under Alternative 4, there would be fewer wells, well pads, and roads constructed and less off-lease development in Zone 3 due to the lease cancellations. The least amount of potential risks to soils would result from Alternative 5 because all leases would be canceled, most of the surface disturbance would occur on previously disturbed soils, and reclamation and revegetation would be implemented for the entire analysis area.

4.4.5 Cumulative Impacts

4.4.5.1 Cumulative Impacts Analysis Area

The CIAA for soils would be the area encompassed by the leases (80,380 acres).

4.4.5.2 Past, Present, and Reasonably Foresee able Future Actions

Past and Present Actions

Past and present actions, as described in Section 4.1, have already impacted soil resources. Approximately 454 acres (0.5 percent of the CIAA) of soils have been disturbed by known past and present activities.

Past oil and gas activities have occurred within the CIAA. Although disturbance areas may be reclaimed using soil removed from the site and stockpiled for later use, soil productivity may be lower than the original natural soils after reclamation. The construction associated with past development of oil and gas wells and associated infrastructure in the analyses area have contributed to cumulative impacts including removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity. These changes to soils could increase runoff and lead to accelerated erosion and sedimentation. Older disturbances may not have been fully revegetated or reclaimed back to their original state.

Other past and present actions, such as timber harvests, livestock grazing, vegetation treatments, and land management decisions have impacted soil resources to varying degrees in the CIAA. Although it is likely that some past actions were not subject to reclamation, most current activities would be subject to reclamation, especially those regulated by federal, state, or local agencies.

Reasonably Foreseeable Future Actions

There are no RFFAs which would result in surface-disturbing activities within the soils CIAA.

As described in Section 4.1, other types of RFFAs that would occur within the CIAA include vegetation treatments and hazardous fuels reduction. Loss of vegetation and soil disturbance associated with the use of mechanical equipment could cause some short-term loss of soil functions, processes, and productivity on approximately 6,000 acres. However, these treatments would help to reduce the risk of wildfire within the CIAA, a major contributor to loss of soil function and processes.

4.4.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance. This is between 0 and 46 percent of the total cumulative long-term surface disturbance within the CIAA. With consideration of past/present actions, RFFAs, and alternatives, the total cumulative impact would affect less than 1 percent of the CIAA. If selected, Alternative 5 would reclaim existing wells that have resulted in some removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity.

4.5 Water Resources

4.5.1 Surface Water

4.5.1.1 Analysis Assumptions and Approach to Analysis

Analysis Area

As described in detail in Section 3.5.2.1, the analysis area for surface water resources includes the 6th-level subwatersheds, otherwise known as the 12-digit Hydrologic Unit Codes (HUC-12) of the watershed boundary dataset (Natural Resources Conservation Service et al. 2010), that encompass the leases under consideration. The subwatersheds comprising the analysis area are displayed by the four Lease Zones in **Figures 3.5-1** and **3.5-2**.

Scoping Issues

During the public scoping process, the following issues and concerns for surface water were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- Water quality impacts due to sedimentation and erosion caused by disturbed areas.
- Water quality impacts due to wastewater disposal, well pad and site runoff, potential spills, and hydraulic fracturing contamination.
- Water use and sources and their associated potential impacts (aquifer drawdown, streamflow reduction, adverse effects to aquatic life, wetlands, etc.).
- Interconnectivity of groundwater and surface water due to concerns with hydraulic fracturing. Potential impacts from hydraulic fracturing are discussed in Section 4.5.2, Groundwater.

Assumptions

The analyses within this section were completed considering certain assumptions. A main assumption is that operators would comply with all applicable laws and regulations, such as the Clean Water Act (CWA), and CDPHE and COGCC rules and regulations. The analysis is based on the estimated surface disturbance that would occur from the construction and maintenance of access roads, well pads, pipelines, and other work areas necessary to develop the reasonably foreseeable development of oil and gas leases projected for each alternative.

Impact Indicators Used for Analysis

The analysis of impacts to water resources considers impact indicators to allow for a quantified comparison of alternatives. The impact indicators used include the following:

- Amount of resource covered by specific stipulations and general stipulation types required by each alternative. Resource impact indicators quantified are listed below.
  - Colorado Source Water Assessment and Protection (CSWAP) sensitivity zones; percentage of coverage for CSWAP Zone 2 is the indicator reported as CSWAP areas because it includes a buffer around wells and streams to encompass the dendritic stream channel pattern up to the headwaters, but not the entire catchment area.
  - COGCC Rule 317B water supply protection zones; percentage of coverage for Rule 317B Zone 3 is the indicator reported because it includes a buffer around streams similar to CSWAP Zone 2.

  - Local Source Water Protection Plans (SWPPs); the indicator reported is the percentage of coverage for the geographic extent of the SWPP area.
  - Outstanding Waters use classification; percentage of coverage for stream reaches with this designation.
  - Impaired Waters; percentage of coverage for stream reaches with this designation.
  - Perennial rivers and streams; percentage of coverage for stream reaches with these flow regimes.
  - Highly erodible soils are discussed in Section 4.4, Soils.
  - Wetlands are discussed in Section 4.6, Vegetation.

- Amount of surface disturbance expected under each alternative as described in **Table 2-8**.
- Amount of water use expected for well development from each RFD. Water depletions related to impacts to fish species are discussed in Section 4.8, Aquatic Resources.

Methods of Analysis

The methods used to quantify the relationship between stipulations and the impact indicators relied upon geospatial overlays and intersection of the areas that would be covered by stipulations and the occurrence of the identified resources.

Impact indicators related to oil and gas development that could occur after additional approval(s) beyond the issuance of leases are analyzed using qualitative methods. Potential impacts from surface disturbance are characterized in a general sense. Potential water use has been contextualized related to current water use in the region. Estimates for these parameters are compared between alternatives.

Occurrence of the water resources parameters is largely within the subwatersheds containing RFD Zones 2 and 3; with less surface water resources occurring within Zones 1 and 4. The parameters that differentiate Zones 1 and 4 include the CSWAP areas, RFD amounts of surface disturbance, and water use expected for well development.

4.5.1.2 Stipulations Providing Coverage to Surface Water Resources

Standard lease terms apply to all leased areas and allow for the surface managing agency to require adjustments to proposed facility siting to protect resource values (e.g., increase the distance of facilities from water resources up to 200 meters and potentially more if necessary to protect those resources). They also allow for the agency's ability to place conditions of approval on operations. An example of a COA would be specification of interim and final reclamation measures, which could promote initial revegetation, thus decreasing erosion; and could encourage greater reclamation success, while decreasing the long-term erosion rates of previously disturbed sites. Additionally, as discussed in Section 3.5.13, new surface operations within the Rule 317B Internal Zone are prohibited without the issuance of a variance from the COGCC. There are additional requirements for new operations within the Intermediate Zone and External Zone.

There could be three types of stipulations in the leases according to the EIS alternatives. These three types, in order of descending protection offered, are NSO, CSU, and timing limitations (TLs). There also are planning decisions that close areas to oil and gas leasing (CTL).

NSO stipulations do not allow for surface occupancy or use in specific areas. This type of stipulation offers coverage to water resources that are found in the areas with NSO designation. NSO avoids surface disturbance of the area, thus avoiding or minimizing impacts to waters from increases in sediment or other runoff pollutants while also maintaining existing vegetative cover and soil infiltration

rates. NSO coverage also avoids occupancy by wells, pipelines, vehicles, or other equipment, thus negating the risk of releases of hazardous materials into waterways.

CSU stipulations dictate special operational constraints, but do not prohibit all activities. Certain CSU stipulations may provide coverage to water resources. This type of stipulation must be considered on a case-by-case basis because the constraints outlined vary greatly (e.g., no net increase in road densities, surveys for specific resources).

It is important to note that stipulations not related to water resources may provide coverage to water resources, but that coverage is uncertain. These are considered through the "Unrelated NSO" stipulation indicator. An example of the uncertainty might be an alternative with a NSO stipulation restricting development in critical big game winter habitat, and a location with a stream that passes through an area where existing GIS data indicated such habitat. This NSO stipulation would cover the stream as well as existing habitat. However, an illustration of the uncertainty would be if the area of indicated habitat was field surveyed and determined to not contain the characteristics of the habitat, and therefore did not warrant coverage by the NSO stipulation; then the water resources would lose coverage as well.

Resource-specific Stipulation Coverage

Table 4.5-1 lists lease stipulations that are included in certain alternatives that offer specific coverage of surface water resources.

Alternatives 1 and 2 have no stipulations specific to water resources. Stipulations designed to avoid or minimize impacts to surface water also may avoid or minimize impacts to groundwater, depending on the interconnections and the locations of the resources. Each of these stipulations is described in further detail below.

Table 4.5-1 Lease Stipulations Offering Specific Coverage of Surface Water Resources

Stipulation	Alternative 1	Alternative 2	Alternative 3	Alternative 4
NSO—Public Water Supply Source Areas			X	X
NSO—Water Influence Zones			X	X

Public water supply source areas are based on the Forest Service White River LRMP 2002 Revision stipulation, which are bounded geographically by the CSWAP program assessment areas. The Forest Service defined the NSO stipulation to cover areas within CSWAP zones 1 and 2 out to a distance of five miles from the water intakes. The geographic extent of this stipulation was updated for this EIS based on the USFS definition and the most recent CSWAP data, received from CDPHE in September 2015. The stipulation states that no surface occupancy or use is allowed within these areas.

Water influence zones are defined in the stipulation as areas within a minimum of 100 feet from each side of a perennial or intermittent stream, lake, wetland, or naturally occurring pond. This minimum distance may be wider where there is a well-developed floodplain. The stipulation states that no surface occupancy or use is allowed within these areas. However, development of road and pipeline crossings in the area of intermittent drainages is not subject to this stipulation.

4.5.1.3 Impacts Common to all Alternatives

Impacts to surface water from the leasing action alternatives would not occur from the approval of leases, but would occur upon additional approval(s) that allowed for the physical development of the leases. Although the types of impacts that would occur from oil and gas development are summarized below, the locations and timing of specific development is not known and cannot be predicted through

the leasing action. Therefore, this section discloses the potential risks that are posed to water resources through the leasing action, and analyzes the levels of coverage provided by each alternative.

If the existing leases are maintained, and the lessees pursue additional approval(s) to develop the oil and gas resources, the types of impacts expected from development would occur temporarily during construction and to a much lesser extent during the operation phase of oil and gas production.

Temporary impacts are generally expected from land disturbance during construction of access roads, well pads, flowlines, and supporting facilities. Temporary impacts would be most likely to occur during construction of stream crossings for access roads and flowlines, and at well pad locations nearest streams. This construction would disturb the vegetation, soils, and mineral substrate; which in turn would increase runoff rates during precipitation events and the spring snowmelt. By increasing the runoff and removing vegetation (the roots of which hold the soil together, and the shoots and stems of which slow the runoff), the disturbed areas would become more susceptible to erosion. Soil that is carried down gradient by runoff due to upslope erosion is deposited in streams and may create sedimentation issues.

Potential leaks or spills of petroleum products or other hazardous materials from construction and operation equipment and vehicles might impact surface water if a spill were to reach a waterway or wetland.

Water consumed for well drilling, dust abatement, and other construction uses would increase water demands, and might temporarily impact groundwater levels during water withdrawals or affect other water users depending on the sources utilized. Any water use would be subject to the rules, regulations, and processes of the Colorado Division of Water Resources.

Because the exact locations or amounts of disturbance from future development of leases are not known, the amounts of coverage provided by stipulations are used as an indicator of the risk to the water resources. Surface disturbance related to the development of these leases would have the potential of occurring outside the lease areas if the mineral resources were accessed via directional drilling; therefore the coverage provided outside the leases also are included. Additionally, the projected amount of disturbance and water needed to develop the leases also is used as an indicator of the impacts to water resources.

NSO stipulations that apply to areas near streams and areas of highly erodible soils would minimize impacts of oil and gas development by requiring disturbance to be located in other areas. CSU and TL stipulations may have beneficial effects for water resources, such as limiting increases in road densities or limiting construction disturbance activities for other resource considerations that happen to coincide with high-flow periods during snowmelt. For the purposes of this analysis, it is assumed that NSO and CTL stipulations would provide coverage to the water resource parameters by limiting development in sensitive areas and by creating vegetated buffers that would minimize impacts from surface-disturbing activities and potential releases of hazardous materials.

Impacts Identified in the WRNF Final EIS

The Forest Service Oil and Gas Leasing Final EIS included an analysis of watershed sensitivity to anthropogenic influence (see USFS 2014a at p. 80). USFS (2014a) states that “The Cache Creek, Garfield Creek, Mamm Creek, Outlet Roaring Fork River, and Rifle Creek (HUC10) watersheds have the highest aggregate sensitivity to potential future surface disturbance impacts (on the National Forest) associated with oil and gas exploration and development.” (Parentheticals added for clarification.) These watersheds drain directly into the Colorado River and correspond to portions of leases considered within Zones 2 and 3 of this EIS. Other areas of Zone 3 also are reported to have a high susceptibility to anthropogenic influences such as oil and gas development. The watersheds containing Zones 1 and 4 are reported to have moderate susceptibility to anthropogenic influences.

Because the Forest Service concluded that the watersheds most sensitive to anthropogenic influence and the occurrence of surface water resource parameters are both found largely in Zones 2 and 3, the impact indicators used in this analysis focus on those zones while still including relevant information related to all zones.

Impact issues that were identified for surface water resources in the WRNF Final EIS include the potential effects of future oil and gas development of chemical water quality degradation or sedimentation in streams from ground disturbance during construction or leaks and spills of industrial chemicals or drilling fluids (USFS 2014a, p. 76). The WRNF Final EIS also recognizes that future development might alter the hydrology through decreases to available water due to use for well drilling and development as well as increases or changes in runoff patterns and timing from reduced infiltration rates of disturbed areas. These changes in flow regimes could impact existing erosion rates and streambank stability in downstream channels (USFS 2014a, p. 77). Watersheds were analyzed for their susceptibility to anthropogenic influences based on ecological drivers such as geology, geochemistry, and hydroclimatic regime (USFS 2014a, p. 78). Watersheds were then grouped based on ecological clusters, and two of these clusters (Cluster M5R and Cluster M6R) fall largely within the water resources analysis area evaluated in this EIS. “Overall, watersheds in the M6R cluster are considered to have the highest sensitivity to potential ground-disturbing activities such as those associated with oil and gas development” (USFS 2014a, p. 81).

4.5.1.4 Impacts by Alternative

Each alternative considered has differing amounts of resource coverage offered through lease stipulations, as well as differing estimates of reasonably foreseeable development due to the stipulation requirements. **Table 4.5-2** summarizes the coverage offered to surface water resources by alternative.

Table 4.5-2 Percent of Surface Water Resources Indicators Covered by Stipulations under Each Alternative

		Alternative				
	Resource Coverage	**1**	**2**	**3**	**4**	**5**[1]
State CSWAP Areas	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	77	45	No Stipulation
	Unrelated NSO/CTL	23	23	88	93	100
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	89	89	No Stipulation
	Unrelated NSO/CTL	0	0	92	92	
Local SWPP Areas[2]	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	9	98	No Stipulation
	Unrelated NSO/CTL	9	11	88	99	100
Outstanding Waters	NSO—Water Influence Zones	No Stipulation	No Stipulation	99	100	No Stipulation
	Unrelated NSO/CTL	11	11	99	100	100
Impaired and Monitored Waters	NSO—Water Influence Zones	No Stipulation	No Stipulation	100	99	No Stipulation
	Unrelated NSO/CTL	52	52	100	100	100
Perennial Streams	NSO—Water Influence Zones	No Stipulation	No Stipulation	100	66	No Stipulation
	Unrelated NSO/CTL	23	23	100	100	100

[1] Although Alternative 5 would cancel all leases and protect the resources in the long-term, there would be short-term impacts associated with decommissioning existing oil and gas development in the cancelled lease areas. See Alternative 5 narrative below for additional information.

[2] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

CTL = closed to leasing.

Alternative 1 (No Action Alternative)

This alternative would reaffirm the lease stipulations on the 65 leases as they were issued. Water resources impact parameters are listed for Alternative 1 by Zone in **Table 4.5-3**.

Table 4.5-3 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 1

	Resource Coverage	Alternative 1 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	Unrelated NSO/CTL	23	100	33	8	2
COGCC Rule 317B Areas	Unrelated NSO/CTL	0	No Resource	0	No Resource	No Resource
Local SWPP Areas[1]	Unrelated NSO/CTL	9	No Resource	42	9	No Resource
Outstanding Waters	Unrelated NSO/CTL	11	No Resource	0	12	No Resource
Impaired and Monitored Waters	Unrelated NSO/CTL	52	No Resource	52	No Resource	No Resource
Perennial Streams	Unrelated NSO/CTL	23	No Resource	52	17	0

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be no surface water resources-specific stipulations under this alternative, which describes the existing leases and associated stipulations. The general NSO stipulations related to other resources would cover up to 23 percent of the CSWAP areas, 9 percent of the local SWPP areas, 11 percent of designated Outstanding Waters, 52 percent of impaired and monitored waters, and 23 percent of perennial streams.

Unrelated NSO stipulations would cover nearly all the individual CSWAPs in Zone 1; 8 percent to nearly 40 percent of the individual CSWAPs within Zone 2; 8 percent to 17 percent of the individual CSWAPs in Zone 3, and 2 percent of the CSWAP within Zone 4. None of the Rule 317B area in Zone 2 would be covered by the unrelated NSO stipulations under this alternative. Approximately 42 percent of the Rifle SWPP areas within Zone 2, and 9 percent of the Carbondale SWPP area in Zone 3 would be covered. Designated Outstanding Waters in Zone 2 (Battlement Creek) would not be covered, and approximately 1.1 miles of designated Outstanding Waters in Zone 3 (out of 9.2 miles) would be covered on North Thompson and Park creeks. Approximately 1.7 miles (out of a total 3.2 miles) of West and Middle Mamm creeks, the impaired streams in Zone 2, would be covered by unrelated NSO stipulations. Perennial streams that would be covered by unrelated NSO stipulations include Cache Creek, Cottonwood Creek, Middle Mamm Creek, and portions of West Divide Creek in Zone 2; and Middle Thompson Creek, Porcupine Creek, and portions of Freeman, North Thompson, and South Branch Middle Thompson creeks in Zone 3.

The Forest Service also has established NSO stipulations outside the existing lease zones, to provide coverage for NFS lands available for future leasing. Within those NFS lands that are included in the analysis area, the NSO stipulations cover 34 percent of the CSWAP areas, 16 percent of Rule 317B areas, and 71 percent of local SWPPs.

Impacts from Projected Future Oil and Gas Development

Initial surface disturbance of 893 acres would be expected to result from reasonably foreseeable future oil and gas development, with the majority falling in Zone 2. Zone 3 would have the second-highest amount of disturbance. The potential for portions of this disturbance to be off-lease exists where there are restrictive on-lease stipulations.

Water use under Alternative 1 is projected to be approximately 1,158 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to "Industrial" use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 2

This alternative would modify leases to address inconsistencies with the 1993 EIS and ROD. Stipulations that were not attached to leases as issued but were identified in the 1993 EIS and ROD would be added to the leases. Water resources impact parameters are listed for Alternative 2 by Zone in **Table 4.5-4**.

Table 4.5-4 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 2

	Resource Coverage	Alternative 2 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	Unrelated NSO/CTL	23	100	33	9	2
COGCC Rule 317B Areas	Unrelated NSO/CTL	0	No Resource	0	No Resource	No Resource
Local SWPP Areas[1]	Unrelated NSO/CTL	11	No Resource	42	10	No Resource
Outstanding Waters	Unrelated NSO/CTL	11	No Resource	0	12	No Resource
Impaired and Monitored Waters	Unrelated NSO/CTL	52	No Resource	52	No Resource	No Resource
Perennial Streams	Unrelated NSO/CTL	23	No Resource	52	17	0

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be no water resources-specific stipulations under this alternative. The unrelated NSO stipulations related to other resources would cover up to 23 percent of the CSWAP areas and 11 percent of local SWPP areas. The unrelated stipulations coverage for the other surface water resource parameters would be the same as that described for Alternative 1. The additional coverage for CSWAP areas and SWPP areas in Alternative 2 would be from the same coverage as under Alternative 1 but with additional coverage for Zone 3. The USFS-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.

Impacts from Projected Future Oil and Gas Development

The potential impacts to surface water resources from reasonably foreseeable future oil and gas development would be the same as that described for Alternative 1.

Alternative 3

This alternative would modify the 65 leases to match the stipulations for future leasing identified in the Proposed Action from the 2014 WRNF Final EIS. Water resources impact parameters are listed for Alternative 3 by RFD Zone in **Table 4.5-5**.

Table 4.5-5 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 3

	Resource Coverage	Alternative 3 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	NSO—Public Water Supply Source Areas	7	7	4	9	0
	Unrelated NSO/CTL	88	100	85	88	89
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	89	No Resource	89	No Resource	No Resource
	Unrelated NSO/CTL	92		92		
Local SWPP Areas[1]	NSO—Public Water Supply Source Areas	9	No Resource	42	8	No Resource
	Unrelated NSO/CTL	88		84	88	
Outstanding Waters	NSO—Water Influence Zones	99	No Resource	100	99	No Resource
	Unrelated NSO/CTL	99		100	99	
Impaired and Monitored Waters	NSO—Water Influence Zones	100	No Resource	100	No Resource	No Resource
	Unrelated NSO/CTL	100		100		
Perennial Streams	NSO—Water Influence Zones	100	No Resource	100	100	100
	Unrelated NSO/CTL	100		100	100	100

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be two surface water resources-specific stipulations under this alternative. The NSO stipulation to limit surface disturbance in Public Water Supply Source Areas would cover approximately 7 percent of the CSWAP areas within the leases; complete coverage would not be achieved because the stipulation would create NSO for areas within 5 miles upstream from the intakes, while the CSWAPs extend to the headwaters along streams as discussed in Section 4.5.1.2. The Public Water Supply Source Area NSO stipulation would cover approximately 8 percent or less of individual CSWAPs in Zones 1 and 2. The stipulation would cover all of the Oak Meadows Subdivision, Brettleberg Condos, Ski Sunlight, and Sunlight Inn and Restaurant CSWAPs, and 42 percent or less of the remaining CSWAPs in Zone 3. None of the CSWAP found in Zone 4 would be covered. This stipulation would cover approximately 89 percent of the COGCC Rule 317B areas in Zone 2. Local SWPPs would be covered at approximately 42 percent (Rifle) in Zone 2 and 8 percent in Zone 3 (2 percent of Carbondale and 33 percent of Oak Meadows Subdivison). The NSO stipulations to limit disturbance of Water Influence

Zones would cover 99 percent of the designated Outstanding Waters in the analysis area, and 100 percent of the impaired and monitored waters, as well as perennial streams. The designated Outstanding Waters that would not be covered consist of less than 0.1 mile of Battlement Creek in Zone 2 and approximately 0.1 mile of a tributary to Thompson Creek.

If they are implemented, the combined unrelated NSO stipulations designed to avoid or minimize impacts to other resources, along with the areas closed to leasing, would cover up to 88 percent of the CSWAP areas, 92 percent of the Rule 317B areas, 88 percent of local SWPP areas, 99 percent of the designated Outstanding Waters, and 100 percent of impaired and monitored waters, and perennial streams. The USFS-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.

Impacts from Projected Future Oil and Gas Development

Initial disturbance of 886 acres would be expected from reasonably foreseeable oil and gas development, with the majority falling in Zone 2. Zone 3 would have the second-highest amount of disturbance due to development of the leases. The potential for portions of this disturbance to be off-lease exists where there are restrictive on-lease stipulations.

Water use under Alternative 3 is projected to be approximately 1,152 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to “Industrial” use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 4 (Proposed Action)

This alternative would modify or cancel the 65 leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Draft ROD. Water resources impact parameters are listed for Alternative 4 by RFD Zone in **Table 4.5-6**.

Table 4.5-6 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 4

	Resource Coverage	Alternative 4 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	NSO—Public Water Supply Source Areas	45	7	4	70	0
	Unrelated NSO/CTL	93	100	85	96	89
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	89	No Resource	89	No Resource	No Resource
	Unrelated NSO/CTL	92		92		
Local SWPP Areas[1]	NSO—Public Water Supply Source Areas	98	No Resource	42	99	No Resource
	Unrelated NSO/CTL	99		84	100	
Outstanding Waters	NSO—Water Influence Zones	100	No Resource	100	100	No Resource
	Unrelated NSO/CTL	100		100	100	
Impaired and Monitored Waters	NSO—Water Influence Zones	99	No Resource	99	No Resource	No Resource
	Unrelated NSO/CTL	100		100		

Table 4.5-6 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 4

	Resource Coverage	Alternative 4 Total	Zone 1	Zone 2	Zone 3	Zone 4
Perennial Streams	NSO—Water Influence Zones	100	No Resource	100	100	100
	Unrelated NSO/CTL	100		100	100	100

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be two surface water resources-specific stipulations under this alternative. The area closed to leasing along with the NSO stipulation to limit surface disturbance in Public Water Supply Source Areas within the leases would cover 45 percent of the CSWAP areas, 89 percent of the Rule 317B areas, and 98 percent of the SWPP areas. Coverage of these indicators would be the same as Alternative 3 in Zones 1, 2, and 4. Within Zone 3, additional coverage would be achieved from the areas closed to leasing; 70 percent of CSWAP areas and 99 percent of local SWPPs would be covered in Zone 3. The CSWAP areas not covered in Zone 3 would all be portions of the “far zones,” or greater than 15 miles upstream of the intakes except for less than 200 acres of Silts “near zone” CSWAP, Approximately 200 acres of Carbondale’s SWPP area in Zone 3 leases would not be covered. The NSO stipulations to limit disturbance of Water Influence Zones, when combined with the areas that would be closed to leasing, would cover all of the designated Outstanding Waters and perennial streams. The impaired and monitored waters also would be covered except for a less than 0.1 mile segment of a tributary to West Mamm Creek in Zone 2.

The unrelated NSO stipulations and CTL areas that avoid or minimize impacts to other resources would cover up to 93 percent of the CSWAP areas, 92 percent of the Rule 317B areas, and 99 percent of the SWPP areas. Similar to the specific NSO discussion above, the coverage for these indicators would be the same as Alternative 3 in Zones 1, 2, and 4. The increased coverage in Zone 3 would be due to the addition of areas closed to leasing. The Forest Service-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.Impacts from Projected Future Oil and Gas Development

Initial disturbance of 821 acres would be expected from reasonably foreseeable oil and gas development, with the majority falling in Zone 2. Zone 1 would have the second-highest amount of disturbance due to development of the leases. The potential for portions of this disturbance to be off-lease exists where leases are not cancelled and there are restrictive on-lease stipulations. There would be no on-lease or off-lease surface disturbance to support oil and gas development within the areas of cancelled leases or designated as closed to leasing.

Water use under Alternative 4 is projected to be approximately 1,079 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to “Industrial” use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 5

This alternative would cancel all 65 existing leases requiring: plugging and abandonment of the producing wells; removal of access roads, well pads, and ancillary facilities; and reclamation of all disturbed areas.

Stipulation Coverage

There would be no stipulations because all leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

There would be no future development, because this alternative would cancel all the leases. However, there would be the potential for short-term impacts to surface water that would occur when the existing wells are plugged and abandoned, existing facilities decommissioned, and disturbed areas reclaimed. This disturbance would be temporary and limited to areas already disturbed by oil and gas development. Upon successful reclamation of disturbed areas, the impact to water resources would be expected to be minimal, approaching a condition better than that of the existing disturbed areas.

4.5.1.5 Summary of Impacts

Compared to the No Action Alternative, Alternatives 2 through 5 in general progressively provide increased coverage to surface water resources inside the lease boundaries through stipulations that would limit surface disturbance and minimize erosion and sedimentation. However, the increased coverage to the lease areas may have the opposite impact to the areas outside the leases by causing the disturbance to occur off-lease. Therefore, Alternatives 2 through 4 may increase the risk of impacts to water resources in the areas immediately adjoining the leases, although Alternative 4 would have less increase because of the leases cancelled due to the areas closed to leasing in Zone 3. Alternative 5 would provide the most coverage to water resources, including those outside the lease areas.

4.5.1.6 Cumulative Impacts

Cumulative Impacts Analysis Area

The CIAA for surface water resources is the same analysis area considered for direct and indirect impacts above, and includes all HUC-12 subwatersheds that contain a portion of the lease areas. **Table 3.5-1** lists these subwatersheds.

Past and Present Actions

The primary past and present actions with surface disturbance likely to affect surface water resources include surface disturbance related to mineral development, road construction, and other land development such as ROWs for pipelines, telephone lines, and communication sites. Section 4.1 presents the total quantifiable past and present surface disturbances by CIAA that have contributed to current conditions.

Reasonably Foreseeable Future Actions

As noted in Section 4.1, oil and gas RFFAs would disturb approximately 14,854 acres in the surface water CIAA. Total projected fresh water use for drilling and completion for oil and gas RFFAs is 22,304 acre-feet over a 20-year period.

There are multiple cumulative actions that may have countervailing impacts. Approximately 11,992 acres are proposed for vegetation treatments and fuels reductions in the surface water CIAA. These actions would effectively reduce the demand for water from vegetation through fire- and mechanical- vegetation cover reduction. While these actions have the potential to increase runoff and thus increase erosion and sedimentation for a temporary period, when performed correctly, the treatments can increase water yield to streams (runoff) while maintaining erosion rates at a minimum through vegetation protection practices and erosion and sediment controls.

Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The impacts from the projected future oil and gas development under Alternatives 1 through 5 would combine with surface disturbance effects from reasonably foreseeable oil and gas development likely to occur nearby. The contribution to surface disturbance under each alternative to total oil and gas RFFAs would be less than 3 percent for all alternatives. The types of cumulative impacts to surface water resources would be the same as those listed for past and present actions.

Total projected fresh water use for drilling and completion under Alternatives 1 through 4 range from approximately 1,079 acre-feet to 1,158 acre-feet over the 20-year timeframe of projected development. This fresh water use would combine with the estimated regional fresh water use for oil and gas RFFAs of 22,304 acre-feet over the same 20-year period, resulting in an average total fresh water use over a 20-year period of approximately 1,170 acre-feet per year, using the same assumptions for water recycling and drilling water used to project the water usage under the alternatives' RFD. This cumulative projection is approximately 0.2 percent of the water currently allocated to "Industrial" use in the region, which is 560,000 acre-feet per year.

4.5.2 Groundwater

4.5.2.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for direct and indirect effects consists of the individual lease tracts and the four zones that encompass the leases.

Scoping Issues

Relevant issues and concerns raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development.

- Potential future development of oil and gas leases might result in degradation of groundwater resources.
- Water depletion from drilling, hydraulic fracturing, and production activities may affect long-term availability of existing water sources.
- Groundwater (in particular, drinking water) may be contaminated from chemicals used in drilling and hydraulic fracturing operations, due to the characteristics of the oil/gas formations, aquifer formations, and their interconnectedness.

Assumptions

The following assumptions were used in the analysis of potential impacts to groundwater:

- Future exploration and development proposals would be subject to specific state and federal regulatory and permitting requirements and additional site-specific environmental analysis under NEPA.
- These subsequent analyses would address site-specific water resource conditions, establish appropriate resource protections to minimize adverse impacts, and serve as the basis for any project-level design features or best management practice requirements.
- The analysis assumes compliance with federal and state regulations, policies, and permit conditions. Therefore, while there would be some risk to drinking water from groundwater sources should there be a break in the casing, the extent of the risk cannot be predicted and is assumed to be minimal due to compliance with the regulations.

- Most, if not all, of the aquifers supplying drinking water are alluvial aquifers, as noted in Chapter 3.0, Section 3.5.6.1, which states that the alluvial aquifers have the most productive wells and most wells are concentrated in the alluvial valleys. It is assumed that the deeper aquifers that are near or connected to the oil and gas formations are not the source of drinking water that is protected by the Colorado Source Water Assessment and Protection (CSWAP) area designations due to their general poor water quality.

Impact Indicators

Impact indicators include the following metrics:

- The extent of development in areas where groundwater resources are potentially susceptible to degradation (see Aquifer Sensitivity in **Figure 3.5-6**). As noted in Section 3.5.6.2, Zones 1 and 4 leases have the greatest extent of high aquifer sensitivity, Zone 2 is primarily in an area with low aquifer sensitivity, and Zone 3 is primarily medium sensitivity. Impacts would be most severe in an area with high aquifer sensitivity, large areas of projected future oil and gas development, and few lease stipulations that would minimize adverse impacts.
- The extent of impacts that may result in potential degradation of groundwater resources, based on information collected from the intensive monitoring in the region conducted by federal, state, and local governments and private entities for over a decade.
- Potential impacts to groundwater sources in SWAP areas.

Methods of Analysis

The methods of analysis include the review of available information on groundwater quality and oil and gas activities, and an assessment of the risks that those activities may degrade aquifers. In addition, the analysis involves the identification of leasing stipulations for other resources that would be in place to protect groundwater resources under each alternative if groundwater stipulations are absent or insufficient.

4.5.2.2 Stipulations Providing Coverage to Groundwater Resources

There are no stipulations developed specifically to protect groundwater in the 1993 Oil and Gas Leasing Final EIS (USFS 1993a). Therefore, there are no groundwater stipulations to be considered for Alternatives 1 and 2. In the 2014 WRNF Oil and Gas Leasing Final EIS (Appendix A, USFS 2014a), a CSU stipulation was developed for the coverage of groundwater resources:

> *Where specific groundwater resources exist, special design, construction, operation, mitigation, or monitoring may be required. Mitigation may include use of contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface will not be allowed.*

There is a NSO stipulation developed to protect Public Water Supply Source Areas. The coverage of this stipulation related to the state-designated CSWAP areas and local SWPP areas within the leases is addressed in Section 4.5.1, Surface Water, because it protects both surface water and groundwater sources. This analysis is not repeated in this section. Timing stipulations are not considered in the analysis because these stipulations would not affect groundwater.

4.5.2.3 Impacts Common to All Alternatives

This discussion refers to Alternatives 1 through 4, but not to Alternative 5 because no drilling or development would be allowed under that alternative.

Potential impacts from oil and gas drilling and production that could occur are listed below:

- Depletion of groundwater resources due to well drilling and completions.
- Accidental spills of hydrocarbons, fuels, or chemical additives used in the well drilling and completion process on the surface. Spills from surface activities would pose the highest risk to shallower groundwater because deeper aquifers would generally be hydraulically isolated.
- Subsurface contamination of groundwater from drilling and completion. Effects could occur through loss of well integrity due to breaches in mechanical, physical, and engineered barriers designed to direct or contain subsurface fluids in drilling or completion operations of the wells.

Aquifers that could be potentially at risk from contamination are Underground Sources of Drinking Water under the Safe Drinking Water Act. Underground Sources of Drinking Water is defined by the USEPA as "an aquifer or portion of an aquifer that:

- Supplies any public water system or that contains a sufficient quantity of ground water to supply a public water system, and
- Currently supplies drinking water for human consumption, or
- Contains fewer than 10,000 milligrams per liter total dissolved solids and is not an exempted aquifer" (USEPA 2012a).

There is a low risk of depletion of groundwater resources by oil and gas well drilling because fresh water for drilling is obtained primarily from surface water sources. In addition, recycling of hydraulic fracturing water of up to 100 percent was reported in the Colorado River basin in 2013 (USEPA 2015d). Although recycling may vary depending on infrastructure and technology used by different operators, recycling rates reported by the USEPA of 80 to 100 percent are indicative that it is possible to achieve such rates. The recycling rates apply to water used for hydraulic fracturing. It is possible that drilling may have to rely on fresh water to maintain drilling fluid quality and consistency that might be compromised by the use of recycled hydraulic fracturing water. According to the development assumptions of Section 2.7.3, an average 0.77 acre-feet of fresh water would be used to drill a vertical or directional well and 6.44 acre-feet of recycled water would be used during well completion. An average of 3.22 acre-feet of fresh water and 77.3 acre-feet of recycled water would be used to drill and complete a horizontal well, respectively. In addition, 4.9 acre-feet and 9.67 acre-feet of produced water is assumed to be recovered from each vertical/directional and horizontal well, respectively, during its 20- to 30-year life.

Sources of potential groundwater contamination include leaks and spills of fluids such as fuels from storage containers, transportation accidents, leaks from impoundments, and well integrity breaches. Likely groundwater sources to be affected would be the near-surface alluvial aquifers because they are shallow, unconfined, and composed of materials that transmit fluids more easily than the solid rock that separates deeper aquifers.

In order to minimize the risk of contaminating shallow aquifers due to leaks and spills, the transportation, storage, and disposal of fuels and chemicals would be done in accordance with regulatory requirements of applicable federal and state programs. In addition, operators would maintain and implement Spill Prevention, Control, and Countermeasure (SPCC) plans for petroleum-based materials and emergency response plans for non-petroleum materials (various ingredients of fracturing fluids and well treatment chemicals).

Hydraulic fracturing has been implicated as a potential source of groundwater contamination. However to date, no contamination has been attributed to hydraulic fracturing in the analysis area (USFS 2014a). Well integrity problems rather than hydraulic fracturing appear to pose a greater risk of causing groundwater contamination (COGCC 2011). The COGCC recently strengthened rules to increase

protection of groundwater from oil and gas operations, including stricter casing and cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

A draft report recently released by the USEPA assesses the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. While specific instances where one or more mechanisms associated with hydraulic fracturing were identified as having impacted drinking water, the study did not identify widespread, systematic impacts on drinking water from mechanisms associated with hydraulic fracturing (USEPA 2015c).

Public concern about the use of hydraulic fracturing has been focused on the potential for contamination of freshwater aquifers and impacts to domestic and municipal water supplies. Hydraulic fracturing would be conducted to stimulate the hydrocarbon-bearing formation, creating additional pathways to facilitate hydrocarbon production. Agents called “proppants” (typically sand, aluminum, glass, or plastic beads with less than 1 percent of other compounds) are mixed with fresh water or produced water and then pumped into the producing formation with sufficient hydraulic pressure to create secondary porosity fractures. The proppants then prop open the secondary porosity fractures to facilitate gas and fluid movement to the borehole. Following completion of hydraulic fracturing activities, the pressure differential between the formation due to the overlying bedrock and the borehole that connects with the surface causes most of the injected fluids to flow toward the borehole and then upward to the surface along with the hydrocarbon fluids released from the formation. The composition of this mixture, called flowback water, gradually shifts over a period of several days to a few months as injected fluids that have not yet migrated back to the wellbore or that have reacted with the native rock are carried out of the formation.

In 2011, the COGCC published an analysis of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph:

> *Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing.*

Based on this information, proper implementation of hydraulic fracturing of oil and gas wells drilled to access federal fluid minerals or for accessing private fluid minerals from federal surface lands does not represent a significant adverse impact to human health and the environment.

Well integrity problems rather than hydraulic fracturing appear to pose a greater risk of causing groundwater contamination (COGCC 2011). Drilling scenarios are developed to prevent fluids and produced hydrocarbons from migrating upward into fresh water zones. Geologic and engineering reviews are conducted to ensure that the cementing and casing programs are adequate to protect all downhole resources. The COGCC recently strengthened rules to increase coverage of groundwater from oil and gas operations, including stricter casing and cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

In addition to the vertical separation of the upper extent of fractures and freshwater aquifers, the BLM and COGCC require the proper casing and cementing of wellbores to isolate aquifers penetrated by a wellbore. The BLM requires that surface casing be set from 800 to 1,500 feet deep, based on a

geological review of the formations, aquifers, and groundwater. Cement is then pumped into the space between the casing and surrounding rock to prevent fluids from moving up the wellbore and casing annulus and coming in contact with shallow rock layers, including freshwater aquifers. BLM petroleum engineers review well and cement design and final drilling and cementing logs to ensure that the cement has been properly placed. When penetration of groundwater and freshwater aquifers is anticipated, BLM inspectors may witness the cementing of surface casing and subsequent pressure testing to ensure that the annular space between the casing and borehole wall is properly sealed.

Potential impacts to groundwater resources from the proposed development would include contamination of the groundwater with produced water, drilling mud, and petroleum constituents. With proper construction practices, drilling practices, and BMPs, no significant adverse impact to groundwater aquifers is anticipated to result from future oil and gas development. For context, it should be noted that the amount of each zone projected to be disturbed for reasonably foreseeable oil and gas development is very small compared to the extent of the coverage by NSO and CSU stipulations. This comparison is presented in the tables in the following sections.

Impacts Identified in the WRNF Final EIS

The WRNF Final EIS identified potential adverse impacts to groundwater from future oil and gas development as inadvertent releases of chemicals through spills, contamination due to improperly cased and sealed wells, or due to releases from improperly constructed or maintained reserve pits (USFS 2014a, p. 92). The WRNF Final EIS states that oil and gas development and production typically do not have a significant adverse effect on groundwater quantity (USFS 2014a, p. 92). Because the oil and gas target formations are hydraulically isolated from the shallow aquifers it is unlikely that hydraulic fracturing would adversely affect underground sources of drinking water (USFS 2014a, p. 93).

The WRNF Final EIS states that use of Colorado River water is not expected to deplete the shallow groundwater supplying springs and seeps. It also points out that acquisition of fresh water from commercial sources for hydraulic fracturing and other drilling and completion stages would supplement local groundwater sources to minimize consumptive use and the resulting groundwater depletion (USFS 2014a, p. 144).

4.5.2.4 Impacts by Alternative

Alternative 1 (No Action Alternative)

Stipulation Coverage

Table 4.5-3 lists the percentage of state CSWAP and local SWPP areas that would be covered by all NSO stipulations under Alternative 1, which includes 100 percent of the CSWAP areas within Zone 1, 33 percent of the CSWAP areas and 42 percent of the SWPP areas within Zone 2, and 8 percent of the CSWAP areas and 9 percent of the SWPP areas in Zone 3 and 2 percent of the CSWAP areas in Zone 4. These CSWAP and SWPP areas were designated to assess the risk and protect groundwater supplies to local communities and the public. However, the exact source of the water, whether to protect shallow or deep aquifers supplying drinking water, is not always available from the CDPHE for security reasons.

Table 4.5-7 lists CSU and NSO stipulations for all resources under Alternative 1. There are no stipulations specifically designed to minimize adverse impacts to groundwater resources under this alternative, so the table presents the stipulations for all resources with the assumption that, should these stipulations be implemented, they also would minimize impacts to groundwater especially where NSO would be allowed within the leases. It should be noted that an NSO stipulation on the lease would most likely move the disturbance off the lease, but the location would be unknown at this time.

Table 4.5-7 CSU and NSO Stipulations for all Resources under Alternative 1

Zone	Total Acres	CSU (% of Zone)	NSO (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	0.8
2	24,938	5	39	2.7
3	42,767	8	8	0.3
4	2,562	0	3	0.8
Total	**80,381**	**6**	**29**	**1.1**

[1] See **Table 2-8** for the source of this information.

Potential impacts to groundwater under Alternative 1 would be the same as discussed above for impacts to all alternatives. In the absence of specific groundwater stipulations, the stipulations developed to minimize adverse impacts to other resources may offer some groundwater source coverage if the stipulation is extensive enough and in force. As shown in **Figure 3.5-8**, the lease zones cover areas of varying degrees of aquifer sensitivity to potential contamination. Zones 1, 3, and 4 are underlain by areas rated medium to high aquifer sensitivity. The stipulations for other resources may provide a degree of coverage, mainly in Zone 1 where the stipulation coverage is greatest. The stipulations in Zones 3 and 4 would provide less coverage of groundwater resources. Zone 2 is mainly underlain by areas that are rated low to medium sensitivity that may need less coverage. Unless stipulations for other resources have extensive coverage, they may not offer sufficient coverage for groundwater because groundwater protection has elements that are technology- or engineering-based such as closed-loop drilling mud systems and fuel containment.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-7**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development of SWAP areas, the risk of impacts to groundwater resources would be minimal.

Alternative 2

Stipulation Coverage

As noted in **Table 4.5-4**, Zones 1, 2, and 4 would have the same coverage to state CSWAP and local SWPP areas as Alternative 1; 9 percent of the state CSWAP areas (1percent more than under Alternative 1), and 10 percent of the local SWPP areas (1 percent more than Alternative 1) within the leases would be covered by stipulations in Zone 3, which includes the Oak Meadows, Carbondale, and Glenwood Springs water sources.

Table 4.5-8 lists CSU and NSO stipulations for all resources under Alternative 2.

Table 4.5-8 CSU and NSO Stipulations for all Resources under Alternative 2

Zone	Total Acres	CSU (% of Zone)	NSO (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	0.8
2	24,938	5	39	2.7
3	42,767	10	9	0.3
4	2,562	0	3	0.8
Total	**80,381**	**7**	**30**	**1.1**

[1] See **Table 2-8** for the source of this information.

Impacts from Projected Future Oil and Gas Development

The analysis of groundwater impacts for Alternative 2 would be similar to Alternative 1 except that there would be slightly more coverage by stipulations in Zone 3 due to increased total NSO acreage.

Alternative 3

Stipulation Coverage

Under Alternative 3, there are CSU stipulations that are designed to protect groundwater resources. **Table 4.5-9** compares the groundwater CSU stipulation coverage with that of stipulations for all resources under Alternative 3. Although the extent of the other stipulations would appear to provide adequate coverage of groundwater sources, technology- and engineering-based measures to protect groundwater resources cannot be implemented through the other stipulations. As noted in **Table 4.5-5**, 7 percent of CSWAP areas in Zone 1, 4 percent of the CSWAP areas and 42 of the SWPP areas in Zone 2, and 9 percent of the CSWAP areas and 8 percent of the SWPP areas in Zone 3 would be covered by the NSO stipulation designed to protect public water supply source areas. In addition to the NSO stipulation coverage of SWAP areas, under Alternative 3 there is a CSU stipulation to protect groundwater resources that WRNF may implement to require special analysis and mitigation plans where specific groundwater resources exist. Special design, construction, operation, mitigation, or monitoring may be required (USFS 2014a, Appendix A, p. 498.) This CSU stipulation also would cover 1,390 acres of the Carbondale Crystal Well SWPP area, approximately 1 acre of the Oak Meadows SWPP area.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-9**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development of SWAP areas, the risk of impacts to groundwater resources would be minimal.

Table 4.5-9 Comparison of Groundwater CSU Stipulations Under Alternative 3 to all CSU and NSO Stipulations

Zone	Zone Total (acres)	Groundwater Resource CSU Stipulation (% of Zone)	CSU of all Resources (% of Zone)	NSO of all Resources (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	100	0.8
2	24,938	5	100	87	2.7
3	42,767	3	100	86	0.2
4	2,562	3	100	99	0.8
Total	**80,381**	**3**	**100**	**89**	**1.1**

[1] See **Table 2-8** for the source of this information.

Alternative 4 (Proposed Action)

Stipulation Coverage

Table 4.5-10 compares the groundwater CSU stipulation coverage with that of the stipulations for other resources under Alternative 4. Compared to Alternative 3, additional acreage would be CTL under Alternative 4. The CTL acreage is included with the NSO percentage in **Table 4.5-10** and applies only to Zone 3. Closing the leases is likely to provide additional limitations to minimize adverse impacts to groundwater sources (SWAP areas) in Zone 3 because no development could occur to access those leases, whether on-lease or off-lease. This would be more restrictive than implementation of NSO stipulations. As under Alternative 3, the measures to minimize potential impacts to groundwater resources may be dependent on engineering and technology measures that may not be implemented by relying on stipulations for other resources. As noted in **Table 4.5-6**, coverage of the combination of areas closed to leasing and NSO stipulation designed to protect public water supply source areas in Zones 1, 2, and 4 would be the same as Alternative 3. Zone 3 coverage would increase to 70 percent of the CSWAP areas and 99 percent of the SWPP areas. Existing leases within Zone 3 would be further protected by the cancellation of all or part of 25 leases under this alternative, precluding any future oil and gas development. This lease cancellation and closure to leasing of the surrounding area in the WRNF within a large part of Zone 3 would further minimize adverse impacts to the CSWAP and SWPP areas compared to Alternative 3.

Table 4.5-10 Comparison of Groundwater Stipulations Under Alternative 4 to all CSU and NSO Stipulations and CTL Areas

Zone	Zone Total (acres)	Groundwater Resource CSU Stipulation (% of Zone)	CSU of all Resources (% of Zone)	NSO/CTL of all Resources (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	100	0.8
2	24,938	5	100	87	2.7
3	42,767	3	100	95	0.1
4	2,562	3	100	99	0.8
Total	**80,381**	**3**	**100**	**93**	**1.0**

[1] See **Table 2-8** for the source of this information.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-10**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development within CSWAP and SWPP areas, the risk of impacts to groundwater resources would be minimal.

Alternative 5

There would be no stipulations in effect for the coverage of groundwater resources. Plugging, abandonment, and reclamation activities would be conducted in accordance with federal and state requirements for spill prevention and containment. Once reclamation is completed, there would be less potential to adversely affect groundwater under this alternative because no oil and gas development would occur from this action. Alternative 5 would have the least potential to adversely affect groundwater resources because oil and gas drilling and development would not occur.

Summary of Impacts

There are no groundwater coverage stipulations in Alternatives 1 and 2. It may be possible that stipulations for other resources may offer some coverage for groundwater, but stipulations for other resources may not be adequate. Protection of groundwater resources would rely on operators' compliance with federal and state requirements.

Alternatives 3 and 4 have a groundwater stipulation that covers limited areas of potential concern. Stipulations for other resources would not be adequate to protect groundwater because they do not contain the technological and engineering controls necessary to lower the risk of contamination. Alternative 4 provides more potential coverage for groundwater when taking into account the leases that would be canceled and closed to future leasing.

4.5.2.5 Cumulative Impacts

Cumulative Impacts Analysis Area

Cumulative effects area would extend to water resources that may be affected by oil and gas development on the leases and within a 2-mile buffer around the leases analyzed for direct and indirect effects.

Past and Present Actions

Past and present activities are described in detail in Section 4.1. In the region, groundwater has been and is beneficially used for agricultural, commercial, domestic, industrial, municipal, recreational, and wildlife purposes. In the WRNF, groundwater is primarily used for domestic (special-use-permit holders, campgrounds, and administrative sites), wildlife, livestock, and ecosystem support (groundwater discharging as springs to wetlands and streams). While not a major source of water in the WRNF, groundwater, where used, is primarily for domestic purposes. The water quality is generally good but can be highly mineralized (USFS 2014a).

Some groundwater from deep in the Mesaverde formation is produced from existing natural gas wells. This water obtained at great depth (nearly 8,000 feet below the ground surface) is typically of very poor quality, and not considered usable to support wetlands, stream flow, aquatic life, or human uses. This water is generally managed by disposing of it at certified disposal wells or other facilities off the WRNF.

One water disposal well in the WRNF in the Divide Creek area receives water from on-Forest gas production from wells within the Divide Creek Unit. The produced water from these wells is injected into a deep horizon about 8,000 feet below the ground surface. The deep strata where produced water is being

withdrawn or injected is not known to be in hydraulic communication with near-surface strata providing water for on-Forest uses.

Reasonably Foreseeable Future Actions

Groundwater consumption and development is anticipated to increase; thereby decreasing groundwater resources. Industrial use, including from oil and gas development, is anticipated to increase on federal, state, private and other lands within and adjacent to the WRNF. According to the RFDS of the region, a total of 330 acre-feet of fresh water and 2,750 acre-feet of recycled water will be used to drill and complete, respectively, vertical or directional wells. A total of 55 acre-feet of fresh water and 1,310 acre-feet of recycled water will be used to drill and complete, respectively, horizontal wells. In addition, 2,090 acre-feet and 80 acre-feet of produced water is assumed to be recovered from the vertical/directional and horizontal wells, respectively, during their 20- to 30-year lives.

Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The oil and gas industry's reliance on surface water resources and recycling of fracturing fluids and/or produced water rather than the use of fresh groundwater resources would cause little cumulative impact on groundwater availability. As stated in the WRNF Final EIS oil and gas development and production typically do not have a significant adverse effect on groundwater quantity (USFS 2014a, p. 92). Because the oil and gas target formations are hydraulically isolated from the shallow aquifers it is unlikely that hydraulic fracturing would adversely affect underground sources of drinking water (USFS 2014a, p. 93).

With an anticipated increase in wells and water use, the failure of wells in the region – not just those related to oil and gas development – could increase the communication between surface water and groundwater, thereby increasing the risk of water contamination. In addition, increased activity in the CIAA would increase the risk of spills and groundwater contamination. As noted in the WRNF Final EIS (USFS 2014a), potential drilling of natural gas or oil wells could affect groundwater resources in discrete areas, particularly if unintended spills or well failures occur. Compliance with stipulations, BMPs, and existing rules and regulations would combine to reduce the potential of groundwater contamination. Further, the likelihood that an unintended release would occur simultaneously with another event that could exacerbate or be exacerbated by a release is low and unlikely to create a cumulative effect.

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4.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

This section addresses the potential impacts of reasonably foreseeable oil and gas development within the leases on vegetation resources including vegetation cover types, wetland and riparian habitats, special status plant species and significant plant community habitats, and the potential for establishment and spread of noxious and invasive weeds (collectively referred to as "vegetation"). The future oil and gas development analyzed for each alternative is based on the RFDS projections that are anticipated to follow the leasing decision under each alternative. Section 3.6.2 lists the vegetation cover types, defines special status plant species and significant plant communities, and describes each habitat type in more detail.

4.6.1 Analysis Assumptions and Approach to Analysis

4.6.1.1 Analysis Areas

For vegetation resources there are two separate analysis areas: general vegetation analysis area and special status plant species analysis area.

The general vegetation analysis area is comprised of the 65 leases (lease area), which are divided into four zones. The general vegetation analysis area applies to vegetation communities, riparian/wetland habitats, and noxious weed analyses and encompasses approximately 80,380 acres.

The special status plant species analysis area is defined as the lease area (Zones 1, 2, 3, and 4) plus a 300-meter extension beyond the edge of the lease boundary (off-lease area). The special status plant species analysis area applies to both special status plant species suitable habitats and significant plant community habitat analyses and encompasses approximately 110,768 acres.

4.6.1.2 Scoping Issues

Scoping issues identified for vegetation cover types, noxious weeds, and riparian/wetland habitats to be considered include:

- Remediation of forested areas and concern about effectiveness of management plans.
- Maintenance of plant diversity along wildlife corridors and key wildlife areas.
- Impacts on already existing fire-prone conditions, especially Gambel oak shrublands.
- Maintenance of existing conservation easements.
- Habitat fragmentation and the establishment of noxious weeds, especially along the Thompson Divide area (riparian and instream habitat especially).
- Impacts of noxious weeds on threatened and endangered species.
- Concerns over hydrological changes and impacts to wetlands and riparian areas.

Scoping issues identified for special status plant species and significant plant communities to be considered include:

- Impacts to special status plants, especially within the area locally known as the Thompson Divide.
- Threats to DeBeque phacelia due to natural gas development.
- Cumulative impacts to rare plant species.

- Inadequate protections for rare plant species.
- Need for field surveys to identify special status plants prior to leasing.

While many of the above issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. All issues listed above would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

4.6.1.3 Assumptions

Assumptions were made concerning the impacts of making lands available to lease for oil and gas exploration and development as they relate to vegetation as a whole.

Assumptions for general vegetation communities, noxious weeds, and riparian/wetland habitats include:

- The RFDS included disturbance acreages and development assumptions for wells, pipelines and road by zone.
- Forest Service vegetation data (FSVeg) and National Wetland Inventory are used to represent the vegetation communities and riparian/wetland habitat in the analysis area, and are the basis for modeled potential habitat.
- All future development would need to be compliant with the WRNF LRMP, GMUGNF LRMP, GJFO RMP, and CRVFO RMP (for development on adjacent BLM lands due to WRNF NSO stipulations).
- Adverse impacts to vegetation could occur during or after initial disturbance. Impacts also could occur as a result of the continued use, maintenance, or reclamation of any resulting infrastructure.
- There is a likelihood of noxious weeds spreading and/or proliferating as disturbance expands.
- All non-resource-specific NSO stipulations would minimize impacts to vegetation resources if implemented. It is not assumed that CSU or TL stipulations not specific to vegetation resources would reduce impacts to general vegetation communities, noxious weeds, and riparian/wetland habitats.

Assumptions for special status plant species and significant plant communities include:

- Areas where sensitive plant species and significant plant communities may exist are modeled and may not be based on known occurrences. Botany surveys would be required to be performed by a qualified botanist during appropriate survey periods for all potential special status plant species prior to any ground-disturbing activity.
- The decision to make lands available for leasing could lead to future oil and gas development. The impacts from that development would not be realized until a later time under a separate decision at the APD stage of permitting, and would require site-specific NEPA analysis.
- The decision whether to make lands on the WRNF available to lease for potential future oil and gas exploration and development could result in future development on adjacent BLM, state, and private lands. Therefore, adverse impacts to rare plants could be realized on lands other than the NFS lands when leased fluid minerals are accessed from surface locations off-lease. Because the off-lease locations are unknown at this time, the impacts to vegetation cannot be quantified.

- All future development activities would need to be compliant with the WRNF LRMP, GMUGNF LRMP, GJFO RMP, and CRVFO RMP (for development pushed off onto adjacent BLM lands due to WRNF NSOs.
- Water depletions associated with well drilling can affect downstream river flows and the availability of water for Ute ladies' tresses.
- Adverse impacts to rare plants could occur during or after initial disturbances. These impacts also could occur as a result of the continued use, maintenance, or reclamation of any resulting infrastructure. This infrastructure could remain on the landscape for up to 30 years with additional time necessary to achieve full reclamation.
- All non-resource-specific NSO stipulations would minimize impacts to special status plant species and significant plant communities if implemented.

In addition to the assumptions listed above, it is assumed that all operators will comply with laws and regulations (e.g., CWA, Endangered Species Act [ESA], etc.) and the analysis assumes implementation of all laws and regulations.

4.6.1.4 Impact Indicators Used for Analysis

Impact indicators identified to analyze the effects of the alternatives on vegetation communities, noxious weeds, and riparian/wetland habitats include:

- Vegetation communities: acre (percent) of surface disturbance by vegetation type and alternative
- Riparian/wetland habitats: acre (percent) of wetland habitat that may be degraded or lost, by alternative
- Noxious weeds: Qualitative and quantitative (acres and percent of surface disturbance) analysis

Impact indicators for special status plant species and significant plant communities include:

- The extent of potential adverse impacts to special status plant species and significant plant communities from reasonably foreseeable oil and gas development is compared by alternative by calculating the estimated acres and percentage of the following habitats that may be degraded or lost.
  - Potential habitat for federally listed, BLM, and Forest Service sensitive plant species
  - Critical habitat for federally listed species
  - Presence of known individuals or populations within the analysis area
- The potential for adverse impacts to special status plant species and significant plant communities is compared by alternative by calculating the estimated acres and percentage of the areas where sensitive plant species habitat would overlap with NSO areas. The assumption would be that NSOs, even if not developed to address these species, would still minimize impacts to special status plant species and significant plant communities by limiting surface disturbance.

4.6.1.5 Methods of Analysis

Methods of analysis for general vegetation communities, noxious weeds, and riparian/wetland habitats include the following for each alternative:

Vegetation Communities

- Identify vegetation community types within the lease area.
- Identify stipulations by alternative that pertain to specific vegetation communities (some are NSO, some are CSU).
- Identify acres of impact per lease zone using surface disturbance projections contained in Chapter 2.0.
- Estimate acres of impact per zone to calculate percentage of each vegetation community's approximate disturbance under each alternative.

Riparian and Wetland Habitats

- Same as vegetation communities' methodology (above), with consideration of fen and other riparian/wetland NSO and CSU stipulations.

Noxious Weeds

- Noxious weed analysis is addressed qualitatively based on the assumption that where more acreage of disturbance and vehicle access is projected, there is a greater likelihood of noxious weeds spreading and establishing.
- Identify weed prevention and treatment management practices that would be applied to all leases and ground-disturbing activities within the lease area.
- Identify reclamation/restoration requirements that would be applied to all leases and ground-disturbing activities within the lease area.

Special Status Plant Species and Significant Plant Communities

- Identify rare plant potential habitat within the lease area.
- Disclose acres of each lease without NSO stipulations in each type of rare plant habitat to identify those locations that may be open to surface disturbance.
- Identify acres of potential surface disturbance per lease zone using surface disturbance projections contained in Chapter 2.0.
- Estimate acres of impact to calculate the percentage of each sensitive species' modeled habitat's approximate disturbance per lease from reasonably foreseeable oil and gas development.

4.6.2 Stipulation Coverage of Vegetation Resources

In order for oil and gas leasing within the analysis area to be consistent with environmental laws and regulations, this analysis considers proposed lease stipulations to reduce potential impacts of oil and gas development on vegetation communities, riparian/wetland habitats, and special status plants and significant plant communities. There are no specific lease stipulations related to noxious weeds. The methodology in developing stipulations is discussed in Section 1.4.6, "Lease Stipulations," and the rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS. The definition of the resource and purpose of the stipulation is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS and in Appendix B of the 1993 Final EIS. The definition of the resource and purpose for GMUGNF resources is identified on each stipulation form in Appendix C of the 1993 GMUGNF Oil and Gas Leasing Plan Amendment.

The following subsections identify the NSO and CSU stipulations that were included in the WRNF 1993 Alternative (Alternative 1, the No Action Alternative) and those proposed under the action alternatives to reduce potential disturbance impacts of oil and gas development on vegetation communities,

riparian/wetland habitats, noxious weeds, and special status plant species and significant plant communities. There are no TL stipulations associated with vegetation.

Standard lease terms allow for reasonable measures that may be required to minimize adverse impacts to other resource values, land uses, or land users. Standard lease terms are described in more detail in Section 1.1.5.1.

4.6.2.1 Resource-specific Stipulations

Table 4.6-1 identifies five NSO and three CSU stipulations specific to vegetation resources. Only the Riparian/Wetland – GMUGNF NSO stipulation applies to Alternatives 1 and 2. All other NSO and CSU stipulations apply to Alternatives 3 and 4 only. There are no TL stipulations associated with vegetation resources.

Table 4.6-1 Vegetation Resource-specific Stipulations

Stipulation	Alternatives 1 and 2[1, 3]	Alternatives 3 and 4[2, 3]
NSO		
Alpine	N/A	X
Fen Wetlands		X
Water Influence Zones (WIZ)		X
Threatened, Endangered, Proposed and Candidate (TEPC) Plant Species Populations and Habitats		X
CSU		
Spruce-Fir Old Growth and Old Growth Recruitment Stands	N/A	X
Plant Species of Local Concern, including Significant Natural Plant Communities		X
Sensitive Plant Species		X

[1] Alternatives 1 and 2 have the same stipulations.

[2] Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

[3] Under Alternatives 1,2, 3, and 4, the Riparian/Wetland GMUGNF NSO stipulation would be applied to approximately 2.9 acres of GMUGNF-managed lands within the leases. This comprises about <0.1 percent of the Analysis Area. The stipulations under consideration in this EIS would not be applied to this acreage.

Definitions: NSO: No Surface Occupancy; CSU: Controlled Surface Use.

NSO Stipulations

The Alpine NSO stipulation would preclude surface disturbance in alpine habitats for the purpose of preventing significant or permanent impairment to alpine vegetation and preventing impacts to rare plant and wildlife species dependent on alpine habitats. There are no exceptions or waivers associated with this stipulation. A modification may be granted if an environmental analysis demonstrates, through specific surveys, that the area of proposed activities is not alpine habitat (Appendix A, USFS 2014a). Under Alternatives 1 and 2, Alpine NSO is unchecked because alpine habitat is not identified within the lease area.

The Fen Wetlands NSO stipulation precludes surface disturbance in all areas within 330 feet of fen wetlands within the leasing area in order to maintain species richness, plant diversity, soil nutrient levels, water budgets, and flow patterns to fen wetlands in order to sustain their ecological function. There are

no exceptions for this stipulation. A modification may be granted if an environmental analysis determines that the wetland is not a fen wetland. However, it should be noted that the NSO stipulation for WIZ (floodplains, streams, wetlands, lakes, or naturally occurring ponds) may still apply to these areas. A waiver may be granted if an environmental analysis determines that the areas mapped as fen wetlands in the entire leasehold do not possess wetland attributes (Appendix A, USFS 2014a).

The WIZ (Stream, Lakes, Floodplains, Wetlands or Naturally Occurring Ponds) NSO stipulation precludes surface disturbance in all areas within a minimum horizontal width of 100 feet from each side of the water-dependent features, but may be wider in areas with well-developed floodplains. An exception may be granted if an environmental analysis finds the nature of the Proposed Action could be conditioned so as not to negatively impact the water resources identified. Consideration must include the degree of slope, soils, importance of the amount and type of wildlife and fish use, water quality, riparian vegetation, and other related resource values. A modification may be granted if an environmental analysis determines that project design or mitigation measures can be used to prevent impacts to WIZ. Consideration must include the variability in terrain, degree of slope, soils, importance of the amount and type of wildlife and fish use, water quality, riparian vegetation, and other related resource values. If wetlands are present, no exceptions or modifications would be granted unless compliance can be demonstrated with Executive Order (EO) 11990. A waiver may be granted if an environmental analysis determines that the areas mapped as WIZ in the entire leasehold do not possess those attributes (Appendix A, USFS 2014a).

The TEPC Plant Species Populations and Habitats NSO stipulation precludes surface disturbance of occupied and potential habitats necessary for the maintenance or recovery of species listed under the ESA (including proposed and candidate species) or by the State of Colorado as threatened or endangered. An exception may be granted if an environmental analysis demonstrates that the activity would have negligible impacts and would not cause adverse effects to species or their critical habitats. If an exception is granted, monitoring, special design, construction, and implementation measures, including relocation of operations by more than 200 meters (656 feet), may be required. In such situations that an exception may be granted, the activity would be subject to additional COAs and reclamation standards to ensure resource values are maintained. Granting of an exception is a discretionary action, which the operator should not routinely expect. A modification may be granted if an environmental analysis determines that the species has relocated; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or recovery of the species. If a species is delisted, the stipulation will continue to apply for 5 years after de-listing to satisfy monitoring requirements. Other requirements will apply if the species remains classified as sensitive, or is otherwise protected. A waiver may be granted if an environmental analysis determines that the species is delisted, becomes extinct or if the site has been unoccupied by the species for a minimum period of 15 years (Appendix A, USFS 2014a). Under Alternatives 1 and 2, TEPC Plant Species Populations and Habitats NSO is unchecked because populations are not mapped. This stipulations would be addressed during site specific NEPA.

As noted in **Table 4.6-1**, A Riparian/Wetland – GMUGNF NSO stipulation, applied to about 3 acres of the lease area, precludes surface disturbance in wetlands and floodplains per EOs 11990 and 11988, respectively, within the GMUGNF. The purpose of the EOs is to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and floodplains and to avoid new construction in wetlands wherever there is a practical alternative. Additionally, it is recognized that there is a direct relationship between impacts on wetlands and floodplains and effects on water quality and aquatic ecosystems. There is a high risk of irreversible and irretrievable impacts on aquatic ecosystems with operations and development in wetlands, floodplains, and riparian areas within the GMUGNF. Waivers, exceptions, or modifications for this stipulation would be considered if it can be shown through environmental analysis and the application of mitigation measures that the impacts to wetlands, floodplains, and riparian resources will be minimized and that no

other alternative route for a road or pipeline is feasible because of environmental effects (Appendix C, USFS 1993b). In such cases, the NSO stipulation for WIZ may still apply to portions of these areas.

CSU Stipulations

The Spruce-Fir Old Growth and Old Growth Recruitment Stands CSU stipulation is applied to maintain spruce-fir old growth and old growth recruitment stands through the retention of ecological functions of old growth spruce-fir forests and conservation of spruce-fir old growth recruitment forest stands. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the old growth or old growth recruitment stands. A modification may be granted if an environmental analysis determines that the old growth or old growth recruitment stands have decreased through natural causes (e.g., wildland fire, insects, blowdown, etc.); or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the old growth or old growth recruitment stands. There are no waivers associated with this stipulation (Appendix A, USFS 2014a).

The Plant Species of Local Concern CSU stipulation is applied to maintain and manage viable and well-distributed habitats for all existing native and desired nonnative plants, including significant natural plant communities. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. A modification may be granted if an environmental analysis determines that the species is no longer present; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the species and would minimize or eliminate threats affecting the status of the species. A waiver may be granted if an environmental analysis determines that the species is no longer designated as a Species of Local Concern or if the site has been unoccupied by the species for a minimum period of 15 years (Appendix A, USFS 2014a).

The Sensitive Plant Species CSU stipulation is applied to avoid disturbance to sensitive plant species and significant natural plant communities that would result in a trend toward federal listing or loss of viability. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. A modification may be granted if an environmental analysis determines that the species is no longer present; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the species and would minimize or eliminate threats affecting the status of the species. A waiver may be granted if an environmental analysis determines that the species is no longer designated as Forest Service sensitive or if the site has been unoccupied by the species for a minimum period of 15 years. (Appendix A, USFS 2014a)

4.6.2.2 All Other NSO Stipulations

Implementation of other (non-vegetation resource) NSO stipulations may minimize impacts to vegetation resources from potential surface-disturbing impacts. Depending on the alternative, these may include, but are not limited to geology/soils (steep slopes and sensitive soils), water resources and aquatic habitat (WIZ), and wildlife (sensitive habitat). However, if the resources these stipulations were designed to address are not found to occur on the leases, the coverage provided by these stipulations to vegetation resources would not be realized. The degree of coverage from the implementation of all NSO stipulations would therefore be overestimated if not all stipulations are implemented.

4.6.3 Impacts Common to All Alternatives

This analysis focuses on potential future surface-disturbing impacts to vegetation resources that could result from making lands available to lease or plugging and abandoning active wells. Surface-disturbing activities from oil and gas development (e.g., construction of well pads, access roads, power lines, and

pipelines) or from reclaiming oil and gas wells (plugging and abandoning) and infrastructure would be similar across all alternatives, but would vary in the overall number of acres impacted and the timing and distribution of disturbance and reclamation. Impacts by alternative are presented in Section 4.6.4.

4.6.3.1 Impacts Identified in the 2014 Final EIS

The 2014 Final EIS for Future Oil and Gas Leasing on the WRNF (USFS 2014a) included an analysis of impacts of future leasing decisions on noxious weeds (see pages 379-385), rare plants (see pages 231-260). Impacts to riparian and wetland areas were tangentially addressed within the surface water impacts analysis (see pages 76-87), and in the rare plants analysis. Impacts to general vegetation were discussion generally within the terrestrial wildlife habitat analysis (see pages 181-219). A biological evaluation was prepared for all potentially affected sensitive plant species that could occur within the analysis area. Impacts identified for vegetation resources within the WRNF Final EIS were considered indirect based on the action of making lands available for future oil and gas leasing. The 2014 Final EIS identified the following direct and indirect effects from reasonably foreseeable disturbance:

- Direct: Trampling of individuals, breaking, crushing, or uprooting plants, driving machinery or skidding material over plants, smothering or covering individuals or populations by slash, chips, soil, dust, or fallen trees resulting in interrupted photosynthesis and reproduction.
- Indirect: Increased dust, changes in vegetation composition and cover, introduction of a gravel layer to the soil surface, increased vectors and habitat for competitive invasive plant species, changing local hydrologic patterns in plant habitat, increased localized fire potential, changed soil conditions in plant habitat, changed foraging behavior of livestock/wildlife in and adjacent to developed areas, changed distribution of recreation activities in and adjacent to developed areas, and impacts on plant pollinators or mycorrhizae (USFS 2014a, page 238).

Impacts under each alternative were compared based on stipulations protecting vegetation habitat available to lease for future oil and gas development and the potential for the RFDS to occur in these habitats. As noted in the 2014 Final EIS, while a very small portion of the leases overlap with the GMUGNF; there would be low potential for the RFDS to occur in these areas (USFS 2014a, page 43).

4.6.4 Vegetation Communities

Surface disturbance from oil and gas development would directly impact vegetation communities and riparian/wetland habitats through vegetation removal and mechanical damage to plants during construction of infrastructure. Plant community composition, species diversity, and the relative occurrence of functional groups and successional stages of those communities would all be affected by oil and gas development. Additional indirect impacts to vegetation from surface disturbance could include soil compaction; erosion; damage to soil structure; mixing of soil horizons; changes in hydrology; loss of biological soil crusts; alteration of soil microbial communities; shifts in soil nutrient availability; reduction in pollinators; and changes to plant species diversity, density or health as a result of noxious weeds (see Section 4.6.3.2). These impacts could affect recovery or reclamation of vegetation communities and riparian/wetland habitats following disturbance. Vehicle traffic on oil and gas access roads could have an impact on vegetation beyond the acreage of disturbance due to the fugitive dust generated from vehicle travel depositing on vegetation, most intensively within approximately 300 feet of the edges of roads. Plant health and vigor may be reduced due to impaired photosynthesis caused by dust accumulation on leaf surfaces. Dust generation and deposition on nearby vegetation also could occur during construction of well pads, road, and pipelines.

Projected oil and gas development under any alternative would result in the disturbance of relatively low percentages of any plant species, plant community, or structural stage. However, where concentrated development occurs over large areas, surface-disturbing activities could affect the overall health of the plant communities and riparian/wetland habitats.

4.6.4.1 Riparian/Wetland Habitats

Riparian/wetland habitats are relatively scarce resources that are vulnerable to degradation. Because of their limited availability, riparian/wetland habitats could potentially have the highest percentage of surface occupancy impacts as compared to other vegetation types.

Development of well pads and roads, and pipelines in or near these areas may produce erosion and sedimentation, compaction and damage to fragile soils, loss of vegetation, and effects to ecosystem function. Any changes in the timing and magnitude of streamflow or introduction of chemical pollutants such as fuels and industrial chemicals also may affect riparian ecosystems. Development also increases the potential for non-native species to invade riparian areas.

While eliminating surface disturbance in and near riparian areas (i.e., implementation of NSO stipulations) is generally assumed to minimize or eliminate these impacts, where development occurs outside of the NSO stipulations, depending on proximity, there is a slight potential for indirect impacts from airborne dust that may settle on riparian vegetation.

4.6.4.2 Noxious Weeds

Surface disturbance and removal of existing vegetation would increase opportunities for the establishment and spread of noxious weeds and other non-native invasive plant species. This could in turn reduce native plant species diversity, native plant densities, desirable plant cover, soil microbial community species composition and function, and overall ecological health of vegetation communities. Decreased ecological health would make vegetation communities and riparian/wetland habitats less resistant to drought, fire, insect pests, livestock and wildlife grazing pressures, non-native species invasion, and other natural disturbances or stressors. Roads act as common vectors for the introduction of noxious weeds and non-native plants, wildlife, and diseases. These noxious weeds and non-native species and diseases can lead to habitat degradation, competition with native species, and potentially reduced survival of native species. Native plant communities could be indirectly impacted by herbicides used to control noxious weeds and other invasive species, potentially resulting in collateral mortality or loss of plant productivity.

The potential for the introduction and spread of noxious weeds would depend on the amount of surface disturbance, the proximity to existing populations, and the BMPs used by Operators to minimize the establishment and spread by noxious weeds. Standard leasing terms allow the BLM to require the relocation of operations up to than 200 meters (approximately 660 feet), noxious weed inventories, or other requirements to minimize impacts of surface disturbance. These may include requirements to clean equipment, use certified weed-free seed and mulch, re-vegetate disturbed areas, and monitor and treat existing weed infestations. While development in close proximity to existing noxious weed populations may increase the potential for weed proliferation, it also offers an opportunity for noxious weed control, since active weed management on the part of the Operator would be required. Similarly, constraining new development to locations with existing populations of noxious weeds also would minimize the potential for establishment of new noxious weed populations in areas where they do not currently exist.

4.6.4.3 Special Status Plant Species and Significant Plant Communities

For all alternatives, any activities that might affect federally listed species would be subject to consultation with the USFWS under Section 7 of the ESA. At the site-specific APD stage of permitting, if adverse effects are likely, the land-managing agency would propose conservation measures, often with advice from the USFWS, which would be applied as COAs. If, during the formal consultation process, either adverse impacts, jeopardy of the species, or destruction or adverse modification of critical habitat is determined to be likely, the USFWS would identify reasonable and prudent alternatives that would avoid the adverse impacts or the likelihood of jeopardy to the species in a Biological Opinion.

Sensitive plant species, plant species of local concern, and significant plant communities all have the potential to be directly and indirectly impacted by oil and gas development. Efforts would be made at the individual project level to minimize direct impacts to special status plant species and habitats. Although agency policy directs management of these species such that they do not trend towards federal listing, they do not receive the same level of protection as federally listed species. Therefore, direct mortality from oil and gas development is possible under any of the alternatives.

Special status plants and significant plant communities could be indirectly impacted by all of the same impacts described for vegetation communities and riparian/wetland habitats in Section 4.6.3.1. These impacts include habitat degradation from noxious weeds and other invasive non-native plant species, harm from herbicide drift during treatment of weeds, physiological impacts from dust deposition, impacts to pollinators and their habitats, shifts in neighboring plant species composition within special status species habitats, and degradation of soils and their microbial communities. These impacts may lead to the loss or degradation of suitable habitat for special status plant species and significant plant communities.

While implementation of NSO stipulations is generally assumed to minimize these impacts, where development occurs outside of the NSO stipulations, depending on proximity, there is a potential for indirect impacts on special status plant species or significant plant communities from deposition of airborne dust, invasive species, herbicide drift from chemical treatment of invasive species, and impacts to pollinators.

4.6.5 Impacts by Alternative

The impacts to vegetation resources by each alternative are analyzed as follows:

- Calculating the percentage of the analysis area covered by resource-specific stipulations and all other NSO stipulations within the analysis areas.
- Evaluating the potential for impacts to vegetation resources based on the relative amount of potential oil and gas exploration opportunities (the RFD) and extent to which the RFDS may be developed in key vegetation communities and habitats.

4.6.5.1 Alternative 1 (No Action Alternative)

Alternative 1 is the No Action Alternative that would reaffirm the existing lease stipulations on the 65 leases as they were originally issued.

<u>Stipulation Coverage</u>

Under Alternative 1, there would be no resource-specific NSO, CSU, or TL stipulations associated with general vegetation or riparian/wetland habitats[1].

General Vegetation

Table 4.6-2 displays the amount of general vegetation cover that would be covered all (combined) NSO stipulations under Alternative 1.

[1] As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2.

Table 4.6-2 Stipulation Coverage of General Vegetation Cover under Alternative 1

Zone	Acres of Vegetation Cover by Zone[1,2]	All NSOs (percent coverage)
1	10,113	100
2	24,938	39
3	42,766	8
4	2,562	3

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF spatial dataset compared to the FSVeg GMUGNF dataset.

[2] Vegetation communities cover the total area of each zone.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) would be covered by the Riparian/Wetland GMUGNF NSO stipulation.

With consideration of all NSO stipulations proposed under this Alternative, there would be no part of Zone 1 open to on-lease oil and gas development as long as all stipulations are implemented without exceptions or waivers. An estimated 61 percent of Zone 2, 92 percent of Zone 3, and 98 percent of Zone 4 would be open to surface-disturbing activities associated with oil and gas development

Riparian/Wetland Habitats

Table 4.6-3 displays the amount of riparian/wetland habitats covered by all NSO stipulations under Alternative 1.

Table 4.6-3 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 1

Zone	Riparian/Wetland Habitat Acreage (percent of zone)[1]	All NSOs (percent coverage)[2]
1	1,718 (17)	100
2	2,668 (11)	38
3	7,895 (18)	8
4	382 (15)	<1

[1] Riparian/wetland habitat was determined by analyzing the following spatial data sources: National Wetland Inventory data, FSVeg data, USFS WIZ data, and USFS Fen data.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

With consideration of all NSO stipulations, none of the riparian/wetland habitats in Zone 1 would available for surface-disturbing activities associated with oil and gas development as long as all stipulations are implemented without exceptions or waivers. An estimated 62 percent of the riparian/wetland habitats in Zone 2, 92 percent of habitat in Zone 3, and 99 percent of habitat in Zone 4 would be open to surface-disturbing activities associated with oil and gas development.

Noxious Weeds

As shown in **Table 4.6-2**, resource-specific NSO stipulations would fully preclude surface disturbance in less than 1 percent of Zone 2, but with consideration of all NSO stipulations, surface-disturbing activities associated with oil and gas development would be precluded in all of Zone 1, 39 percent of Zone 2, 8 percent of Zone 3, and 3 percent of Zone 4. **Table 4.6-4** displays the acres of known noxious weed infestations relative to NSO stipulation coverage in each zone under Alternative 1.

Table 4.6-4 Stipulation Coverage of Known Populations of Noxious Weeds under Alternative 1

Zone	Acres of Known Populations of Noxious Weeds[1]	All NSOs (percent coverage)
1	2	100
2	1,105	51
3	310	2
4	<1	<1

[1] Known population acreages are based on data from both WRNF and GMUGNF.

With consideration of all NSO stipulations, no surface-disturbing activities would occur in Zone 1, so there would be no impacts relative to known noxious weed populations in Zone 1. About half of the area within Zone 2 would be precluded from surface disturbance, but the density of known noxious weed infestations is greatest within this zone. Most of Zone 3 lacks NSO coverage, so the risk of disturbance within known weed infestations is high. Impacts within the small acreage of Canada thistle in Zone 4 would be prevented where this infestation occurs due to all NSO coverage.

Special Status Plant Species

The special status plant species and significant plant communities are analyzed by the habitat categories listed below.

- Federally listed plant species suitable habitat: DeBeque phacelia (*Phacelia submutica*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*), and Colorado hookless cactus (*Sclerocactus glaucus*).
- Special status plant species (BLM sensitive species, Regional Forester's Sensitive Plant Species) suitable habitat types: alpine, fen, forested, and non-forested habitat.
- Significant plant community habitat.

There are no resource-specific stipulations associated with vegetation resources. The following subsections analyze resource-specific stipulations and all other stipulations with respect to vegetation resources within the special status plant species analysis area for Alternative 1.

Table 4.6-5 displays amount of special status plant species and significant plant community suitable habitats and the percent of that habitat covered by individual resource specific NSO stipulations and all NSO stipulations. A 300-meter extension from the leasing area is included in the analysis, because this area could be subject to indirect impacts from on-lease oil and gas development, and because of potential for direct impacts in that area if oil and gas development infrastructure were constructed off the lease to access fluid minerals within the lease using directional or horizontal drilling.

Table 4.6-5 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 1

Location	Suitable Habitat [1] Acreage (percent of zone)	All NSOs (percent coverage)[3]
DeBeque Phacelia Suitable Habitat		
Off-lease[2]	121 (<1)	94
Zone 1	3,729 (37)	100
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Ute Ladies'-tresses Suitable Habitat		
Off-lease[2]	355 (1)	95
Zone 1	4,829 (48)	100
Zone 2	92 (<1)	0
Zone 3	0	N/A
Zone 4	0	N/A
Colorado Hookless Cactus Suitable Habitat		
Off-lease[2]	121 (<1)	94
Zone 1	3,729 (37)	100
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Special Status Plant Species Suitable Alpine Habitat		
Off-lease[2]	1 (<1)	100
Zone 1	0	N/A
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Special Status Plant Species Suitable Fen Habitat		
Off-lease[2]	150 (<1)	10
Zone 1	0	N/A
Zone 2	4 (<1)	100
Zone 3	113 (<1)	12
Zone 4	10 (<1)	0
Special Status Plant Species Suitable Forested Habitat		
Off-lease[2]	11,254 (37)	39
Zone 1	6,518 (64)	100
Zone 2	10,844 (43)	47
Zone 3	36,478 (85)	8
Zone 4	2,182 (85)	3

Table 4.6-5 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 1

Location	Suitable Habitat [1] Acreage (percent of zone)	All NSOs (percent coverage)[3]
Special Status Plant Species Suitable Non-forested Habitat		
Off-lease[2]	4,904 (16)	61
Zone 1	2,924 (29)	100
Zone 2	12,985 (52)	34
Zone 3	6,123 (14)	11
Zone 4	379 (15)	<1
Significant Plant Community Habitat		
Off-lease[2]	6,308 (21)	
Zone 1	1,993 (20)	100
Zone 2	306 (1)	0
Zone 3	11,415 (27)	9
Zone 4	0	N/A

[1] Suitable habitats were determined by Forest Service modeling for significant plant species; significant plant community habitat is based on Colorado Natural Heritage Program data, see Section 3.6.5 for more information.

[2] The "off-lease" area is the 300-meter extension from the leasing area. Total NSO column is reported to address the potential for off-lease development. Individual stipulations are not reported for off-lease areas because they are covered by stipulations unrelated to this EIS. For off lease areas only, the total NSO percentage includes both existing NSO and areas that are designated as closed to leasing.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Under Alternative 1, there would be no resource-specific stipulations identified to preclude or minimize surface disturbance within special status plant species and significant plant communities. Without consideration of non-resource related NSO stipulations, all special status plant species habitat on the WRNF would be available to oil and gas development activities prior to site-specific surveys and ESA consultation at the APD stage of permitting. With consideration of all NSO stipulations, the potential for development in special status plant species and significant plant community habitat would as follows.

- **DeBeque phacelia:** Within Zone 1, all (100 percent) DeBeque phacelia suitable habitat in Zone 1 would be covered by non-resource-related NSOs. There is no suitable habitat for DeBeque phacelia in Zones 2, 3, and 4. Ninety-four percent of DeBeque phacelia suitable habitat in off-lease areas is covered by existing NSO stipulations.
- **Ute ladies'-tresses:** One hundred percent of suitable habitat would be covered by non-resource-related NSOs in Zone 1. In Zone 2, there would be no NSO stipulations covering suitable habitat. There is no suitable habitat for Ute ladies'-tresses in Zones 3 and 4. An estimated 95 percent of Ute ladies'-tresses suitable habitat in the off-lease area is covered by existing NSO stipulations.
- **Colorado hookless cactus:** One hundred percent of suitable habitat would be covered by all other NSOs in Zone 1. There is no suitable habitat for Colorado hookless cactus in Zones 2, 3, and 4. An estimated 94 percent of Colorado hookless cactus suitable habitat in the off-lease area is covered by existing NSO stipulations.

- **Special status plant species:** All suitable alpine habitat within the analysis area is located in off-lease area and is closed to leasing for future oil and gas development.
  - There is no suitable fen habitat in Zone 1. One hundred percent of suitable fen habitat in Zone 2 and 12 percent of suitable fen habitat in Zone 3 would be covered by NSOs. No suitable fen habitat in Zone 4 would be covered by NSO stipulations. In off lease areas, an estimated 68 percent of suitable fen habitat is precluded from surface development (10 percent is covered by existing NSOs; and an additional 58 percent is closed to leasing).
  - One hundred percent of suitable forested habitat in Zone 1, 47 percent of suitable forested habitat in Zone 2, 8 percent of suitable forested habitat in in Zone 3, and 3 percent of suitable forested habitat in Zone 4 would be covered by NSOs. In off-lease areas, an estimated 82 percent of suitable forested habitat is precluded from surface development (39 percent is covered by existing NSOs, and an additional 43 percent is closed to leasing).
  - One hundred percent of suitable non-forested habitat in Zone 1, 34 percent of suitable non-forested habitat in Zone 2, 11 percent of suitable non-forested habitat in Zone 3, and less than 1 percent of suitable non-forested habitat in Zone 4 would be covered by NSOs. An estimated 74 percent of suitable non-forested habitat in the off-lease area is covered by existing NSOs; an additional 13 percent is closed to leasing.

- **Significant plant community habitat:** One hundred percent of significant plant community habitat in Zone 1 and 9 percent in Zone 3 would be covered by NSOs. No significant plant community habitat within Zone 2 would be covered by NSO stipulations. There is no significant plant community habitat in Zone 4. In off-lease areas, 31 percent of significant plant community habitat is covered by existing NSOs; an additional 37 percent is closed to leasing.

Impacts from Projected Future Oil and Gas Development

The RFDS under Alternative 1 projects up to 416 wells on an estimated 60 well pads, resulting in 892 acres of short-term (construction) disturbance and 387 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts by zone are discussed below.

The Zone 1 RFDS (36 wells on 5 well pads) would result in 76 acres of construction surface disturbance and 33 acres of operations disturbance within the 10,114-acre zone. With consideration of all NSOs, surface-disturbing activities associated with the RFDS could not be conducted on any of the 10,113 acres of vegetation within the Zone 1 leases. This includes all general vegetation cover, all riparian/wetland habitat; all suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus; all special status plant species suitable forested and non-forested habitat; and all significant plant community habitat within this zone. All known populations of noxious weeds (2 acres) would be avoided and the potential for introducing new weed infestations to the zone would be minimized by the NSO stipulations present in all zone acreages. If NSO stipulations were exempted, there would be no resource-specific CSU stipulations that could require surveys or special development techniques to otherwise minimize disturbance.

The Zone 2 RFDS (319 wells on 46 well pads) would result in 684 acres of construction surface disturbance and 296 acres of operations disturbance within the 24,938-acre zone. Initial surface disturbance associated with the RFDS would comprise about 3 percent of the lease. Portions of the Zone 2 RFDS could occur in any or all of the 92 acres of Ute ladies'-tresses suitable habitat (the only federally listed plant species within Zone 2). NSO stipulations would preclude surface disturbance in special status species suitable fen habitat, but the full Zone 2 RFDS could occur in special status plant species suitable forested or non-forested habitats (which comprise 64 and 29 percent of the zone, respectively). If the full Zone 2 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 2. If the full Zone 2 RFDS were to occur in

suitable non-forested habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 2. The full Zone 2 RFDS could not be developed within significant plant community habitat because there are only 306 acres of this habitat present in the Zone 2, but if the full extent of significant plant community habitat without NSO stipulations were developed, this would affect 100 percent of all such habitat within Zone 2. With consideration of all NSOs, the full Zone 2 RFDS could be developed within riparian/wetland habitats (since surface disturbing activities would not be precluded in 61 percent of the riparian/wetland areas present within this zone). If the full Zone 2 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect about 26 percent of all such habitat in the zone. Known populations of noxious weeds would be present in the areas that are available for on-lease development; however, the BLM could require minor project relocations or impose conditions of approval at the site-specific level to control existing populations and minimize the potential for spread to areas of new surface disturbance.

The Zone 3 RFDS (52 wells on 7 well pads) would result in 111 acres of construction surface disturbance and 48 acres of operations surface disturbance within the 42,766-acre zone. Most of the lease zone would have standard lease terms or timing limitations that do not address vegetation resources. Surface disturbance associated with the RFDS would comprise less than 1 percent of the lease. There would be no impacts to any suitable habitat for federally listed plant species, as none are present in this zone. The full Zone 3 RFDS could occur in special status plant species suitable fen, forested, or non-forested habitats (which comprise <1, 85, and 14 percent of the zone, respectively); significant plant community habitat (which occur in 27 percent of the zone); or riparian/wetland areas (which comprise 18 percent of the zone). If the full Zone 3 RFDS were to occur in suitable fen habitat, construction surface disturbance would affect almost 100 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all such habitat in Zone 3. If the full RFDS were to occur in suitable non-forested Zone 3 habitat, construction surface disturbance would affect 3 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect about 1 percent of all such habitat in Zone 3. All known populations of noxious weeds would be present in the areas that are available for on-lease development.

The Zone 4 RFDS (10 wells on 1 well pad) would result in 21 acres of construction surface disturbance and 9 acres of operations surface disturbance within the 2,562-acre zone. The zone would be primarily covered by standard lease terms or timing limitations that do not address vegetation resources. Surface disturbance associated with the RFDS would comprise less than 1 percent of the lease. There would be no impacts to any suitable habitat for federally listed plant species, as none are present in this zone. The full Zone 4 RFDS could occur in special status plant species suitable forested or non-forested habitats (which comprise 85 and 15 percent of the zone, respectively). If the full Zone 4 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 4. If the full Zone 4 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 4. The full Zone 4 RFDS also could occur in riparian/wetland habitat (which comprises 15 percent of the zone). If the full Zone 4 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 4. Portions of the Zone 4 RFDS also could occur in the 10 acres of suitable fen habitat affecting up to 100 percent of all such habitat in Zone 4. There would be no impacts to any significant plant community habitat as none are present in this zone.

Directional or horizontal drilling techniques may be used to develop some or all of the RFDS from off-lease locations. Within 300 meters of leases, almost all suitable habitat for federally listed species is precluded from development through closure or NSO stipulations. About 18 acres of suitable habitat for Ute ladies'-tresses and 7 acres of suitable habitat for DeBeque phacelia and Colorado hookless cactus are available for surface disturbing activities. Surface disturbance in off-lease areas is precluded in all

off-lease special status species suitable alpine habitat. While the majority of off-lease suitable fen, forested, and non-forested habitat and significant plant community habitat also is precluded from surface disturbance, portions of the RFDS could still be developed in those habitats given the percentage of coverage relative to the amount of total habitat. After consideration of off-lease stipulations and closures approximately 48 acres of suitable fen habitat, 2,025 acres of suitable forested habitat, 1,275 acres of suitable non-forested habitat, and 2,018 acres of significant plant community habitat are open to surface disturbing activities.

Surveys would be conducted during site-specific NEPA to ensure compliance with the ESA, and any activities that may affect federally listed species would be subject to consultation with the USFWS under Section 7 of the ESA. Depending on stipulation coverage, the BLM can require minor or major project relocations to minimize the potential for spread to areas with new surface disturbance. Under all stipulations may impose conditions of approval at the site-specific level to control existing populations.

4.6.5.2 Alternative 2

Alternative 2 would modify 8 of the 65 existing leases to address inconsistencies with the 1993 EIS and ROD. This alternative would add stipulations to eight leases (identified in the 1993 EIS and ROD), but not attached to leases as they were issued.

Stipulation Coverage

Under Alternative 2, there would be no resource-specific NSO, CSU, or TL stipulations associated with general vegetation or riparian/wetland habitats[2].

General Vegetation

The only change between Alternative 1 and Alternative 2 would occur in Zone 3 (see Alternative 1, Section 4.6.4.1), where additional stipulations would preclude surface disturbance in an additional 1 percent of the 42,766 acres of vegetation cover within the zone.

Riparian/Wetland Habitats

The only change between Alternative 1 and Alternative 2 would occur in Zone 3 (see Alternative 1, Section 4.6.4.1), where additional stipulations would preclude surface disturbance in an additional 1 percent of the 7,895 acres of riparian and wetland habitat within the zone.

Noxious Weeds

Alternative 2 would have NSO stipulations applied to an additional 1 percent of vegetation cover within Zone 3; however, there would be no changes to the percentage of coverage of known noxious weed populations within this zone as compared to Alternative 1.

Special Status Plant Species

Alternative 2 would have NSO stipulations applied to an additional 1 percent of vegetation cover within Zone 3. The additional stipulations would preclude surface disturbance in an additional 1 percent of suitable forested and non-forested habitats and 3 percent of significant plant community habitat within the zone. There would be no changes to the stipulation coverage of suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus, or suitable habitat alpine habitat because Zone 3 does not contain those habitats.

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[2] As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 2 would result in the same amount surface disturbance as Alternative 1. The potential for the RFDS to affect vegetation resources would be similar to Alternative 1 except that in Zone 3, there would be slightly fewer acres of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat available for on-lease development of the RFD.

4.6.5.3 Alternative 3

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in the Alternative 2 from the 2014 WRNF Final EIS. There are four NSO stipulations specific to vegetation under Alternative 3:

- Alpine
- Fen Wetlands
- WIZ
- TEPC Plant Species Populations and Habitats.

There are three CSU stipulations specific to vegetation resources:

- Spruce-Fir Old Growth and Old Growth Recruitment Stands
- Plant Species of Local Concern, including Significant Natural Plant Communities
- Sensitive Plant Species

Section 4.6.2 provides a description of these stipulations. As with all stipulations within the lease area, it is possible that resource-specific stipulations may overlap each other. As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2).

Stipulation Coverage

General Vegetation

Table 4.6-6 displays the amount of general vegetation cover that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations under Alternative 3.

Within Zone 1, CSUs for Species of Local Concern and Sensitive Plant Species would be applied to constrain development in the majority of the 10,113-acre zones. Under the Sensitive Plant Species CSU, surveys and special design, construction and implementation measures may be required to ensure that disturbance that would not result in a trend toward federal listing or loss of viability of any Sensitive Plant Species. Under the Species of Local Concern CSU, surveys and special design, construction, and implementation measures may be required to maintain and manage viable and well-distributed habitats for all species. Exceptions to either CSU may be granted if a site-specific environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. If implemented, the TEPC NSO stipulation also would preclude surface disturbance in 73 percent of the lease. Sixteen percent of Zone 1 would preclude surface disturbance under the WIZ NSO. One hundred percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 2, the CSU for Sensitive Plant Species could be applied to 95 percent of the 24,938-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone

acreage. An estimated 87 percent would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 3, the CSU for Sensitive Plant Species could be applied to 66 percent of the 42,766-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone acreage. An estimated 86 percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 4, the CSU for Sensitive Plant Species could be applied to 89 percent of the 2,562-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone acreage. An estimated 92 percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Riparian/Wetland Habitats

Table 4.6-7 displays the amount of riparian/wetland habitat that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations under Alternative 3.

The TEPC NSO would cover 83 percent of Zone 1 and the Fen NSO stipulation would preclude surface disturbance in 7, 8, and 21 percent of riparian/wetland habitat in Zones, 2, 3, and 4, respectively. Under all zones, the Sensitive Plant Species CSU would apply to the majority of riparian/wetland habitat. Under this CSU, surveys and special design, construction, and implementation measures may be required to ensure that disturbance would not result in a trend toward federal listing or loss of viability of any Sensitive Plant Species. Under all zones, the WIZ NSO would preclude surface disturbance in 93, 85, 63, and 67 percent of riparian/wetland habitat in Zones 1, 2, 3, and 4, respectively. This stipulation may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO). Within Zone 1, the Species of Local Concern CSU would overlay over 85 percent of all riparian/wetland habitat. Under this CSU, surveys and special design, construction and implementation measures during site-specific development may be required to minimize impacts to these species. The coverage afforded to riparian/wetland habitat by other CSU resource-specific stipulations would be minimal. With consideration of all stipulations developed under Alternative 3, surface disturbance would be fully precluded in 100 percent of Zone 1, 98 percent of Zone 2, 98 percent of Zone 3, and 96 percent of Zone 4 riparian/wetland habitats if all NSOs were implemented.

Noxious Weeds

As shown in **Table 4.6-8**, with consideration of all NSO stipulations, surface-disturbing activities associated with oil and gas development would be precluded in all of Zone 1 and Zone 4, 95 percent in Zone 2, and 77 percent in Zone 3.

Table 4.6-6 Stipulation Coverage of General Vegetation Cover Under Alternative 3

Location[1]	Acres of Vegetation Cover[1,2]	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 1	10,113	1	81	100	0	16	73	0	100
Zone 2	24,938	7	11	95	0	9	2	<1	87
Zone 3	42,766	13	0	66	<1	13	0	2	86
Zone 4	2,562	5	0	89	0	12	0	4	92

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF dataset compared to the FSVeg GMUGNF dataset.

[2] Vegetation communities cover the total area of each zone.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) would be covered by the Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-7 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 3

Location[1]	Riparian/ Wetland Habitat Acreage (percent zone)[1,]	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 1	1,718 (17)	<1	85	100	0	93	83	0	100
Zone 2	2,668 (11)	7	2	96	0	85	2	7	98
Zone 3	7,895 (18)	9	0	82	0	63	0	8	98
Zone 4	382 (15)	5	0	96	0	67	0	21	96

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF dataset compared to the FSVeg GMUGNF dataset.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-8 Stipulation Coverage of Known Populations of Noxious Weeds under Alternative 3

Zone	Acres of Known Populations of Noxious Weeds[1]	All NSOs (percent coverage)
1	2	100
2	1,105	95
3	310	77
4	<1	100

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF spatial dataset compared to the FSVeg GMUGNF dataset.

Special Status Plant Species

Table 4.6-9 displays the amount of special status plant species and significant plant community suitable habitats that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations proposed under Alternative 3. A 300-meter extension from the leasing area is included in the analysis because this area could be subject to indirect impacts from on-lease oil and gas development, and because of potential for direct impacts in that area if oil and gas development infrastructure were constructed off the lease to access fluid minerals within the lease using directional or horizontal drilling. With consideration of all NSO stipulations, the potential for development in special status plant species and significant plant community habitat would as follows:

- **DeBeque phacelia:** Within Zone 1, CSU stipulations for Species of Local Concern and Sensitive Plant Species would be applied to 99 percent of the 3,729 acres of suitable habitat. The NSO for TEPC would overlay almost all of the same acreage, and the NSO for WIZ would overly about 22 percent of suitable habitat. All (100 percent) DeBeque phacelia suitable habitat in Zone 1 would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for DeBeque phacelia in Zones 2, 3, and 4. Ninety-four percent of DeBeque phacelia suitable habitat in off-lease areas is precluded from surface disturbance by existing NSO stipulations.
- **Ute ladies'-tresses:** The CSU stipulation Sensitive Plant Species and the NSO for TEPC would be applied to almost all of the Ute ladies'-tresses suitable habitat within the lease zones (4,829 acres in Zone 1 and 92 acres in Zone 2). Within Zone 1, the CSU stipulation for Species of Local Concern would overlay about 96 percent of this habitat and the WIZ NSO would overlay about 18 percent. One hundred percent of suitable habitat would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for Ute ladies'-tresses in Zones 3 and 4. An estimated 95 percent of Ute ladies'-tresses suitable habitat in the off-lease area is precluded from surface disturbance by existing NSO stipulations.

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
DeBeque Phacelia Suitable Habitat									
Off-lease[2]	121 (<1)								94
Zone 1	3,729 (37)	0	99	99	0	22	97	0	100
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A
Ute Ladies'-tresses Suitable Habitat									
Off-lease[2]	355 (1)								95
Zone 1	4,829 (48)	0	96	99	0	18	100	0	100
Zone 2	92 (<1)	0	0	100	0	43	100	0	100
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	NA
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	NA
Colorado Hookless Cactus Suitable Habitat									
Off-lease[2]	121 (<1)								94
Zone 1	3,729 (37)	0	99	99	0	22	97	0	100
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Special Status Plant Species Suitable Alpine Habitat									
Off-lease[2]	1 (<1)								100
Zone 1	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A
Special Status Plant Species Suitable Fen Habitat									
Off-lease[2]	150 (<1)								68
Zone 1	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 2	4 (<1)	1	3	100	0	100	3	100	100
Zone 3	113 (<1)	5	0	96	0	100	0	100	100
Zone 4	10 (<1)	0	0	100	0	100	0	100	100
Special Status Plant Species Suitable Forested Habitat									
Off-lease[2]	11,254 (37)								82
Zone 1	6,518 (10)	1	85	100	0	9	78	0	100
Zone 2	10,844 (43)	17	4	91	0	11	1	<1	93
Zone 3	36,478 (85)	15	0	62	<1	10	0	2	87
Zone 4	2,182 (85)	6	0	87	0	9	0	2	94
Special Status Plant Species Suitable Non-Forested Habitat									
Off-lease[2]	4,904 (16)								74
Zone 1	2,924 (29)	<1	67	100	0	20	64	0	100
Zone 2	12,985 (52)	<1	1	99	0	8	1	<1	82

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 3	6,123 (14)	1	0	84	<1	29	0	4	82
Zone 4	379 (15)	0	0	100	0	28	0	14	81
Significant Plant Community Habitat									
Off-lease[2]	6,308 (21)								68
Zone 1	1,993 (20)	0	99	99	0	18	99	0	100
Zone 2	306 (1)	3	0	76	0	13	0	0	60
Zone 3	11,415 (27)	10	0	59	0	12	0	2	92
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A

[1] Suitable habitats were determined by Forest Service modeling for significant plant species; significant plant community habitat is based on Colorado Natural Heritage Program data, see Section 3.6.5 for more information.

[2] The "off-lease" area is the 300-meter extension from the leasing area. Total NSO column is reported to address the potential for off-lease development. Individual stipulations are not reported for off-lease areas because they are covered by stipulations unrelated to this EIS. For off leas areas only, the Total NSO percentage includes both existing NSO and areas that are designated as closed to leasing.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

- **Colorado Hookless Cactus:** Within Zone 1, CSU stipulations for Species of Local Concern and Sensitive Plant Species would be applied to 99 percent of the 3,729 acres of suitable habitat. The NSO for TEPC would overlay almost all of the same acreage, and the NSO for WIZ would overly about 22 percent of suitable habitat. One hundred percent of suitable habitat would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for Colorado hookless cactus in Zones 2, 3, and 4. An estimated 94 percent of Colorado hookless cactus suitable habitat in the off-lease area is precluded from surface disturbance by existing stipulations.
- **Special status plant species*:*** NSO coverage of suitable habitat types would be as follows:
  - All suitable alpine habitat within the analysis area is located in off-lease area and is CTL for future oil and gas development.
  - There is no suitable fen habitat in Zone 1. Within Zones 2, 3, and 4, the Fen NSO, WIZ NSO, and the Sensitive Plant Species CSU would cover all suitable habitat. The WIZ NSO may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO). In off-lease areas, an estimated 74 percent of suitable fen habitat is precluded from surface development (10 percent through existing NSOs; an additional 58 percent is closed to leasing).
  - Within Zones 1, 2, and 4, the Sensitive Plant Species CSU would be applied to between 87 and 100 percent of all suitable forested habitat within those zones; within Zone 3, the Sensitive Plant Species CSU would cover about 60 percent of all suitable forested habitat. Additionally, within Zone 1, the Species of Local Concern CSU and the TEPC NSO would overlay 85 and 78 percent all suitable forested habitat, respectively, but would cover little or no suitable forested habitat within the other zones. The WIZ NSO would overlay relatively small percentages at 9, 11, 10, and 9 percent of all suitable forested habitat in Zones 1, 2, 3, and 4, respectively. All (100 percent) suitable forested habitat in Zone 1, 93 percent of suitable forested habitat in Zone 2, 87 percent of suitable forested habitat in Zone 3, and 94 percent of suitable forested habitat in Zone 4 would be precluded from surface disturbance if all NSOs were implemented. Off lease, an estimated 82 percent of suitable forested habitat is precluded from surface development (39 percent through NSOs; an additional 43 percent is CTL).
  - The Sensitive Plant Species CSU would overlay almost all suitable non-forested habitat in all four zones. Coverage would range from 84 (in Zone 3) to 100 percent (Zones 1 and 4). Additionally, within Zone 1, the Species of Local Concern CSU and the TEPC NSO would overlay 67 and 64 percent all suitable non-forested habitat, respectively. The WIZ NSO would overlay 20, 8, 29, and 28 percent of all suitable non-forested habitat in Zones 1, 2, 3, and 4, respectively. All (100 percent) suitable non-forested habitat in Zone 1, 82 percent of suitable non-forested habitat in Zone 2, 82 percent of suitable non-forested habitat in Zone 3, and 81 percent of suitable non-forested habitat in Zone 4 would be precluded from surface disturbance if all NSOs were implemented. Off lease, an estimated 74 percent of suitable non-forested habitat is precluded from surface development (61 percent though existing NSOs, and an additional 13 percent is closed to leasing).
- **Significant plant community habitat:** Within Zone 1, significant plant community habitat would be covered by 4 resource-specific stipulations (Sensitive Plant Species CSU, Species of Local Concern CSU, WIZ NSO, and the TEPC NSO). Within Zones 2 and 3, the Sensitive Plant Species CSU would be applied to 76 and 59 percent of significant plant community habitat, respectively, and the WIZ NSO would be applied to 13 and 12 percent of significant plant community habitat, respectively. There would be very little coverage afforded by other stipulations, except in Zone 3, where 10 percent of the habitat would be covered by the Spruce-fir Old Growth CSU and 12 percent would be covered by the WIZ NSO. One hundred percent of significant plant community habitat in Zone 1, 60 percent of significant plant community habitat in

Zone 2, 92 percent of significant plant community habitat in Zone 3 would be precluded from surface disturbance if all NSOs were implemented. There is no significant plant community habitat in Zone 4. In off-lease areas, an estimated 74 percent of significant plant community habitat is precluded from surface development (31 percent through existing NSOs; an additional 37 percent is closed to leasing).

Impacts from Projected Future Oil and Gas Development

The RFDS under Alternative 3 projects up to 413 wells on an estimated 59 well pads, resulting in 886 acres of short-term (construction) disturbance and 384 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts by zone are discussed below.

The Zone 1 RFDS (36 wells on 5 well pads) would result in 76 acres of construction surface disturbance and 33 acres of operations disturbance within the 10,114-acre zone. With consideration of all NSOs, surface-disturbing activities associated with the RFDS could not be conducted on any of the Zone 1 leases. This includes all riparian/wetland habitat; all suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus; all special status plant species suitable habitat; and all significant plant community habitat within this Zone. All known populations of noxious weeds (2 acres) would be avoided and the potential for introducing new weed infestations to the zone would be minimized by the total preclusion of surface disturbance through NSO stipulations. If NSO stipulations were exempted, most riparian and special status species also would be covered by one or more CSU stipulations that could require surveys or special development techniques to minimize habitat disturbance.

The Zone 2 RFDS (319 wells on 46 well pads) would result in 684 acres of construction surface disturbance and 296 acres of operations disturbance within the 24,938-acre zone. Surface disturbance would be precluded in all suitable habitat for Ute ladies'-tresses (the only federally listed plant species within Zone 2) through a resource-specific NSO stipulation. While NSOs overlay the majority of special status plant species suitable habitat and significant plant community habitat in Zone 2, given the percentage of NSO coverage relative to the amount of total habitat, the entire RFDS could still be developed in suitable forested and non-forested habitat and significant plant community habitat; however, most (between 76 and 99 percent) of these habitats would be covered by resource-specific CSUs that could require surveys or special development techniques to minimize habitat disturbance. With consideration of all NSOs (none of which are resource-specific), about 760 acres of suitable forested habitat, 2,335 acres of suitable non-forested habitat, and 122 acres significant plant community habitat would be open to surface disturbance. If the full Zone 2 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 2. If the full Zone 2 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 2. The RFDS could not be developed in full within significant plant community habitat because there are only 306 acres present in Zone 2, but if the full extent of acreage without NSO stipulations were developed, this would affect about 40 percent of all such habitat within Zone 2. All suitable fen habitat (4 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. A portion of the RFDS could be developed in the 267 acres of riparian habitat that are not covered by NSO stipulations. Most, but not all, riparian habitat would be covered one or more CSU stipulation that could require surveys or special development techniques to minimize disturbance. If all 267 acres without NSO stipulations were developed, this would affect about 10 percent of riparian/wetland habitat within the Zone 2. About 5 percent of the known noxious weed populations in Zone 2 are present in areas in which surface disturbance would not be precluded.

The Zone 3 RFDS (49 wells on 7 well pads) would result in 104 acres of construction surface disturbance and 45 acres of operations surface disturbance within the 42,766-acre zone. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the full RFDS could occur in special status plant species suitable

forested or non-forested habitat, or in significant plant community habitat. Between 59 and 84 percent of these habitats would be subject to resource-specific CSUs. With consideration of all NSOs covering these habitats (none of which are resource-specific), about 1,742 acres of suitable forested habitat, 1,102 acres of suitable non-forested habitat, and 9,132 acres of significant plant community habitat would be open to surface disturbance. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all suitable forested habitat in Zone 3. If the full Zone 3 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 3 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. All suitable fen habitat (10 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. About 80 percent of the approximately 7,900 acres of riparian/wetland habitat in Zone 3 would be covered by a resource-specific CSU stipulation that could require surveys or special development techniques to minimize disturbance. If all NSO stipulations were implemented, about 2 percent (158 acres) of Zone 3 riparian/wetland habitat would be available to surface disturbing activities. If the full Zone 3 RFDS were to occur in riparian/ wetland habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. Twenty-three percent of known noxious weed populations within Zone 3 are present in areas that would not be precluded from surface disturbance.

The Zone 4 RFDS (10 wells on 1 well pad) would result in 21 acres of construction surface disturbance and 9 acres of operations surface disturbance within the 2,562-acre zone. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the full RFDS could occur in special status plant species suitable forested or non-forested habitat; however, almost 90 percent of suitable forested habitat and 100 percent of suitable non-forested habit would be subject to resource-specific CSUs. With consideration of all NSOs covering these habitats (none of which are resource-specific), about 130 acres of suitable forested habitat and 72 acres of suitable non-forested habitat would be open to surface disturbance. If the full Zone 4 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 4. If the full Zone 4 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 4. All suitable fen habitat (10 acres) would be precluded from surface disturbance by NSO stipulations as well as covered by a resource-specific CSU stipulation. With consideration of all NSOs, about 23 percent (88 acres) of all riparian/wetland habitat in Zone 4 would be available for surface disturbance. Most acreage would be subject to resource-specific CSUs. If the full Zone 4 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 4. All known populations of noxious weeds (less than 1 acre) would be avoided if NSO stipulations were implemented.

Directional or horizontal drilling techniques may be used to develop some or all of the RFDS from off-lease locations. Within 300 meters of leases, almost all suitable habitat for federally listed species is precluded from development through closure or NSO stipulations. About 18 acres of suitable habitat for Ute Ladies'-tresses and 7 acres of suitable habitat for DeBeque phacelia and Colorado hookless cactus are available for surface disturbing activities. Surface disturbance in off-lease areas is precluded in all off-lease special status species suitable alpine habitat. While the majority of off-lease suitable fen, forested, and non-forested habitat and significant plant community habitat also is precluded from surface disturbance, portions of the RFDS could still be developed in those habitats given the percentage of coverage relative to the amount of total habitat. After consideration of off-lease stipulations and closures approximately 48 acres of suitable fen habitat, 2,025 acres of suitable forested habitat, 1,275 acres of suitable non-forested habitat, and 2,018 acres of significant plant community habitat are open to surface disturbing activities.

Surveys would be conducted during site-specific NEPA to ensure compliance with the ESA, and any activities that may affect federally listed species would be subject to consultation with the USFWS under

Section 7 of the ESA. Depending on stipulation coverage, the BLM can require minor or major project relocations to minimize the potential for spread to areas with new surface disturbance. Regardless of specific stipulations, the BLM may impose conditions of approval at the project-specific level to mitigate impacts to existing special status plant species and significant plant community populations or habitat.

4.6.5.4 Alternative 4 (Proposed Action)

Alternative 4 is the Proposed Action and modifies or cancels the existing 65 leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Final EIS. Lease modification would be the same as under Alternative 3. Alternative 4 proposes 25 lease cancellations, all within Zone 3.

Stipulation Coverage

General Vegetation

Table 4.6-10 displays the Zone 3 vegetation cover that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The combination of proposed lease stipulations and proposed lease cancellations would preclude surface disturbance in about 95 percent of Zone 3 (about 9 percent more than under Alternative 3). Unlike NSO stipulations, however, lease cancellations would offer no potential for exceptions, modification, or waivers that would allow surface disturbance. Proposed lease cancellation would remove 68 percent of the original zone acreage from leasing availability; the remaining acreage in Zone 3 would comprise 14,307 acres. A resource-specific CSU would be applied to about 72 percent of the remaining acreage. The WIZ NSO would be applied to about 15 percent of the remaining acreage. With consideration of all NSOs (none of which are resource-specific), about 98 percent of remaining acreage in Zone 3 would be precluded from surface disturbance.

Riparian / Wetland Areas

Table 4.6-11 displays the Zone 3 riparian/wetland habitat that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The combination of proposed lease stipulations and proposed lease cancellations would preclude surface disturbance about 89 percent of all riparian/wetland habitat in Zone 3 (13 percent more than under Alternative 3). However, the lease cancellation would remove 3,574 (45 percent) of the 7,895 acres of riparian/wetland habitat in Zone 3 from leasing availability. Cancelled acreages would not be subject to exceptions, modifications, or waivers. A resource-specific CSU would be applied to 58 percent of the remaining riparian/wetland habitat and the WIZ NSO would be applied to about 47 percent of the remaining habitat. With consideration of all NSOs (none of which are resource-specific), 94 percent of the remaining riparian/wetland habitat in Zone 3 would be precluded from surface disturbance.

Noxious Weeds

Approximately 8 percent of known noxious weed populations would be within cancelled leases (in Zone 3). The potential for spread of these populations through surface disturbance associated with new oil and gas development would be eliminated in these areas. Conversely, any opportunity for Operator control of these populations through COAs also would be eliminated in these areas. However, Forest Service treatment of noxious weeds would continue.

Table 4.6-10 Zone 3 Stipulation Coverage of General Vegetation Cover under Alternative 4

Vegetation Cover			Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (% coverage)	NSO plus Closed (% original acreage)
Original Zone Acreage[1]	Acres Cancelled	Remaining Zone Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
42,766	28,459	14,307	4	0	72	<1	15	0	1	98	95

[1] Acreage of Zone 3 with no lease areas cancelled.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-11 Zone 3 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 4

Vegetation Cover			Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (% coverage)	NSO plus Closed (% original acreage)
Original Zone Acreage[1]	Acres Cancelled	Remaining Zone Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
7,895 (18)	3,574	4,321	<1	0	58	0	47	0	1	94	89

[1] Acreage of Zone 3 with no lease areas cancelled.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Special Status Plant Species

Table 4.6-12 displays the Zone 3 suitable habitat for special status plant species and significant plant communities that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The differences between Alternative 3 and Alternative 4 for special status plant species and significant plant communities are summarized below.

- **DeBeque Phacelia Suitable Habitat Ute Ladies'-tresses Suitable Habitat Colorado Hookless Cactus Suitable Habitat**: There would be no difference between Alternatives 3 and 4, as there is no suitable habitat in Zone 3.
- **Suitable Alpine Habitat*:*** There would be no difference between Alternatives 3 and 4, as there is no suitable habitat in Zone 3.
- **Suitable Fen Habit**: The combination of NSO lease stipulations and proposed lease cancellations would preclude surface disturbance in about 100 percent of suitable fen habitat (same as under Alternative 3); however, under Alternative 4, cancelled lease acreages would not be subject to exceptions, modifications, or waivers. Eighty percent of the 113 acres of suitable fen habitat in Zone 3 would be within cancelled leases. All of the remaining acreage would be covered by resource specific NSO and CSU stipulations. Of this remaining acreage, the WIZ NSO may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO).
- **Suitable Forested Habitat:** With consideration of both NSO and lease cancellations, 95 percent of the Zone 3 suitable forested habitat would be precluded from surface disturbance if all NSOs were implemented. This is 7 percent more than Alternative 3. Sixty-seven percent of the 36,478 acres of suitable forested habitat in Zone 3 would be within cancelled leases and therefore not subject to exceptions, modification, or waivers. The CSU stipulation for Sensitive Plant Species would be applied to approximately 68 percent of the remaining suitable forested habitat; coverage afforded by other resource-specific NSO and CSU stipulations would be minimal. Surface disturbance would be precluded on 85 percent of the remaining suitable forested habitat acreage if all NSOs were implemented.
- **Suitable Non-Forested Habitat**: With consideration of both NSO and lease cancellations, 86 percent of the Zone 3 suitable non-forested habitat would be precluded from surface disturbance if all NSOs were implemented. This is 4 percent more than Alternative 3. Sixty-three percent of the 6,123 acres of suitable non-forested habitat within Zone 3 would be within cancelled leases. The CSU stipulation for Sensitive Plant Species would be applied to approximately 96 percent of the remaining suitable non-forested habitat; coverage afforded by other resource-specific NSO and CSU stipulations would be minimal. Surface disturbance would be precluded on about 88 percent of the remaining suitable non-forested habitat if all NSOs were implemented.
- **Significant Plant Community Habitat:** With consideration of both NSO and lease cancellations, 98 percent of the Zone 3 significant plant community habitat would be precluded from surface disturbance if all NSOs were implemented. This is 1 percent more than Alternative 3. Sixty-four percent of the 11,415 acres of significant plant community habitat within Zone 3 would be within cancelled leases. The CSU stipulation for Sensitive Plant Species would be applied to about half of the remaining habitat, but surface disturbance would be precluded on about 90 percent of the remaining significant plant community habitat if all NSOs were implemented.

Table 4.6-12 Zone 3 Stipulation Coverage of Special Status Species Habitat /Wetland Habitats under Alternative 4

Habitat Type	Habitat Acreages Within Zone			Resource-specific CSU Stipulations (%of remaining acreage)			Resource-specific NSO Stipulations (% of remaining acreage)[2]				All NSOs (% remaining acreage)	NSO plus Closed (% original acreage)
	Original Acreage (% zone)[1]	Acres Cancelled	Remaining Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
Special Status Plant Species Suitable Fen Habitat	11;3 (<1)	90	23	1	0	100	0	100	0	100	100	100
Special Status Plant Species Suitable Forested Habitat	36,478 (85)	24, 620	11,858	3	0	68	<0.1	11	0	1	85	95
Special Status Plant Species Suitable Non-Forested Habitat	6,123 (14)	3,829	2,294	<0.1	0	96	<0.1	<0.1	0	3	88	86
Significant Plant Community Habitat	11,415 (27)	7,351	4,064	6	0	50	0	11	0	0	90	98

[1] Zone percentage based on a 42,766-acre zone.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Impacts from Projected Future Oil and Gas Development

RFDS under Alternative 4 projects up to 383 wells on an estimated 55 well pads, resulting in 821 acres of short-term (construction) surface disturbance and 356 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts from the RFDS are summarized by zone.

Impacts in Zones 1, 2, and 4 would be the same as Alternative 3.

Within Zone 3, 28,459 acres of leases within the 42,766-acre zone would be cancelled, reducing the area available for development to 14,307 acres. The Zone 3 RFDS would be reduced to 18 wells on 3 well pads. This would result in 39 acres of construction surface disturbance and 17 acres of operations surface disturbance. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the RFDS could occur in special status plant species suitable forested or non-forested habitat, or in significant plant community habitat. Between 50 and 96 percent of these habitats would be subject to resource-specific CSUs. With consideration of lease cancellations and NSOs in the remaining lease acreage, about 1,778 acres of suitable forested habitat, 275 acres of suitable non-forested habitat, and 406 acres of significant plant community habitat would be open to surface disturbance. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all such habitat in remaining Zone 3 leases (and less than 1 percent of the original Zone 3 habitat acreage). If the full Zone 3 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 2 percent of all such habitat in remaining Zone 3 leases (and about 1 percent of the original Zone 3 habitat acreage). If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in remaining Zone 3 leases (and less than 1 percent of the original Zone 3 habitat acreage). All remaining suitable fen habitat (23 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. With consideration of lease cancellations and NSOs, about 2,115 acres of riparian/wetland habitat would be open to surface disturbance, half of which would be covered by a resource-specific CSU stipulation. If the full Zone 3 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 1 percent of all such habitat in remaining Zone 3 leases (less than 1 percent of the original Zone 3 habitat acreage). Portions of known noxious weed populations within Zone 3 would be present in the areas that are available for on-lease development.

The potential for off-lease development would be the same as under Alternative 3.

4.6.5.5 Alternative 5

Under Alternative 5, all leases would be cancelled, and producing wells would be plugged and abandoned. Existing wells, access roads, and ancillary facilities would be removed, and all disturbed areas would be reclaimed. Under Alternative 5, 75 wells on 16 well pads would be reclaimed, resulting in 86 acres of short-term disturbance.

Within Zone 2, there would be approximately 37 acres of disturbance associated with the reclamation of well pads and 39 acres associated with roads. Within Zone 3, surface disturbance associated with the reclamation would comprise 1 acre from well pads and 9 acres from roads. No surface disturbance would occur in the off-lease area, Zone 1, or Zone 4 because there are no existing wells in these areas. Impacts from well removal are discussed under Section 4.1.3, Impacts Common to All Alternatives, and may include vegetation removal and mechanical damage to plants, soil compaction, erosion, changes in hydrology, and encroachment by noxious weeds and invasive plant species, as well as impacts from fugitive dust.

After reclamation, existing disturbance areas would be seeded with native plant species. Eventual return to a native plant community would be anticipated, following an interim period of time where the sites

would be vulnerable to noxious weeds and other non-native invasive species. Due to the cancellation of the leases, there would be no anticipated new disturbance to vegetation from new oil and gas development. As part of well abandonment and road reclamation activities, direct disturbance to special status species and significant plant communities would be restricted in compliance with federal regulations under the ESA.

4.6.5.6 Summary of Impacts

Alternative 1 (the No Action Alternative) and Alternative 2 would apply almost no resource-related NSO stipulations and the level of NSO coverage afforded to vegetation resources by other NSO stipulations would be minimal. Alternative 3 would apply resource-related NSO and CSU stipulations to the leases and the level of NSO coverage afforded to vegetation resources by other NSO stipulations would be greater than Alternatives 1 and 2. Alternative 4 offers the same resource-related NSO and CSU stipulations and a similar level of coverage to vegetation resources from other NSO stipulations, but in Zone 3, a portion of that coverage would be provided through lease cancellation rather than NSO stipulations. There are no leasing stipulations associated with Alternative 5, which would cancel all leases, plug and abandon 75 wells, and reclaim associated facilities and roads. The level of proposed new surface disturbance associated with the RFDS would be very similar under Alternative 1 (the No Action Alternative), Alternative 2, and Alternative 3. Proposed new surface disturbance under Alternative 4 would be slightly lower than under Alternatives 1, 2, and 3. Alternative 5 would have the lowest level of surface disturbance, which would not be associated with any new development, but rather would result from the reclamation activities. Impacts to general vegetation, riparian areas, noxious weeds, and special status plant species habitat are summarized by alternative below.

<u>General Vegetation</u>

Under the No Action Alternative, and Alternative 2, outside of Zone 1 (which would be fully precluded from surface disturbance), the RFDS could occur in any vegetation type. Under Alternative 3, surface disturbance would be fully precluded in Zone 1 and there would be NSO stipulations in the majority of all vegetation cover in Zones 2, 3, and 4. While there would still be potential for the RFDS to occur in portions not covered by NSO stipulations, most areas would be covered by one or more CSU stipulations that could require surveys or special development techniques to minimize disturbance. Alternative 4 would have the same impacts as Alternative 3 except in Zone 3, where surface disturbance would be precluded on almost 10 percent more vegetation cover. Additionally, proposed lease cancellations would remove the potential for exceptions, modifications, or waivers of NSO stipulations in over 66 percent of the zone. Alternative 5 would minimize impact to vegetation cover to the greatest extent possible, since all surface disturbance would be associated with reclamation of vegetation cover.

<u>Riparian/Wetland Areas</u>

Alternatives 1 through 5, in general, progressively provide increased coverage to riparian and wetland areas inside the lease boundaries through stipulations, lease modifications, and lease cancellations. Alternatives 1 and 2 propose no resource-specific stipulations (however, an existing Riparian/Wetland GMUGNF would be applied to 2.9 acres under all alternatives). Alternatives 3 and 4 apply several resource-specific CSU and NSO stipulations. While Alternatives 3 and 4 apply the same stipulations, Alternative 4 also cancels 25 leases in Zone 3 (which equates to more than 45 percent of the riparian and wetland areas in Zone 3).

However, the increased coverage to the lease areas may have the opposite impact to the areas outside the leases by causing the disturbance to occur off-lease. Therefore, Alternatives 1 through 4 may increase the risk of impacts to riparian and wetland areas immediately adjoining the leases (with the exception of the 25 cancelled lease areas of Alternative 4, which would not be developed).

Alternative 5 would minimize the risk of impacts to riparian and wetland areas to the greatest extent possible, since oil and gas development of the 65 leases would not occur on-lease or off-lease.

Noxious Weeds

The potential for the introduction of noxious weeds through surface-disturbing activities would be similar under Alternative 1 (the No Action Alternative), Alternative 2, and Alternative 3 since they have a very similar level of proposed development. Alternative 4 would have a lower potential due to a lower level of proposed development. Alternative 5 would have the lowest potential for noxious weed introduction.

While development in near proximity to existing noxious weed populations may increase the potential for weed proliferation, it offers an additional possibility beyond Forest Service weed treatments for noxious weed control. Under Alternatives 1 and 2, most known noxious weed populations are located in areas that would be open to surface disturbance. Under Alternatives 3 and 4 most known noxious weed populations are in areas that would be precluded from surface disturbance. Alternative 5 would minimize the potential for the spread of noxious weeds to the greatest extent, since all surface disturbance would be associated with reclamation.

Under all alternatives, the BLM would retain the ability to relocate operations to some degree and require BMPs or conditions of approval to minimize the potential for noxious weeds to become established or proliferate.

Special Status Plant Species

Oil and gas development under Alternatives 1 and 2 would have the greatest potential for impacts to Special Status Plant Species due to the least amount of potential protection from associated stipulations. Under Alternatives 1 and 2, with the exception of Zone 1 (which would be fully precluded from surface disturbance), any or all of the RFDS could occur in suitable habitat for most special status species. While Zone 1 contains the most suitable habitat for federally listed species, there is potential for RFDS to occur in Ute ladies'-tresses suitable habitat in Zone 2, as well as special status species suitable fen habitat, suitable forested habitat, suitable non-forested habitat, and significant plant community habitat in Zones 2, 3, and 4. The degree to which these habitats could be affected by the RFDS would generally depend on the relative abundance of habitat. Assuming the RFDS occurs in each special status habitat to the maximum allowed by NSO stipulations (and available acreage, since in some cases the habitat is not present in sufficient acreage to accommodate a full RFD), the RFDS would have the potential to occur in 92 percent of Ute Ladies'-Tresses suitable habitat (present only in Zone 2); 100 percent of suitable fen habitat in Zones 3 and 4; and between 1 to 6 percent of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat present in each lease zone, except in Zone 2 where it would have the potential to occur in 100 percent of the significant plant community habitat present in that zone. Under Alternatives 1 and 2, there would be no resource-specific CSU that could minimize disturbance if any NSO stipulations were exempted.

Under Alternatives 3 and 4, Zone 1 also would be fully precluded from surface disturbance and more special status species suitable habitat would be precluded from surface disturbance in Zones 2, 3, and 4. Assuming the RFDS occurs in each special status habitat to the maximum allowed by NSO stipulations and habitat availability, there is no potential for the RFDS to occur in Ute Ladies'-tresses suitable habitat, or in suitable fen habitat. The full RFDS would have the potential to occur in about 1 to 6 percent of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat present in each lease zone (including Zone 2). Additionally, under Alternatives 3 and 4, many of the NSO stipulations covering these habitats are resource-specific and much of the habitat also is covered by one or more resource-specific CSU that would minimize disturbance if NSO stipulations were exempted. While both Alternatives 3 and 4 preclude surface disturbance within special status species habitat to a similar degree, Alternative 4 would offer an advantage over Alternative 3 because in Zone 3, surface disturbance in over half of all special status species habits present within the zone would be precluded through lease cancellation, which cannot be exempted. However, increased surface protections within the lease areas may increase potential impacts to special status plant species and habitat on lands outside of the lease areas (with the exception of the 25 cancelled lease areas of Alternative 4, which

would not be developed). Alternative 5 would minimize the potential for the impacts to special status species habitat to the greatest extent, since all surface disturbance would be associated with reclamation.

4.6.6 Cumulative Impacts

4.6.6.1 Cumulative Impacts Analysis Area

The CIAA for general vegetation is the existing 65 leases (80,380 acres). The CIAA for special status species is the lease area plus a 300-meter extension outside of the leasing area (CIAA acreage varies depending on species).

4.6.6.2 Past and Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

The primary past and present actions affecting the vegetation resources for both cumulative impacts analysis areas analyzed in this EIS include surface-disturbing activities such as mineral development; road development and other land development such as ROWs for pipelines, telephone lines or other developments. Section 4.1 presents the total quantifiable past and present surface disturbance by CIAA. Within the vegetation resources CIAA, there are 454 acres of surface disturbance from past or present actions. This is less than 1 percent of the CIAA. Other Forest Service District or BLM FO actions such as farming, timber harvests, livestock grazing, vegetation treatments, agriculture, recreation, and land management decisions are considered when analyzing past and present actions, but do not have quantifiable surface disturbance. No additional quantifiable past and present surface disturbance was identified within the 300-meter extension outside of the leasing area, but it is assumed that activities such as farming, timber harvests, livestock grazing, vegetation treatments, agriculture, and recreation also have taken place in that area.

Reasonably Foreseeable Future Actions (RFFAs)

RFFAs are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. RFFAs are summarized in Section 4.1 and are described in detail in **Appendix B**.

Oil and Gas and Other Surface Disturbance RFFAs

Within the General Vegetation CIAA, the impacts for Alternatives 1 through 5 (discussed in Sections 4.6.4.1, 4.6.4.2, 4.6.4.3, 4.6.4.4, and 4.6.4.5) would be the only surface disturbance effects from oil and gas development. There is no other RFFA long-term surface disturbance planned for the vegetation resources CIAA.

Within the Special Status Species CIAA, there is potential for additional oil and gas development to occur outside of the leases, but within the 300-meter buffer area (the “off-lease” area), subject to leasing availability and existing NSO stipulations. Within the 300-meter buffer area, there is potential for about 590 acres of long-term disturbance to occur on BLM lands within the CRVFO and GJFO, and about 23 acres to occur on NFS lands within the GMUGNF. The portion of this development that may occur within the 300-meter buffer is reasonably assumed to be a fraction of this total, given the total acreage over which the RFFA is projected and the acreage of the 300-meter buffer.

RFFA Projects with Countervailing Impacts

Impacts under this section are those that may not have adverse impacts on vegetation resources and may have a countervailing effect on cumulative impacts. There is an estimated 6,000 acres within the vegetation resources CIAA and special status species CIAA that may have countervailing impacts on vegetation resources under the South Rifle Habitat Enhancement Project. In addition, vegetation

treatments (e.g., noxious weed control) and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact. These actions are described in greater detail in **Appendix B**.

4.6.6.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

Within the Vegetation CIAA, the Proposed Action and alternatives would contribute between 0 percent (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long-term surface-disturbing activities within the CIAA. If selected, Alternative 5 would eliminate existing and proposed surface disturbance that could affect vegetation.

As noted in the analysis, most special status species habitat in the “off-lease” area is either closed to leasing or covered by NSO stipulations. Impacts from any RFFA development within the 300-meter buffer or on haul roads associated with the RFFA would be the same as discussed in Section 3.6.3. Indirect impacts from RFFAs such as dust deposition or noxious weed spread could affect vegetation within the leases as well as off-lease areas. There are no other identified RFFAs that would occur within the vegetation resources or special status species CIAA.

4.7 Terrestrial Wildlife Including Special Status Species

4.7.1 Analysis Assumptions and Approach to Analysis

4.7.1.1 Analysis Area

The analysis areas for terrestrial wildlife, including special status species, were chosen to represent the combination of geographic areas containing contiguous habitat that may be impacted by the proposed leasing decisions and subsequent oil and gas development, as well as the management regimes for this habitat.

The analysis areas for terrestrial wildlife species are defined as follows:

- **Nongame and Small Game Terrestrial Wildlife Analysis Area:** The terrestrial wildlife analysis area for small game species and nongame species, including raptors and other migratory birds, includes suitable habitat (as determined through use of the Forest Service Region 2 vegetation data) within the lease boundaries.
- **Special Status Species Wildlife Analysis Area:** The analysis area for special status species, including Federally Listed, Proposed, or Candidate Wildlife Species, Forest Service and BLM Sensitive Wildlife Species, and Forest Service Management Indicator Species (MIS) comprises of suitable, historic, or occupied, habitat within the 65 leases based on Region 2 vegetation data. The exception is elk, which is a MIS but is analyzed under the analysis area.
- **Big Game Analysis Area:** The big game analysis area consists of the GMUs that are crossed by the lease boundaries. Sensitive habitat is typically considered the limiting factor for big game populations, therefore additional focus will be given on these areas (e.g., winter range, transition range, migratory corridors, fawning and calving areas and summer range) within the GMUs. GMUs included in the analysis area are 12, 23, 42, 43, 421, and 521.
- **Canada Lynx Analysis Area:** The Canada lynx analysis area includes the LAUs crossed by the lease boundaries.
- **Greater Sage-grouse Analysis Area:** The greater sage-grouse analysis area includes Priority Habitat Management Areas and General Habitat Management Areas (GHMAs) as classified by Colorado Parks and Wildlife (CPW), crossed by the lease boundaries.

4.7.1.2 Scoping Issues

The public scoping issues related to terrestrial wildlife are listed below. While many of the scoping issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analysis of many of these issues in detail. All issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- How would reasonably foreseeable habitat disturbance, vehicle use, and other elements of oil and gas development such as noise affect wildlife, special status species, and their habitat?
- How will the Proposed Action and alternatives affect big game, including effects on habitat fragmentation and connectivity and the potential for additional human disturbance or poaching from roads? How would these impacts affect big game hunting?
- What stipulations or BMPs, mitigation measures, or conditions of approval can be incorporated into the Proposed Action and alternatives to reduce risk to wildlife and special status species? (As noted in Chapter 2.0 and Section 4.1, because the locations of future oil and gas development are unknown, mitigation measures have not been identified for this leasing analysis. Onsite evaluations and site-specific NEPA analysis will be performed at the APD stage

and BMPs, mitigation measures, or COAs would be developed to address site-specific conditions as part of the permit process.)

- How will the cumulative impacts from oil and gas and other regional development affect air quality, visibility, water resources, greater sage-grouse, and other wildlife?

4.7.1.3 Assumptions

Assumptions were made concerning the impacts of making lands available to lease for oil and gas exploration and development as they relate to terrestrial wildlife and special status species.

- Species will be considered as having the potential to occur within the analysis area if:
  - Occurrence has been documented for the species;
  - The current species range exists within the study area and suitable habitat is present; and
  - Historical range for species that have the potential to be reintroduced and suitable habitat is present.
- Management direction and guidance for special status species are provided through implementation of recovery plans, conservation agreements, management plans, and state wildlife plans (e.g., Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan).
- Leasing is a commitment of the oil and gas resources for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions. As a result of leasing, future exploration and development proposals would be subject to specific state and federal regulatory and permitting requirements and to additional site-specific environmental analysis under NEPA at the APD stage of permitting. These subsequent analyses would address site-specific wildlife conditions and effects to them, and serve as the basis for any project-level design features or best management practice requirements.
- The proposed management actions in each alternative would include the proposed stipulations (e.g., NSO, CSU, or TL stipulations) to reduce impacts on wildlife. Direct and indirect impacts of land uses on terrestrial wildlife are generally best mitigated by avoiding or minimizing the impact on the degree practicable with stipulations. The various management actions and allowable use decisions outlined in this document emphasize this approach for maintaining or conserving terrestrial wildlife and their habitat. Impacts that cannot be avoided would at least be minimized by the application of COAs or BMPs.
- Impacts on wildlife populations and habitat are not discrete since actions may benefit one species while having an adverse or beneficial impact on another.
- Significant modifications to habitat suitability can impact the survivability and viability of populations (e.g., higher winter mortality or reduced reproductive success).
- Impacts on terrestrial wildlife from displacement depend on the location, extent, timing, or intensity of the disruptive activity. Impacts from displacement of wildlife would be greater for wildlife species that have limited habitat or a low tolerance for disturbance.
- The quality and quantity of winter ranges are generally considered to be the limiting factors on big game populations. The ability of these areas to support wintering populations is a major factor in determining yearlong population levels.
- The CPW would continue to manage wildlife populations, and the BLM would continue to manage wildlife habitat in coordination with the CPW. Big game habitat would be managed in coordination with CPW herd objectives and species-specific plans. Sufficient habitat currently exists to maintain current CPW Data Analysis Unit objectives for big game.

- In the context of this analysis, avoidance means reduced use and does not imply zero use or an absence of use by wildlife. When making a decision regarding discrete surface–disturbing activities following site-specific environmental review, BLM has the authority to impose reasonable measures to minimize impacts on other resource values, including restricting the siting or timing of lease activities (43 CFR 3100; 43 CFR 3160; Yates Petroleum Corp., 176 IBLA 144 [2008] a; Interior Board of Land Appeals 2010-25).
- Impacts on special status species can occur from actions that result in direct mortality of special status species, loss of habitat or modifications to habitat suitability, and in the case of special status wildlife, actions that displace individuals or disrupt behavior. Because special status species have specific habitat requirements, and their habitats are often diminishing, disturbance to the species or their habitat could result in population declines, which could adversely affect viability of local populations.
- Since special status species populations are, by their nature, generally small and localized, the total area affected by other activities or restrictions is less important than where the activities or restrictions occur in relation to special status species and their habitat.
- The health of special status species populations is directly related to the overall health and functional capabilities of upland, aquatic, riparian and wetland resources, which in turn are a reflection of overall watershed health.
- Special status species health, population levels, and habitat conditions fluctuate in response to natural factors. Periods of drought or excessive moisture and outbreaks of diseases that affect special status species directly or alter habitat (e.g., mountain pine beetle) would likely affect special status species population levels.
- Implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area.
- All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level. The BLM would implement measures to conserve BLM sensitive species and their habitats to reduce the likelihood and need for these species to become listed. Success of mitigation depends on the specific protective measures employed and the assumption that proper implementation of these measures would take place. Adaptive management would be used (i.e., changing techniques, as necessary) until success is achieved.

4.7.1.4 Impact Indicators Used for Analysis

The following indicators have been identified to analyze the effects of the alternatives on terrestrial wildlife and special status habitat and populations.

- Acres of surface disturbance within each lease zone and habitat.
- Acres of surface disturbance by suitable habitat type (big game winter range, production areas, etc., as well as special status species and migratory birds), by alternative and zone.
- Acres of special status species habitat subject to NSO stipulations, by alternative and zone.

4.7.1.5 Methods of Analysis

Methods of analysis for terrestrial wildlife and special status species include the following for each alternative:

- Identify and estimate the acres of terrestrial habitats (vegetation communities) located within the analysis areas using data provided in Section 3.6, Vegetation, and published information.
- Identify and estimate acres of designated big game ranges that occur within the analysis areas using Forest Service, BLM, and CPW data.
- Identify special status terrestrial species (federally threatened, endangered, candidate, and proposed species under the ESA; Forest Service Sensitive Species and MIS) that occur within the analysis areas using Geographic Information System data and CPW and BLM occurrence information.
- Determine the extent of lease stipulations under each alternative that would provide some level of protection from disturbance of wildlife and habitats, and where those populations and habitats would potentially be at risk due to the lack of lease stipulations.

4.7.2 Stipulations Providing Coverage to Terrestrial Wildlife Resources

In order for future oil and gas leasing within the analysis area to be consistent with environmental laws and regulations, this analysis includes proposed lease stipulations to reduce potential impacts of oil and gas development on terrestrial wildlife including special status species. It is important to note that a one-time exemption from a stipulation can be applied that is determined on a case-by-case basis. The exception suspends the restrictions of a stipulation for a specified period of time, activity, or portion of the area where applied but remains in effect relative to other periods of time, activities, or areas where applied. As detailed in Section 2.7, the 2014 WRNF Oil and Gas Leasing EIS is a programmatic environmental analysis that considers conceptual or planning-level alternatives. For this EIS analyzing potential changes to the 65 previously issued leases, the RFDS (USFS 2010a), described briefly in Chapter 1.0, Section 1.1.4 and included as Appendix F of the WRNF Oil and Gas Leasing Draft EIS (USFS 2012) was used to determine the amount of conceptual future development in order to compare potential impacts of the proposed leasing stipulations under each alternative.

Stipulations are the same under Alternatives 1 and 2 and include CSU, NSO, and TL stipulations associated with big game species only. There are no stipulations identified for special status species. Under Alternative 3, the Proposed Action, modifications of the 65 leases would be made to match the stipulations for future leasing in the Forest Service's Proposed Action from the WRNF Final EIS (USFS 2014a). Under Alternative 3, the BLM would modify the existing leases to apply stipulations that match those identified by the Forest Service for future leasing in its Proposed Action. Under this alternative, the BLM would offer the lessee the option of either accepting the new lease terms or having the lease cancelled. Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

Standard Lease Terms (SLTs) also offer some level of protection of terrestrial wildlife species and habitat through modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measure, including the relocation of proposed operations up to 200 meters and a delay for new surface-disturbing operations for up to 60 days annually. SLTs identify the independent requirement for ESA compliance.

4.7.2.1 Wildlife-specific Stipulations

Tables 4.7-1 and **4.7-2** identify stipulations specific to terrestrial wildlife for all Alternatives. The methodology in developing stipulations is discussed in Section 1.4.6, "Lease Stipulations," and the rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS (USFS 2014a). The definition of the resource and purpose (need for protection) for WRNF resources is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS. The definition of the resource and purpose for GMUGNF resources is identified on each stipulation form in Appendix C of the 1993 GMUGNF Oil and Gas Leasing Plan Amendment.

Table 4.7-1 Stipulations Associated with Terrestrial Wildlife Under Alternatives 1 and 2

CSU
Elk Production Area—GMUGNF
NSO
Big Game Winter Range
Critical Bighorn Sheep Habitats
Federal and State TEPC Species
TL
Big Game Winter Range (December 1 through April 30, applies to elk and mule deer)
Big Game Winter Range—GMUGNF
Elk Production Area (May 1 through June 30)

Table 4.7-2 Stipulations Associated with Terrestrial Wildlife Under Alternatives 3 and 4

CSU
Big Game Migration Corridors
Big Game Production Areas
Big Game Summer Concentration
Big Game Winter Ranges
Elk Production Area—GMUGNF
Sensitive Terrestrial/Avian/ Invertebrate Species
NSO
Bighorn Sheep Migration Corridors and Water Sources
Bighorn Sheep Production
Bighorn Sheep Summer Concentration
Raptor Species Breeding Territories
TEPC Raptor Species
TEPC Wildlife Species\Wallace Creek Wildlife Seclusion Area
TL
Big Game Summer Concentration (June 16 through October 14; applies to deer, elk, moose, and black bear)
Big Game Winter Range (December 1 through April 14 applies to deer, elk, and moose and includes winter ranges, winter concentration areas, and severe winter ranges)
Raptor Species Breeding Territories (NSO buffers and dates vary by species)

NSO Stipulations

NSO stipulations are designed to provide the maximum coverage by prohibiting surface use or occupancy. Under Alternatives 1 and 2, there are NSO stipulations for Big Game Winter Range, Critical Bighorn Sheep Habitats, and Federal and State TEPC species. Under Alternatives 3 and 4, the NSO stipulation for Big Game Winter Range has been eliminated but there are NSO stipulations for, Bighorn Sheep Migration Corridors and Water Sources, Bighorn Sheep Production Areas, and Bighorn Sheep Summer Concentration Areas; Raptor Species Breeding Territories; TEPC Raptor Species; and TEPC Wildlife Species.

Controlled Surface Use Stipulations

CSU stipulations provide special operational constraints beyond SLT but do not prohibit all activities. Under Alternatives 1 and 2, there is one CSU stipulation for Elk Production Area on the GMUGNF. Under Alternatives 3 and 4, there are CSU stipulations for Big Game Migration Corridors, Production Areas, and Winter Ranges (applicable to deer, elk and moose); Big Game Summer Concentration Areas (applicable to deer, elk, moose, and back bear); Elk Production Areas (within the GMUGNF only); and Sensitive Terrestrial/Avian /Invertebrate Species. These CSU stipulations allow for special design, construction, operation, mitigation, implementation, reclamation, and monitoring measures, including the relocation of operations by more than 200 meters to protect terrestrial wildlife habitats.

Timing Limitations

TL stipulations are designed to limit use of key habitat during periods in which disturbance may result in mortality, reduced animal fitness, reduced reproductive success or poor survivorship of young. TL stipulations do not apply to operation and maintenance of existing facilities.

Under Alternatives 1 and 2, there is a TL stipulation that prohibits exploration, drilling and development activities in elk and mule deer winter range from December 1 through April 30. There also is a TL stipulation for elk production areas that prohibit exploration, drilling and development activities from May 1 through June 30 to protect habitats used for rearing young and concentrated feeding sites. Both TL stipulations also prescribe year-round closures of new oil and gas roads to the public in these areas.

- Under Alternatives 3 and 4, the Big Game TL stipulation precludes construction, drilling, and completion activities from December 1 to April 15 in elk, mule deer, and moose winter ranges as mapped by CPW. In addition, a new TL stipulation prohibiting surface use in deer, elk, moose, or black bear summer concentration areas (used for rearing young and providing high value foraging sites) between June 16 through October 14, was added to reduce behavioral disturbances that can result in abandonment of critical habitats, reduced animal fitness, or reduction of reproductive success, recruitment, and survival. Under these alternatives the elk production TL was not brought forward based on the decision made in the 2014 WRNF Oil and Gas Leasing EIS. Though the stipulation will not be included on any of the leases under Alternatives 3 and 4, there is still an opportunity to apply a 60-day TL as a COA under the BLM SLTs during site-specific NEPA analyses at the implementation level. However, implementing the TL stipulation for big game summer concentration areas (June 16 through October 14) and not including the elk production TL under Alternatives 3 and 4, would result in a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection.
- In addition to a new TL stipulation for big game summer concentration areas, a TL stipulation for raptor species breeding territories was added under Alternatives 3 and 4. This stipulation prohibits surface use within species-specific buffers and time periods and also prohibits any activity or disturbance that would result in active raptor nests not being used, or which would lead to raptor nest failure, abandonment, or mortality of fledglings.

4.7.2.2 Other Stipulations Offering Additional Coverage to Terrestrial Wildlife

There are other NSO stipulations that overlay with terrestrial wildlife habitat that may offer some coverage through prohibition of surface disturbance, but are not designed to specifically cover terrestrial wildlife habitat. These stipulations include, but are not limited to the following:

- NSO—Alpine
- NSO—Fen Wetlands
- NSO—Roadless Areas
- NSO—Slopes Greater than 60 percent
- NSO—Slopes Greater than 50 percent
- NSO—USFS Administrative Sites
- NSO—High Geologic Hazard—GMUGNF
- NSO—Riparian/ Wetland—GMUGNF
- NSO—Severe or High Landscape Stability Hazards
- NSO—TEPC Aquatic Species
- NSO—TEPC Plant Species
- NSO—Water Influence Zones
- NSO—Authorized Sites And Facilities
- NSO—High Scenic Integrity Objective
- NSO—RNAs

If all other NSO stipulations are implemented, these could potentially provide additional protection to some terrestrial wildlife resources from future surface-disturbing impacts in the areas where there is overlap with suitable habitat. However, should the resource being covered not occur within an area designated for a specific stipulation, the operator may obtain a waiver or exception, resulting in a lack of coverage to terrestrial wildlife species and associated habitat. The level of coverage from the implementation of these NSO stipulations would therefore be overestimated if not all stipulations were implemented.

4.7.3 Impacts Common to All Alternatives

Within the WRNF Final EIS (USFS 2014a), impacts identified for terrestrial wildlife species were considered indirect based on the action of making lands available for future oil and gas leasing. These impacts were disclosed in terms of two key indicators:

1. Behavioral disturbance (i.e., changes in use of habitats, use of movement corridors, and in behavior; and reactions to stress as a result of human disturbance including vehicle use, noise, and lighting); and
2. Physical impacts (i.e., habitat loss, habitat degradation, habitat fragmentation and isolation, interruption of wildlife movement corridors, wildlife mortality resulting from vehicle collisions, entrapment, drowning, and poisoning) (USFS 2014a, p. 192).

Impacts under each alternative were compared based on stipulations covering wildlife habitat available to lease for future oil and gas development (USFS 2014a, p. 201-211). Physical impacts were measured by evaluating the percent habitat lost or substantially degraded by habitat group within the analysis area. Estimated physical impacts are shown as a percentage of the lands available for oil and gas leasing without NSO stipulations (USFS 2014a, Tables 49, 51, 52, 54, and 55). Behavioral disturbance impacts were measured by evaluating road density and terrestrial wildlife habitat effectiveness within the analysis area for each alternative. Habitat effectiveness objectives are detailed in Section 3.3.2.2 of the WRNF Final EIS (USFS 2014a, p. 190-200).

Within this EIS, and similar to the WRNF Final EIS (USFS 2014a), leasing, by itself, would not directly impact terrestrial wildlife resources but, given that the development of the leases is a reasonably foreseeable result of the granted lease right, the impact analysis considers the potential impacts of reasonably foreseeable future development (see Section 4.1.1).

The primary issues related to terrestrial wildlife resources include the loss or alteration of associated habitats; mortality to individuals or loss of breeding sites, nests, eggs, and young; disturbance to wildlife species due to human presence, noise and lighting effects on wildlife; increased access to sensitive wildlife habitats; and potential impacts to threatened and endangered species. The degree to which

these effects affect wildlife species depends on a variety of factors including the species, time of year, duration of effect, and intensity of effect. Impacts common to all terrestrial wildlife species, including special status, as a result of oil and gas development are detailed in the 2014 Final EIS for Leasing on the WRNF (USFS 2014a, p 192-198).

4.7.4 Impacts by Alternative

4.7.4.1 Alternative 1 (No Action Alternative)

As shown in **Table 2-8**, Alternative 1 would result in 892 acres of initial disturbance and 387 acres of long-term disturbance across all zones. The majority of the disturbance would occur in Lease Zone 2, with an estimated 684 acres of initial disturbance and 296 acres of long-term disturbance. This would represent an estimated 76 percent of the overall disturbance under Alternative 1. Development in Lease Zone 3 would be 111 acres of the initial disturbance and 48 acres of long-term disturbance, which comprises an estimated 12 percent of the overall disturbance. Development in Lease Zones 1 and 4 result in less than 10 percent of the total disturbance. Development in Lease Zones 1 would be 77 acres of the initial disturbance and 33 acres of long-term disturbance. Development in Lease Zone 4 would be 21 acres of the initial disturbance and 9 acres of long-term disturbance.

Stipulation Coverage

Under Alternative 1, the BLM would continue to administer the leases with their current stipulations. Those leases that are currently under suspension would be reaffirmed and allowed to be developed at the discretion of the lessee. Should a suspension be lifted and lease reaffirmed, the process for management of exploration, development, and reclamation would continue to follow the process described in Section 1.1.3. Due to the limited number of lease stipulations and number of acres available to development, Alternative 1 would have the most potential to impact terrestrial wildlife species. Impacts from Projected Future Oil and Gas Development

Section 4.6.4.1 (Vegetation, Alternative 1) details impacts to vegetation communities that represent the associated terrestrial wildlife habitats. **Table 4.6-2** displays the amount of associated terrestrial wildlife habitats that would be covered by resource-specific stipulations under this alternative. Terrestrial wildlife habitat, with the exception of riparian/wetland habitats would not be subject to any resource-specific NSO stipulations. This stipulation would cover less than one percent of Zone 2 for both vegetation communities and riparian/wetland habitat. Greater than 99 percent of Zone 2 would be open for oil and gas development with respect to vegetative resource-specific NSOs. No resource-specific NSO stipulations apply to Zones 1, 3, or 4.

Non-resource related NSO stipulations (Section 4.7.2.2) that overlay with terrestrial wildlife habitat that would offer additional protection against surface disturbance, but are not designed to specifically cover these habitats. With consideration of all NSO stipulations, there is no area (0 percent) open for oil and gas development (surface occupancy) in Zone1; 61 percent of Zone 2, 92 percent of Zone 3, and 98 percent of Zone 4 would be available for oil and gas development; however, it should be clarified that one or more of these other NSO stipulations could be waived during site-specific NEPA analysis.

The stipulations providing coverage to terrestrial wildlife species under Alternative 1 are listed in **Table 4.7-1**. This includes a variety of stipulations specifically designated for big game ungulate species:

- CSU—Elk Production Area for the GMUGNF
- NSO—Big Game Winter Range and Critical Bighorn Sheep Habitats
- TL—Big Game Winter Range
- TL—Elk Production Areas

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, depending on habitat, all present terrestrial wildlife species would have the potential to be impacted directly and indirectly by oil and gas development as was described and referenced in Section 4.7.3, Impacts Common to All Alternatives. Reduction of impacts from surface-disturbing activities would be in place for terrestrial wildlife habitat through NSO stipulations for big game as well as non-wildlife related NSO stipulations. Limited protection from surface-disturbing activities to all terrestrial wildlife species would be potentially applied as a CSU in this Alternative. Potential protection from behavioral disturbance during winter months would be applied as a TL.

Under this alternative, the NSO stipulation for Big Game Winter Range was only applied to 26 percent of lease 066695 in Zone 3. However, as discussed in Section 4.7.2.3, there are non-wildlife related stipulations that overlay with big game wildlife habitat that do offer some level of protection to, but are not designed to specifically cover big game wildlife habitat. With consideration of these non-wildlife-related NSO stipulations that overlay big game sensitive ranges within the analysis area, the entirety of Zone 1 is closed to surface-disturbing activities due to a variety of NSOs. Therefore, all bighorn sheep sensitive ranges, mule deer winter concentration areas and winter range, elk winter range, black bear fall concentration areas, and all greater sage-grouse habitat would potentially be covered within the lease boundaries. However, with no exceptions granted to the NSOs, the development scenario under Alternative 1 would imply that the development would occur on the adjacent lands surrounding the leases. It is understood that there could be impact to sensitive wildlife habitats on adjacent lands with similar impacts to those addressed in Section 4.7.3, Impacts Common to All Alternatives. The percentage of big game ranges within the lease boundaries covered by wildlife-specific and non-wildlife-specific NSOs are included in tables below.

Mule Deer

Sensitive mule deer ranges within the analysis area include severe winter range, winter concentration areas and winter range. A Big Game Winter Range NSO stipulation exists under Alternative 1 that would afford these areas some protection, however, this stipulation does not overlay with any of these sensitive ranges under Alternative 1. As detailed in **Table 4.7-3** below, 100 percent of the mule deer sensitive ranges identified as occurring within the analysis area in Zone 1 would be covered by other non-resource NSO stipulations. Due to the generally higher elevation, Lease Zones 2 and 3 only contain 65 acres of mule deer winter range, 62 and 3 acres, respectively.

These acres would not be covered by any NSO stipulations and would be at risk for surface disturbance during lease development. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Alternative 1 also includes a TL stipulation for Big Game Winter Range, which is applied to mule deer. The TL would provide seasonal coverage to 2 percent (93 acres) of Mule Deer Winter Range in Zone 1, 58 percent (36 acres) of the 62 acres of mule deer winter range in Zone 2, and no acreage in Zone 3. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day Big Game Winter Range TL as a COA at the implementation level.

Table 4.7-3 Mule Deer Habitats with NSO Under Alternative 1

Zone	Mule Deer Severe Winter Range			Mule Deer Winter Concentration Areas			Mule Deer Winter Range		
	Acres within Analysis Area	NSO Coverage (% of habitat)		Acres within Analysis Area)	NSO Coverage (% of habitat)		Acres within Analysis Area	NSO Coverage (% of habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	184,360	0	13	278,273	0	16	615,817	0	15
1	0	0	0	19	0	100	6,160	0	100
2	0	0	0	0	0	0	62	0	0
3	0	0	0	0	0	0	3	0	0
4	0	0	0	0	0	0	0	0	0

0 = Outside the lease zones, but within the Analysis area. These areas would not be affected by the alternative, but are included for cumulative impact analyses.

Elk

The following sensitive elk ranges occur within the analysis area: production areas; severe winter range, winter concentration areas, and winter range; and summer concentration areas. Impacts are disclosed below.

Production Areas: Elk production areas within the analysis area would not be covered by any resource-specific NSO stipulations under Alternative 1. As detailed in **Table 4.7-4** by zone, between 1 percent (in Zone 4) and 41 percent (in Zone 2) of elk production areas within the analysis area would potentially be covered by non-resource NSO stipulations. The remaining acreages (over 19,000 acres within Zones 2, 3, and 4) could potentially be developed. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Under Alternative 1, a TL stipulation for elk production areas would be applied to areas within Zones 2 and 3. This stipulation would prohibit exploration, drilling and development activities from May 1 through June 30, and would prohibit the use of any new oil and gas roads by the public year-round. The percentage of coverage to elk production areas afforded by this stipulation is disclosed in **Table 4.7-4**. The TL stipulation would cover 25 percent of elk production areas in Zone 2 and 39 percent of elk production areas in Zone 3, but would not cover any of the 1,709 acres of elk production areas in Zone 4. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day elk production TL as a COA at the implementation level.

Table 4.7-4 Elk Production Areas Subject to NSO and TL Stipulations Under Alternative 1

Zone	Acres within Analysis Area	NSO Stipulations		TL Stipulations within Elk Production Areas (% of Habitat)
		Resource-specific NSO (% of Habitat)	Any NSO (% of Habitat)	
0[1]	207,158	0	29	NA
1	0	0	0	0
2	8,581	0	41	25
3	13,523	0	4	39
4	1,709	0	1	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas would not be affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Winter Range: As showing **Table 4.7-5**, the NSO stipulation for Big Game Winter Range included under Alternative 1 would cover 8 percent of the 2,112 acres of Elk Winter Range in Zone 3. Coverage would only occur on lease number 066695. The NSO stipulation would not cover any winter range in the other zones, nor would it cover any elk severe winter range or elk winter concentration areas. Coverage afforded to Elk Severe Winter Range, Elk Winter Concentration Areas, and Elk Winter Range from other NSO stipulations also are disclosed in **Table 4.7-5**. Within the lease area, the level of coverage for Winter Range habitat afforded by other NSO stipulations under Alternative would range from 1 percent (in Zone 4) to 100 percent (in Zone 2). Coverage afforded to Elk Severe Winter Range and Elk Winter Concentration Areas would range from 0 (in Zone 3, which contains 100 acres of Elk Severe Winter Range) to 6 percent (in Zone 2, which contains 454 acres of Elk Winter Concentration Areas). Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Alternative 1 also would include a TL stipulation for Big Game Winter Range. **Table 4.7-6** discloses the level of coverage afforded to Elk Severe Winter Range, Elk Winter Concentration Areas, and Elk Winter

Table 4.7-5 Elk Winter Ranges Covered by NSO Stipulations Under Alternative 1

Zone	Elk Severe Winter Range			Elk Winter Concentration Areas			Elk Winter Range		
	Acres Within Analysis Area	NSO Coverage (% of habitat)		Acres Within Analysis Area	NSO Coverage (% of habitat)		Acres Within Analysis Area	NSO Coverage (% of habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	302,343	0	12	302,821	0	14	1,067,300	0	17
1	0	0	0	0	0	0	5,038	0	100
2	455	0	3	454	0	6	11,625	0	21
3	100	0	0	0	0	0	2,112	8	23
4	0	0	0	0	0	0	317	0	1

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative but are included for cumulative impact analyses.

Table 4.7-6 Elk Winter Ranges Covered by TL Stipulations Under Alternative 1

Zone	Elk Severe Winter Range		Elk Winter Concentration Area		Elk Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	302,343	NA[1]	302,821	NA[1]	1,067,300	NA[1]
1	0	0	0	0	5,038	2
2	455	14	454	23	11,625	76
3	100	0	0	0	2,112	13
4	0	0	0	0	317	93

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Range through application of this seasonal stipulation. The TL stipulation would cover between 2 percent (Zone 1) and 93 percent (Zone 4) of all Elk Winter Range. The TL stipulation also would offer coverage to Elk Severe Winter Range and Elk Winter Concentration Areas within Zone 2 (14 and 23 percent, respectively) but would not cover any of the 100 acres of Elk Severe Winter Range within Zone 3. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day winter Big Game TL as a COA at the implementation level.

Summer Concentration Areas: There are no stipulations that provide seasonal protections for elk summer concentration areas. As detailed in **Table 4.7-7**, within the analysis area, about 50 percent of the summer concentration areas within Zone 2 and about 5 percent of summer concentration areas within Zone 3 would be covered by other non-resource NSO stipulations. The remaining acreages (over 18,500 acres within Zones 2 and 3) would be at risk for surface disturbance during lease development. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. There are no TL stipulations related to protection of summer concentration areas under Alternative 1.

Table 4.7-7 Elk Summer Concentration Areas Covered by NSO Stipulations Under Alternative 1

Zone	Elk Summer Concentration Areas within the Analysis Area (acres)	NSO Coverage within Elk Summer Concentration Areas (% habitat)	
		Resource-specific NSO	Any NSO
0[1]	223,723	0	42
1	0	0	0
2	7,714	0	51
3	18,063	0	5
4	0	0	0

[1] 0= Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Moose

Under Alternative 1, there are no stipulations specifically designated for the protection of moose within the analysis area. As detailed in **Table 4.7-8**, NSO stipulations unrelated to moose would provide minimal coverage to moose concentration areas within the leases (0 to 2 percent, by zone). Under Alternative 1, NSO stipulations would cover about 12 percent of all moose summer range within the leases. There are no TL stipulations related to seasonal protection of moose concentration areas or moose summer range under Alternative 1. Impacts to habitat not covered by any stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-8 Sensitive Moose Habitat Covered by NSO Stipulations Under Alternative 1

Zone	Moose Concentration Areas			Moose Summer Range		
	Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)		Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	124,086	0	22	334,837	0	9
1	0	0	0	0	0	0
2	8,861	0	2	0	0	0
3	2,584	0	<1	128	0	12
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Rocky Mountain Bighorn Sheep

An NSO stipulation for Critical Bighorn Sheep Habitats would be applied under Alternative 1. Only Zone 1 contains sensitive bighorn sheep ranges. Therefore, impacts would be specified to the Battlement herd only as the range of the Avalanche herd overlaps with Zone 3. As detailed in **Table 4.7-9**, 43 percent of overall range and summer range would be covered by the Critical Bighorn Sheep Habitats NSO and all designated bighorn sheep ranges within Zone 1 would be covered by NSO stipulations.

As described above, with consideration of all NSO stipulations, Zone1 could potentially be closed to surface occupancy related to oil and gas development. Therefore, all bighorn sheep ranges within the lease boundaries would be covered under Alternative 1. Outside the lease boundaries, but within the analysis area, 24 percent of overall range, 84 percent of production areas, 7 percent of severe winter range, 53 percent of summer concentration areas, 26 percent of summer range, 57 percent of water sources, and 61 percent of winter concentration areas would be covered by an NSO. These areas are not affected by Alternative 1, but are included for cumulative impact analyses.

Carnivores

Black Bear

Under Alternative 1, there are no stipulations specifically designated for the protection of black bear concentration areas within the analysis area. As detailed in **Table 4.7-10**, NSO stipulations unrelated to black bear would provide NSO coverage to between 43 percent (in Zone 2) and 100 percent (in Zone 1) of fall concentration areas, and 18 percent of all fall concentration areas outside of the leases (but within the analysis area). NSO stipulations would cover about 12 percent of all summer concentration areas within the leases and 13 percent of all summer concentration areas outside of the leases (but within the analysis area). Impacts to habitat not subject to stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-9 Bighorn Sheep Habitat with NSO Coverage

Zone	Overall Range			Production Areas			Summer Concentration Areas			Summer Range			Winter Concentration			Water Sources		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	164,545	0	24	30,034	0	84	8,744	0	53	149,229	0	26	5,484	0	61	12,224	0	57
1	9,361	43	100	935	0	100	404	0	100	9,361	43	100	404	0	100	5,227	0	100
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

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Table 4.7-10 Black Bear Fall and Summer Concentration Areas with NSO Coverage

Zone	Fall Concentration Areas			Summer Concentration Areas		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0	482,403	0	18	435,685	0	13
1	993	0	100	0	0	0
2	14,857	0	43	0	0	0
3	285	0	67	128	0	12
4	0	0	0	2	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Special Status Species

Federally Listed and Candidate Species

Under Alternative 1, there would be an NSO stipulation for all known locations of federally listed TEPC species. The stipulation specifies the need for surveys during the site-specific NEPA stages, and development of appropriate mitigation. The stipulation does not extend to suitable or potential habitat. However, as stated in Section 4.7.1, Analysis Assumptions, implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area. All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level.

Federally Threatened

Canada Lynx

Impacts to the Canada lynx would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Under Alternative 1, there would be no stipulations specifically designated for the protection of Canada lynx habitat within the Canada Lynx Analysis Area that consists of LAUs crossed by the lease boundaries. Lynx denning habitat was located in Zones 2 and 3 within the Canada lynx analysis area. Other non-resource-specific NSO stipulations would provide coverage to less than 1 percent of the designated habitat within Zones 2 and 3 (**Table 4.7-11**).

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Table 4.7-11 Canada Lynx Habitat with NSO Coverage

Zone	Denning Habitat			Denning/Winter Habitat			Winter Habitat			Winter Forage Habitat			Other Habitat		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	8,009	0	2	344	0	<1	1022	0	<1	732	0	<1	18	0	<1
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2,043	0	<1	0	0	0	0	0	0	0	0	0	0	0	0
3	365	0	<1	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

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Western Yellow-Billed Cuckoo

Impacts to the yellow-billed cuckoo would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Under Alternative 1, within the GMUGNF, an NSO stipulation for riparian and wetland communities would afford coverage of yellow-billed cuckoo potential habitat within the Terrestrial Wildlife Analysis Area. Impacts to wetland habitat were analyzed in Section 4.6.4.1 (Vegetation, Alternative 1).

Mexican Spotted Owl

Impacts to the Mexican spotted owl would be the same as those described above as in Section 4.7.3, Impacts Common to All Alternatives for raptor species. Under Alternative 1, there would be no stipulations specifically designated for the protection of Mexican spotted owl suitable habitat within the analysis area.

Forest Service Sensitive and Management Indicator Species

Under Alternative 1, there are no stipulations specifically designated for the protection of Forest Service Sensitive and MIS species, with the exception of elk and bighorn sheep, which are analyzed above under big game ungulates. Section 4.6.4.1 (Vegetation, Alternative 1) details impacts to associated vegetation communities that represent the habitats associated with these species within the terrestrial wildlife analysis area. There are non-resource related stipulations that overlay with Forest Service Sensitive and MIS habitat that do offer some level of coverage, but are not designed to specifically protect them.

As detailed in **Table 3.7-11**, there are 255 acres of GHMA habitat for the greater sage-grouse that overlap with leases located in Zone 1. Under Alternative 1, known greater sage-grouse locations would be protected during site-specific development as described within the Northwest Colorado Greater Sage-grouse Proposed Land Use Plan Amendment and Final EIS (BLM and USFS 2015), but there would be no stipulations specifically designated for the protection of greater sage-grouse or designated GHMA habitat. However, an NSO non-resource related stipulation, slopes greater than 60 percent, overlays with all designated GHMA, potentially affording some coverage to this habitat from future oil and gas development. Additionally with consideration of all NSO stipulations, Zone 1 is precluded from development. Should a waiver to this stipulation be granted under a separate NEPA process, impacts to greater sage-grouse would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Therefore, Impacts to Forest Service Sensitive and MIS would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Impacts to associated Forest Service Sensitive and MIS habitat would be the same as those described above under nongame species.

4.7.4.2 Alternative 2 (Proposed Action)

Alternative 2 addresses inconsistencies between the 1993 WRNF ROD (USFS 1993a) and the lease stipulations as they were subsequently issued. In cases where the leases did not include the stipulations as stated in the Forest Service decision document; leases would be modified to include those stipulations (**Table 4.7-1**) under this alternative.

As shown in **Table 2-8**, oil and gas development under Alternative 2 would result in the same amount of initial and long-term disturbance as Alternative 1 (892 acres of initial disturbance and 387 acres of long-term disturbance). The distribution of disturbance between zones also would be the same as Alternative 1.

Stipulation Coverage

The level of coverage afforded to terrestrial wildlife and special status species under Alternative 2 would be similar to Alternative 1 (**Table 4.7-1**) except for minor changes to 8 of the 65 leases. No additional NSO stipulations specifically designated for terrestrial wildlife species would be added as a result of Alternative 2, but TL stipulations for 85 acres of big game winter range and 1,725 acres of elk production areas would be added. In addition, non-resource-specific stipulations added under Alternative 2 provide additional coverage to terrestrial wildlife resources.

Impacts from Projected Future Oil and Gas Development

Impacts to all terrestrial wildlife species, including special status species, and associated habitat would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives and as discussed under Alternative 1, with the exception of additional non-wildlife resource specific NSO coverage to the following species habitats.

1. Sensitive elk ranges:

- **Elk Production Area:** Under Alternative 2, an additional 340 acres of non-resource-specific NSO coverage occurred within Zone 3 increasing the coverage of elk production areas from 4 percent to 7 percent (**Table 4.7-12**). TL stipulation coverage would be increased by an additional 351 acres in Zone 3, increasing seasonal protections from 39 percent to 41 percent.
- **Elk Winter Range:** Impacts would be the same as under Alternative 1 except coverage of Elk Winter Range by TL stipulations in Zone 1 (which currently cover 2 percent of the total elk winter range in that zone) would be increased by 5 acres, maintaining 2 percent coverage of the total elk winter range in Zone 1.

Table 4.7-12 Elk Production Areas with NSO and TL Coverage Under Alternative 2

Zone	Acres within Analysis Area	NSO Coverage		TL Coverage for Elk Production Areas (% of Habitat)
		Resource-specific NSO (% of Habitat)	Any NSO (% of Habitat)	
0[1]	207,158	0	29	NA
1	0	0	0	0
2	8,581	0	41	25
3	13,863	0	7	41
4	1,709	0	1	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

2. Special Status Species:

- An additional 129 acres of Canada lynx denning habitat would be covered by a NSO for slopes greater than 60 percent on Lease No. 066687 in Zone 3 under Alternative 2. The additional acres would still result in less than 1 percent coverage of denning habitat within Zone 3.

4.7.4.3 Alternative 3

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in the Proposed Action from the 2014 WRNF Final EIS (**Table 4.7-2**).

As shown in **Table 2-8**, oil and gas development under Alternative 3 would result in 886 acres of initial disturbance and 383 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2, with 684 acres of initial disturbance and 296 acres of long-term disturbance (76 percent of the overall disturbance and the same as Alternatives 1 and 2). Development in Lease Zone 3 would be 104 acres of the initial disturbance and 45 acres of long-term disturbance, which comprises approximately 12 percent of the overall disturbance. Development in Lease Zones 1 and 4 result in less than 10 percent of the total disturbance. Development in Lease Zones 1 would be 77 acres of the initial disturbance and 33 acres of long-term disturbance. Development in Lease Zone 4 would be 21 acres of the initial disturbance and 9 acres of long-term disturbance.

<u>Stipulation Coverage</u>

Under Alternative 3, the NSO stipulation for Big Game Winter Range included under Alternatives 1 and 2 would be eliminated. Additional NSO stipulations specific to wildlife resources based on the 2014 WRNF Final EIS include:

- Bighorn Sheep Migration Corridors and Water Sources, Bighorn Sheep Production Areas, and Bighorn Sheep Summer Concentration Areas
- Raptor Species Breeding Territories
- TEPC Raptor Species
- TEPC Wildlife Species

Alternative 3 also would apply CSU stipulations to:

- Big Game Migration Corridors, Big Game Production Areas, Big Game Summer Concentration, Big Game Winter Ranges
- Elk Production Area (within the GMUGNF)
- Sensitive Terrestrial/Avian/Invertebrate Species

The big game winter range TL stipulation would be extended to moose, but would not include a year-round road closure for new oil and gas roads on public lands for the general public. Alternative 3 also would apply a TL stipulation prohibiting surface use in deer, elk, moose, or black bear summer concentration areas (used for rearing young and providing high value foraging sites) between June 16 through October 14, to reduce behavioral disturbances that can result in abandonment of critical habitats, reduced animal fitness, or reduction of reproductive success, recruitment, and survival.

- Under Alternative 3, the TL stipulation for elk production areas included under Alternatives 1 and 2 was eliminated to be consistent with decision made in the WRNF EIS. Portions (June 16 through June 30) of the sensitive time period (May 1 to June 30) can be covered through SLTs, under which operations may be delayed up to 60 days during site specific NEPA analyses at the implementation level. However, implementing the TL stipulation for big game summer concentration areas (June 16 through October 14) and not including the elk production TL under Alternatives 3 and 4, would result in a 45-day window (May 1 through June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection.

- To cover raptor species breeding territories that prohibits surface use within species-specific buffers and time periods and to prohibit any activity or disturbance that would result in active raptor nest failure, abandonment, or the mortality of fledglings.

Impacts from Projected Future Oil and Gas Development

Section 4.6.4.3 (Vegetation, Alternative 3) details impacts to associated vegetation communities that represent the habitats associated with terrestrial wildlife. As shown in **Table 4.6-8**, an estimated 89 percent of associated terrestrial wildlife habitat in Zone 1 would be covered by resource-specific NSOs. For Zone 2, 11 percent of habitat and 15 percent in Zone 3 would be covered by resource-specific NSOs. For Zone 4, an estimated 16 percent of vegetation cover would be covered by resource-specific NSOs. It is estimated that 11 percent of vegetation community cover in Zone 1 would be at risk from oil and gas development. An estimated 89 percent in Zone 2, 85 percent in Zone 3, and 84 percent in Zone 4 would be at risk from oil and gas development activities prior to site-specific surveys and ESA consultation at the APD stage of permitting.

An estimated 100 percent of vegetation community cover would be covered by resource-specific CSUs for Zone 1 and Zone 2. For Zones 3 and 4, 79 percent and 94 percent, respectively, would be covered by resource-specific CSUs. No portions of Zone 1 and 2 would be at risk. Approximately 21 percent and 6 percent would be at risk from oil and gas development for Zones 3 and 4, respectively.

Mule Deer

Under Alternative 3, there would be no NSO stipulations for coverage of mule deer; however, as shown in **Table 4.7-13**, with consideration of unrelated NSO stipulations, all sensitive mule deer winter habitat within lease Zones 1 and 3 would be fully covered. Within Zone 2, 31 percent of the mule deer winter range (19 acres) would not be covered by other NSO stipulations and thus at risk for surface disturbance during lease development. TL stipulations designated for the protection of big game winter range would preclude surface use seasonally from December 1 to April 14 within deer winter range, winter concentration areas, and severe winter range. Acreages covered by stipulations are disclosed in **Table 1.4-14**. Within the lease zones, all mule deer winter habitats would be fully covered by TL stipulations except for Zone 1, in which only 71 percent of the mule deer winter range would be covered. The remaining 29 percent can be covered with a 60-day TL through BLM SLTs at the implementation level. With consideration of all NSO stipulations and resource-specific TL stipulations, all mule deer sensitive habitats would be covered during key time periods.

Elk

Production Areas: Elk production areas within the analysis area would not be covered by any resource-specific NSO or TL stipulations; however there are CSU stipulations for big game production areas as well as the option to apply a 60-day TL through BLM SLTs at the implementation level. As a result, under Alternatives 3 and 4, there is a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection. Additionally, as shown in in **Table 4.7-15**, with consideration of all NSO stipulations, most elk production areas in in the lease area also are covered by NSO stipulations unrelated to elk.

Table 4.7-13 Mule Deer Winter Ranges Covered by NSO Stipulations Under Alternative 3

Zone	Mule Deer Severe Winter Range			Mule Deer Winter Concentration Areas			Mule Deer Winter Range		
	Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Resource-specific NSO		Resource-specific NSO	Resource-specific NSO
0[1]	184,360	0	13	278,273	0	16	615,882	0	15
1	0	0	0	19	0	100	6,160	0	100
2	0	0	0	0	0	0	62	0	69
3	0	0	0	0	0	0	3	0	100
4	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-14 Mule Deer Winter Ranges Covered by TL Stipulations Under Alternative 3

Zone	Mule Deer Severe Winter Range		Mule Deer Winter Concentration Area		Mule Deer Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	184,360	19[1]	278,273	NA[1]	615,882	NA[1]
1	0	0	19	100	6,160	71
2	0	0	0	0	62	100
3	0	0	0	0	3	100
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-15 Elk Production Areas Covered by NSO Stipulations Under Alternative 3

Zone	Acres within Analysis Area	NSO Coverage	
		Resource- specific NSO (% of Habitat)	Any NSO (% of Habitat)
0[1]	207,158	0	29
1	0	0	0
2	8,581	0	95
3	13,523	0	83
4	1,709	0	96

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Winter Range: There are no resource-specific NSO stipulations designated for the protection of elk winter habitats, but with consideration of all NSO stipulations, the majority of elk winter habitat within the leases would be covered by an NSO stipulation (**Table 4.7-16**). As disclosed in **Table 4.7-17**, all elk winter habitat within the leases would be covered by a TL stipulation precluding surface use within elk winter ranges, winter concentration areas, and severe winter ranges from December 1 through April 14.

Summer Concentration Areas: There are no resource-specific NSO stipulations designated for the protection of elk summer concentration areas, but a CSU stipulation would be applied to all summer concentration area acreage within the lease area. Additionally, almost all elk summer concentration areas within the leases would be covered by other unrelated NSO stipulations (**Table 4.7-18**). TL stipulations precluding surface use in elk summer concentration areas from June 16 through October 14 also would be applied to all acreage (see **Table 4.7-18**).

Moose

Under Alternative 3, there are no NSO stipulations specifically designated for the protection of moose habitat. As detailed in **Table 4.7-19**, NSO stipulations unrelated to moose would provide coverage to 91 and 83 percent of moose concentration areas within Zones 2 and 3, respectively. NSO stipulations also would cover almost 100 percent of moose summer range within the leases. There also is a TL stipulation related to the protection of big game summer concentration areas under Alternative 3, which would cover almost 100 percent of moose summer range within the lease area. Impacts to habitat not covered by stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-16 Elk Winter Ranges Covered by NSO Stipulations Under Alternative 3

Zone	Elk Severe Winter Range			Elk Winter Concentration Areas			Elk Winter Range		
	Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	302,343	0	12	302,821	0	14	1,067,300	0	17
1	0	0	0	0	0	0	5,038	0	100
2	455	0	89	454	0	90	11,625	0	78
3	100	0	72	0	0	0	2,112	8	72
4	0	0	0	0	0	0	317	0	91

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-17 Elk Winter Ranges Covered by TL Stipulations Under Alternative 3

Zone	Elk Severe Winter Range		Elk Winter Concentration Area		Elk Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	302,343		302,821		1,067,300	
1	0	0	0	0	5,038	100
2	455	100	454	100	11,625	100
3	100	100	0	0	2,112	100
4	0	0	0	0	317	100

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-18 Elk Summer Concentration Areas Covered by NSO and TL Stipulations Under Alternative 3

Zone	Elk Summer Concentration Areas within the Analysis Area (acres)	NSO Coverage within Elk Summer Concentration Areas (% habitat)		TL for Summer Concentration Areas
		Resource-specific NSO	Any NSO	
0[1]	223,723	0	42	0
1	0	0	0	0
2	7,714	0	97	100
3	18,063	0	93	100
4	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Table 4.7-19 Sensitive Moose Habitat Covered by NSO Stipulations Under Alternative 3

Zone	Moose Concentration Areas			Moose Summer Range		
	Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)		Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	124,086	0	22	334,837	0	9
1	0	0	0	0	0	0
2	8,861	0	91	0	0	0
3	2,584	0	83	128	0	99
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Rocky Mountain Bighorn Sheep

Several NSO stipulations for Bighorn Sheep would be applied to under Alternative 3. Only Zone 1 contains sensitive bighorn sheep ranges. Therefore, impacts would be specified to the Battlement herd only as the range of the Avalanche herd overlaps with Zone 3. **Table 4.7-20** identifies the potential level of coverage afforded to bighorn sheep range from these stipulations. All production areas, summer and winter concentration areas and water resource areas would be covered and 70 percent of all overall range and summer range would be covered through NSO stipulations.

With consideration of all NSO stipulations, Zone 1 would potentially be closed for oil and gas development (surface occupancy). Therefore, all bighorn sheep ranges within the lease boundaries would be covered under Alternative 3. All NSO coverage to bighorn sheep ranges within the analysis area, but outside the lease boundaries would be the same as Alternative 1.

Table 4.7-20 Bighorn Ranges Covered by Bighorn Sheep NSOs Under Alternative 3

Zone 1	Lease No.	Bighorn Range NSO Coverage (% of Habitat)					
		Overall Range	Production Areas	Summer Concentration Areas	Summer Range	Winter Concentration Areas	Water Source
	COC 058677	100	-	-	100	-	100
	COC 059630	79	-	-	79	-	100
	COC 066727	81	-	-	81	-	100
	COC 066728	100	-	-	100	-	100
	COC 066729	41	-	-	41	-	100
	COC 066730	56	-	-	56	-	100
	COC 066731	19	-	-	19	-	100
	COC 066732	54	-	-	54	-	100
	COC 066733	63	-	-	63	-	100
	COC 066926	57	100	100	57	100	100
	Total Coverage	**71**	**100**	**100**	**71**	**100**	**100**

Table 4.7-21 Black Bear Fall and Summer Concentration Areas Covered by NSO Stipulations

Zone	Fall Concentration Areas			Summer Concentration Areas		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0	482,403	0	18	435,685	0	13
1	993	0	100	0	0	0
2	14,857	0	86	0	0	0
3	285	0	57	128	0	98
4	0	0	0	2	0	50

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Carnivores

Black Bear

Under Alternative 3, there are no stipulations specifically designated for the protection of black bear concentration areas within the analysis area. As detailed in **Table 4.7-21**, NSO stipulations unrelated to black bear would provide coverage to between 57 percent (in Zone 3) and 100 percent (in Zone 1) of black bear fall concentration areas and would cover almost all of the back bear summer concentration acreage within the leases. Application of the TL stipulation related to protection of big game summer concentration areas under Alternative 3 also would cover almost 100 percent of black bear summer

range within the lease area. Impacts to habitat not covered by stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Special Status Species

Federally Listed and Candidate Species

Under Alternative 3, there would be an NSO stipulation for all known locations of federally listed TEPC species. The stipulation extends to occupied and potential habitats necessary for the maintenance or recovery of species listed under the ESA (including proposed and candidate species) or by the State of Colorado as threatened or endangered. Therefore, under Alternative 3, the Canada lynx, Western yellow-billed cuckoo, and Mexican spotted owl would be subject to 100 percent coverage within all zones. Additionally, as stated in Section 4.7.1, Analysis Assumptions, implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area. All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level.

Forest Service Sensitive and Management Indicator Species

Under Alternative 3, there are no stipulations specifically designated for the protection of Forest Sensitive Species and MIS. Impacts to Forest Sensitive Species and MIS under Alternative 3 would be the same as those discussed for Alternative 1. Section 4.6.4.3 (Vegetation, Alternative 3) details impacts to associated vegetation communities that represent the habitats associated with these species within the terrestrial wildlife analysis area.

4.7.4.4 Alternative 4

As shown in **Table 2-8**, oil and gas development under Alternative 4 would result in 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2, with 684 acres of initial disturbance and 296 acres of long-term disturbance (76 percent of the overall disturbance and the same as Alternatives 1, 2, and 3). Development in Lease Zone 3 would be reduced to 39 acres of the initial disturbance and 17 acres of long-term disturbance, which comprises 4 percent of the overall disturbance. Development in Lease Zones 1 and 4 would be the same as under Alternative 3.

Stipulation Coverage

Alternative 4 would apply the same stipulations as Alternative 3 (**Table 4.7-2**) but also would cancel all or part of 25 leases in Zone 3.

Impacts from Projected Future Oil and Gas Development

Section 4.6.4.4 (Vegetation, Alternative 4) details impacts to associated vegetation communities that represent the habitats associated with terrestrial wildlife. An estimated 5 percent vegetation cover (15 percent of under Alternative 3) in Zone 3 would be covered by resource-specific NSO stipulations. Resource-specific CSUs would cover an estimated 25 percent (79 percent under Alternative 3) in Zone 3. In addition to the changes between area covered by resource-specific NSOs and CSUs, 67 percent vegetation cover of Zone 3 is covered due to its CTL designation under Alternative 4.

In Zone 3, an estimated 95 percent would be potentially at risk from oil and gas development where there would be no NSO stipulations; 75 percent would be at risk where there would be no CSU stipulations; and 33 percent of vegetation cover would be at risk where areas are not designated as CTL.

An estimated 37 percent riparian/wetland habitats (91 percent of under Alternative 3) in Zone 3 would be covered by resource-specific NSO stipulations. Resource-specific CSUs would cover an estimated 41 percent riparian/wetland habitats (92 percent under Alternative 3) in Zone 3. In addition to the changes between area covered by resource-specific NSOs and CSUs, 55 percent riparian/wetland habitats in Zone 3 is covered due to its CTL designation under Alternative 4.

In Zone 3, an estimated 63 percent of riparian/wetland habitat would be potentially at risk from oil and gas development where there would be no NSO stipulations; 59 percent habitat would be at risk where there would be no CSU stipulations; and, 45 percent habitat would be at risk where areas are not designated as CTL.

Impacts to all terrestrial wildlife species, including special status species, would be the same as those described under Alternative 3, with the exception of the areas closed for leasing. Additional protection afforded to certain terrestrial wildlife species by the cancellation of leases are discussed by species affected below.

Mule Deer

Coverage by stipulations to limit adverse effects to mule deer from Alternative 4 would be the same as Alternative 3 except that the 3 acres of mule deer winter range in Zone 3 that were covered with TL stipulations specific to mule deer and which also were covered with NSO stipulations not specific to mule deer would be eliminated through lease cancellation.

Elk

Production Areas: Under Alternative 4, all or part of 25 leases within Zone 3 would be cancelled. Lease cancellation would preclude surface disturbance in 9,724 of the 13,523 acres (72 percent) of elk production areas within Zone 3. Therefore, coverage of elk production areas would increase due to the cancellation of the leases. Within the remaining elk production areas (3,800 acres) that would still be open to oil and gas development, 90 percent would be covered by non-resource-specific NSO stipulations. As with Alternative 3, SLTs could be used to provide for a delay of operations for up to 60 days during calving, however, there is a 45-day window (May 1 to June 15) that leaves approximately 3,800 acres in Zone 3 without stipulation protection. CSU stipulations also would be applied to provide additional coverage.

Winter Range: Under Alternative 4, of the 100 acres of elk severe winter range located in Zone 3 without any NSO coverage, all but three would be canceled. Other resource stipulations would provide coverage to the remaining 3 acres and therefore, 100 percent of the elk severe winter range would be covered by NSO stipulations within Zone 3. Lease cancellation also would preclude development in 1,902 of the 2,112 acres of elk winter range (90 percent) within Zone 3. Impacts to severe winter range and winter range in Zones 1, 2, and 4 would be the same as Alternative 3. Impacts to elk winter concentration areas would be the same as Alternative 3.

Summer Concentration Areas: Impacts to elk summer concentration areas would be the same as Alternative 3 except that within Zone 3, 57 percent of the 18,063 acres of elk summer concentration areas within Zone 3 would be precluded from development through lease cancellation.

Moose

Impacts to moose from Alternative 4 would be the same as Alternative 3 (**Table 4.7-17**) except 1 acre of moose summer range would be precluded from development through lease closure in Zone 3.

Carnivores

Black Bear

Impacts to black bear concentration areas and moose summer range would be the same as Alternative 3 except that within Zone 3, 85 percent (241 acres) of black bear fall concentration areas and 1 percent (1 acre) of summer concentration areas would be precluded from development through lease closure. Of the remaining 44 acres of fall concentration areas within Zone 3, 86 percent would be covered through application of NSO stipulations unrelated to black bear.

Special Status Species

Federally Listed and Candidate Species

Impacts to TEPC wildlife species under Alternative 4 would be the same as those discussed for Alternative 3. Specific to the Canada lynx, 4,105 acres of lynx denning habitat would be closed to leasing. The remaining designated denning habitat (1,466 acres) would all be covered by the NSO for TEPC wildlife species.

Forest Service Sensitive and Management Indicator Species

Impacts to Forest Service Sensitive and MIS under Alternative 4 would be the same as under Alternative 3 with the exception of additional stipulation coverage associated with suitable habitat as analyzed in Section 4.6.4.4 (Vegetation, Alternative 4).

4.7.4.5 Alternative 5

Alternative 5 would cancel all 65 existing leases, which would result in plugging and abandoning wells; removing roads, wells pads, and ancillary facilities; and reclaiming all areas of disturbance. Disturbance resulting from lease cancellations would be 37 acres for pads and 39 acres for roads in Zone 2, and 1 acre from pads and 9 acres for roads in Zone 3. No surface disturbance would occur in the off-lease area, Zone 1, and Zone 4 because there are no existing wells.

After reclamation, there would be no anticipated alteration of habitat related to oil and gas development within the lease zones that could affect terrestrial wildlife resources. As part of well abandonment and road reclamation activities, direct disturbance to special status species would be restricted in compliance with federal regulations under the ESA.

Stipulation Coverage

Under this alternative, there are no stipulations providing additional coverage to terrestrial wildlife resources, as all leases would be cancelled by this action.

Impacts from Projected Future Oil and Gas Development

There would be no future development under this alternative; however, there would be impacts to wildlife resources from the surface disturbance required to plug and abandon the existing wells and reclaim any associated infrastructure (e.g., roads) as described above in Section 4.7.3, Impacts Common to All Alternatives.

4.7.4.6 Summary of Impacts

Alternative 1

Under Alternative 1, the No Action Alternative, oil and gas development would continue as operations currently exist. Under this alternative, wildlife-specific NSO stipulations would only be applied to bighorn sheep ranges and elk and mule deer game winter ranges. With consideration of all NSO stipulations, Alternative 1 offers additional coverage for all terrestrial wildlife resources beyond wildlife-specific NSO

stipulations. Stipulations may be waived during site-specific NEPA at the implementation level, reducing the level of coverage to terrestrial wildlife.

Based on the NSO for Big Game Winter Range under Alternative 1:

- 8 percent of elk winter range in Zone 3 would be covered, but no designated mule deer winter ranges within the analysis area would be covered by this NSO; and
- 43 percent of bighorn sheep overall and summer ranges would be covered by the Critical Bighorn Sheep Habitat NSO.

In addition, all known locations of special status species listed as federally threatened, endangered, and candidate species under the ESA would be covered by TEPC species NSO under Alternative 1.

With regard to combined NSO stipulations, Zone 1 would be fully covered by NSO, thus potentially protecting all terrestrial wildlife resources, including special status species within the lease areas, if those NSO stipulations were not granted exceptions. Based on wildlife-specific NSO stipulations providing coverage to wildlife species:

The Big Game Winter Range TL stipulation that would apply to mule deer and elk winter range within the analysis area would not always cover winter range as it is currently mapped. However, under Alternative 1, the TL could potentially provide seasonal protection to 2 percent (93 acres) of mule deer winter range in Zone 1, 58 percent (36 acres) of the 62 acres of mule deer winter range in Zone 2, and no acreage in Zone 3. This TL stipulation would cover between 2 percent (Zone 1) and 93 percent (Zone 4) of all Elk Winter Range. The TL stipulation also would cover Elk Severe Winter Range and Elk Winter Concentration Areas within Zone 2 (14 and 23 percent, respectively) but would not cover any of the 100 acres of Elk Severe Winter Range within Zone 3. The TL stipulation for elk production areas would cover between 25 and 39 percent of all elk production habitat by zone, but would not cover any of the 1,709 acres of elk production areas in Zone 4. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day Big Game Winter Range TL or an Elk Production Area TL as a COA at the implementation level.

Alternative 2

Any future oil and gas development under Alternative 2 would follow the same guidelines as the No Action alternative, with the exception of a few modifications to eight of the leases. These modifications would address inconsistencies with the 1993 WRNF Oil and Gas Leasing EIS, and add stipulations identified in the document but not attached to the leases as issued. Impacts would be the same as Alternative 1 except that the additional stipulations would:

- Increase the coverage of elk production areas from unrelated NSO stipulations from 4 to 7 percent and the coverage afforded by TL stipulations for elk production areas from 39 to 41 percent.
- Increase coverage of elk winter range afforded by TL stipulation for big game winter range in Zone 1 by 5 acres.
- Cover an additional 129 acres of Canada lynx denning habitat through application of unrelated NSOs.

Alternative 3

Alternative 3 would modify the existing leases to match stipulations for future leasing identified in the 2014 WRNF Final EIS. These modifications would add substantial stipulation coverage to terrestrial resources compared to the No Action Alternative and Alternative 2. These additional stipulations would leave much of the lease area potentially protected against future oil and gas exploration activities and it

is anticipated that under this alternative it would become more difficult for oil and gas development to occur. All of the zones gain substantial coverage from combined NSO lease stipulations under this alternative, and the majority of sensitive terrestrial wildlife habitats have the potential to be almost or completely protected from future development. The increase in stipulation coverage to applicable terrestrial wildlife species are as follows:

- Mule deer would have 100 percent NSO stipulation coverage in Zones 1 and 3, and about 70 percent NSO stipulation coverage in Zone 3.
- Elk production areas would have between 83 and 96 percent NSO stipulation coverage by zone. Elk winter range in all zones would have between 72 and 100 percent NSO stipulation coverage. Elk severe winter range and elk winter concentration areas in Zone 2 would have 89 to 90 percent NSO stipulation coverages. Severe winter range in Zone 3 would have 72 percent NSO stipulation coverages. Elk summer concentration areas would have over 90 percent NSO stipulation coverage in all zones and a new TL stipulation would cover 100 percent of all elk summer concentration areas. The TL stipulation or elk production areas contained under Alternative 1 would be eliminated, resulting in a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection. However, SLT also could be applied to delay development during calving periods and combined NSOs would cover more of the habitat than the TL stipulation.
- The TL stipulation for mule deer and elk winter range could potentially provide better seasonal protection of winter range as currently mapped compared to Alternative 1. Mule deer winter range would have 100 percent TL coverage in Zones 2 and 3, and 71 percent TL coverage in Zone 1. Elk winter range would have 100 percent TL coverage in all zones.
- Moose concentration areas would have over 80 percent NSO stipulation coverage in all zones; moose summer range would have over 99 percent NSO stipulation coverage. Moose winter habitat also would have 100 percent TL coverage (unlike Alternative 1, which only covers elk and mule deer).
- Bighorn sheep habitat would have 100 percent stipulation coverage. Black bear fall concentration areas would have 57 to 100 percent NSO stipulation coverage by zone; summer concentration areas would have almost 100 percent NSO stipulation coverage.
- Canada lynx, Western yellow-billed cuckoo, and Mexican spotted owl and associated habitat would be covered under NSO stipulations as federally listed species.

<u>Alternative 4</u>

Any future oil and gas development under Alternative 4 would follow the same guidelines as Alternative 3, with the addition of cancelling 25 leases in Zone 3. These modifications would potentially add substantial coverage for terrestrial resources compared to the Alternatives 1, 2, and 3 by precluding development in the following habitats:

- 3 acres of mule deer habitat within the leasing area;
- 9,724 (72 percent) of elk production areas within the leasing area;
- 97 acres (17 percent) of all elk severe winter range within the leasing area;
- 1,902 acres (90 percent) of all elk winter range within the leasing area;
- 10,296 acres (57 percent) of all elk summer concentration areas;

- 241 acres (85 percent) of black bear fall concentration areas and 1 acres (1 percent) of all summer concentration areas; and
- 105 acres of lynx denning habitat.

The cancellation of these leases would protect all terrestrial resources within the cancelled lease area; and unlike combined NSO stipulations, could not be granted. Stipulation coverages for other lease areas would be the same as Alternative 3, which offer greater coverage of terrestrial wildlife resources than Alternative 1.

Alternative 5

Alternative 5 would cancel all existing leases in the area, providing the maximum amount of protection to terrestrial wildlife resource. No oil and gas development would occur; however, there would be temporary impacts to terrestrial wildlife from the process of plugging and abandoning existing wells; removing roads, well pads, and ancillary facilities; and reclaiming disturbed areas.

4.7.5 Cumulative Impacts

4.7.5.1 Cumulative Impacts Analysis Area

The CIAAs for terrestrial wildlife species were chosen to represent the combination of geographic areas containing contiguous habitat that would be impacted by the proposed leasing decisions, as well as the management regimes to which this habitat is subject. The CIAAs primarily comprise NFS lands (WRNF and GMUGNF) but also include BLM lands within the CRVFO, GJFO, and WRFOs, as well as non-federal lands.

The CIAAs for terrestrial wildlife species are defined as follows:

- **Nongame, Small Game, and Special Status Terrestrial Wildlife:** The CIAA for small game species and nongame species, including raptors and other migratory birds, includes suitable habitat (as determined through use of the Forest Service Region 2 vegetation data) within the lease boundaries (80,380 acres). The CIAA for the remainder of the special status species, including Forest Service MIS and other threatened and endangered species includes suitable, historic, or occupied, habitat within the lease boundary based on Region 2 vegetation data. The exception is elk, which is an MIS but is analyzed under the analysis area described above.
- **Big Game:** The big game CIAA includes designated ranges (e.g., winter range, transition range, migratory corridors, fawning and calving areas and summer range) within the GMUs that are crossed by the lease boundaries. GMUs included in the analysis area include: 12, 23, 42, 43, 421, and 521 (2,121,890 acres).
- **Canada Lynx:** The Canada lynx CIAA includes LAUs crossed by the lease boundaries (510,805 acres). Within the LAU boundaries crossed by the lease boundaries, there is 32,809 acres of suitable lynx habitat.
- **Greater Sage-grouse:** The greater sage-grouse CIAA includes Priority Habitat Management Areas and GHMA crossed by the lease boundaries as classified by CPW. There are 255 acres of GHMA within the analysis area.

4.7.5.2 Past and Present Actions

The past and present actions impacting terrestrial wildlife resources are identified in Section 4.1. Past and present actions within the Terrestrial Wildlife CIAA include surface disturbance from energy development as well as other land development activities and other land management actions from the Forest Service and BLM. The primary past and present actions with surface disturbance affecting the resources analyzed in this EIS include mineral development; road development and other land

development such as ROWs for pipelines, telephone lines or other developments. **Table 4.1-2** presents total quantifiable past and present surface disturbance by CIAA. **Appendix B** discusses each of these actions in more detail. In total, past and present actions would disturb 8,697 acres (<1 percent) of the Big Game CIAA, 2,057 acres (<1 percent) of the Lynx CIAA, and 50 acres (<1 percent) of the Greater Sage-grouse CIAA.

The types of impacts to terrestrial wildlife and special status species would mainly consist of activities associated with surface disturbance and permanent structures that eliminate or fragment habitat, as well as human disturbance and direct mortality to terrestrial wildlife species.

4.7.5.3 Reasonably Foreseeable Future Actions

RFFAs within the terrestrial wildlife CIAAs that may result in surface disturbance are similar to those described as past and present actions and are described in detail in **Appendix B**. Some projects such as vegetation treatments may not have adverse impacts on terrestrial wildlife resources and may have a countervailing effect on cumulative impacts. This includes activities that enhance wildlife habitat, including specific wildlife habitat improvement projects, vegetation treatments (e.g., noxious weed control), and hazardous fuels reduction activities. These actions are described in greater detail in **Appendix B**.

Nongame, Small Game, and Special Status Species Terrestrial Wildlife CIAA

The surface disturbance effects from oil and gas within this CIAA would be limited to those associated with Alternatives 1 through 5 as described above. There are no other long term surface-disturbing RFFAs planned for this CIAA. There is an estimated 6,000 acres within this CIAA that may have countervailing impacts on vegetative resources under the South Rifle Habitat Enhancement Project. In addition, vegetation treatments (e.g., noxious weed control) and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Big Game CIAA

Oil and gas development RFFAs would disturb 16,391 acres (1 percent) of the Big Game CIAA. NSO stipulations would cover designated big game ranges outside of the leases to the degree detailed in Zone 0 for each species specific analysis and within **Tables 4.7-4** through **4.7-19**. Stipulation coverages range from 9 percent (moose summer concentration areas, see **Table 4.7-8** and **4.7-19**) to 84 percent (bighorn sheep overall range). Given the percentage of coverage afforded by NSO stipulations; it is reasonable to assume that development will occur in sensitive big game habitats. It also should be noted that these percentages consider all NSO stipulations. Waivers, Exceptions, or Modifications (WEMs) to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of coverage to minimize adverse effects to terrestrial wildlife resources. Surface disturbance from non-oil and gas RFFAs would result in 99 acres. This disturbance would result from reservoir enlargement, trail reroutes, and road improvement projects. Leasing stipulations would not limit location of these developments.

In total, disturbance from all surface-disturbing RFFAs would disturb 16,490 acres (less than 1 percent) in the Big Game CIAA. The alternatives would add between 821 and 892 acres, resulting in a total cumulative impact of between 17,311 and 17,382 acres (less than 1 percent of the CIAA).

As noted, there are 21,392 acres of vegetation treatments and hazardous fuels reduction RFFAs planned the Big Game CIAA (1 percent of the CIAA). Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Lynx CIAA

Oil and gas development RFFAs would disturb 687 acres (less than 1 percent) of the Lynx CIAA. NSO stipulations would cover 14,760 acres (45 percent of suitable lynx habitat within the lynx analysis area) of lynx habitat outside of the leases. Given the low percentage of coverage afforded by NSO stipulations; it is reasonable to assume that development will occur in suitable lynx habitats. It also should be noted that these percentages consider all NSO stipulations. WEMs to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of protection for terrestrial wildlife resources.

There are no other long term surface-disturbing RFFAs planned for the Lynx CIAA. There is an estimated 14,770 acres within the Lynx CIAA (3 percent of the CIAA) that may have countervailing impacts on vegetative resources due to vegetation treatments and hazardous fuel reductions. It is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Greater Sage-grouse CIAA

Oil and gas development RFFAs would disturb 71 acres (28 percent) of the Greater Sage-grouse CIAA. 100 percent coverage would be afforded by NSO stipulations to the CIAA. Under Alternatives 1 and 2, the NSO coverage would not be specific to greater sage-grouse habitat WEMs to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of coverage for terrestrial wildlife resources. Thus the amount of coverage afforded by NSO stipulations may be overstated. There are no other long-term surface-disturbing RFFAs or vegetation or fuels reduction planned for the Greater sage-grouse CIAA. It is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Projects with Countervailing Impacts

Impacts under this section are those that may not have adverse impacts on terrestrial wildlife resources and may have a countervailing effect on cumulative impacts. This includes activities that enhance wildlife habitat, including specific wildlife habitat improvement projects, vegetation treatments (e.g., noxious weed control), and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. These actions are described in greater detail in **Appendix B**. As noted, there are 6,000 acres of vegetation treatments and hazardous fuels reduction RFFAs planned for the Terrestrial Wildlife CIAA (7 percent of the CIAA; 21,392 acres planned for the Big Game CIAA (1 percent of the CIAA); and 14,770 acres within the Lynx CIAA (3 percent of the CIAA). There are no vegetation or fuels reduction treatments planned within the Greater Sage-grouse CIAA.

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4.8 Aquatic Resources

4.8.1 Analysis Assumptions and Approach to Analysis

4.8.1.1 Analysis Area

The analysis area for aquatic resources coincides with the surface water resources analysis area. As shown in **Figure 3.5-1**, the geographical extent of the analysis area for aquatic species and their habitats includes the subwatersheds (HUC12) and perennial waterbodies located within the oil and gas lease boundaries. Additional downstream reaches are included to evaluate potential offsite indirect effects from upstream leased lands, as well as the effects from water depletions. The downstream analysis area is defined as the perimeter of the subwatersheds that extend downstream of the lease boundaries. For federally listed fish species in the Colorado River, the downstream analysis area relates to the closest occurrence of the fish species including their critical habitat.

4.8.1.2 Scoping Issues

The following issues were identified for aquatic biological resources during public scoping. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development. Those issues that cannot be addressed in this leasing analysis are followed by a statement in parentheses explaining the reason for not addressing them.

- What is the potential for the Proposed Action and alternatives to affect the Colorado River System fish through consumptive use or impacts to water quality?
- How will the cumulative impacts from oil and gas and other regional development affect air quality, visibility, water resources, greater sage-grouse, and other wildlife?
- What acute or chronic impacts could result from reasonably foreseeable development that would affect aquatic species, including special status native and/or game species? How would these impacts affect hatchery operations and fishing activities? (Specific impacts to fisheries, such as chronic impacts, cannot be addressed without site-specific knowledge of the chemicals to be used and the precise locations in relation to aquatic habitat. Without knowledge of the site-specific locations for future oil and gas development, the high-level analysis in this EIS is not able to relate potential effects on fish populations to hatchery or stocking operations. Fishing activities are a recreation activity and are discussed in Section 4.13, Recreation.)
- What stipulations or BMPs, mitigation measures, or conditions of approval can be incorporated into the Proposed Action and alternatives to reduce risk to wildlife and special status species? (As noted in Chapter 2.0 and Section 4.1, BMPs, mitigation measures, and COAs will be addressed at the site-specific APD stage of oil and gas development. They are not included in this EIS.)

4.8.1.3 Assumptions

The following assumptions were used in analysis of impacts to aquatic biological resources.

- Species were considered as having the potential to occur within the analysis area if:
  - Occurrence has been documented for the species;
  - The current species range exists within the study area and suitable habitat is present; and
  - Historical range for species that have the potential to be reintroduced and suitable habitat is present.

- Important aquatic habitats are defined as perennial waterbodies such as ponds, reservoirs, lakes, streams, and rivers that provide habitat on a consistent basis throughout the year. The 100-year floodplains of rivers such as the Colorado and White represent critical habitat for the Colorado River federally listed fish species.
- Analysis for aquatic species includes select game fish (i.e., trout) and special status aquatic species.
- Effects on habitat for federal or state listed species could adversely affect population viability.
- The analysis for special status aquatic species assumes that the BLM and the Forest Service would continue to manage special aquatic status species' habitats on their lands in coordination with CPW and the Forest Service.
- The USFWS would have regulatory oversight regarding the management of federally listed species.
- The green lineage for cutthroat trout (GB) is treated the same as the federally threatened greenback cutthroat trout (GBCT).
- Management direction and guidance for special status species are provided through implementation of recovery plans, conservation agreements, management plans, and state wildlife plans (e.g., Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan), BLM policies (BLM 6840 Manual), and Forest Service policies (Forest Service Manual 2600, Rocky Mountain Region – Wildlife, Fish, and Sensitive Plant Habitat Management).
- Leasing is a commitment of the oil and gas resources for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions in support of the exploration or development of a lease. As a result of leasing, future exploration and development proposals could be brought forward that would be subject to specific state and federal regulatory and permitting requirements and to additional site-specific environmental analysis under NEPA. These subsequent analyses would address site-specific wildlife conditions and effects to them, and serve as the basis for any project-level design features or best management practice requirements.
- The leasing analysis relies on a RFDS that projects future potential surface-disturbing activities to provide a development scenario that has been determined to be reasonable on the proposed available lands. The RFD or alternatives will contain assumptions regarding well distribution within leases.
- It is conservatively assumed at this leasing stage that all water use for oil and gas drilling would be considered a water depletion. The source of water for future development could include municipal supplies, which have already been through previous Section 7 consultation. This water use would not result in further depletions.
- Additional mitigation measures are not identified as part of this programmatic analysis, but they will be identified and implemented as part of the APD stage.

4.8.1.4 Impact Indicators Used for Analysis

The following impact indicators are used in the impact analysis for aquatic resources:

- Amount of perennial stream miles subject/not subject to stipulations, by alternative and by lease zone.
- Length of perennial stream miles containing Colorado River cutthroat trout (CRCT), by alternative and by zone.

- Percentage of stream miles subject to stipulations compared to total perennial stream miles within each lease zone by alternative.
- Number and names of CRCT streams covered/not covered by stipulations, by alternative and by zone.
- Acres covered/not covered for boreal toad and northern leopard frog by stipulations, by alternative and by zone.

4.8.1.5 Methods of Analysis

Impacts were evaluated for each alternative using the following methods:

- Aquatic habitat for game fish and special status aquatic species was identified as perennial waterbodies (i.e., rivers, streams, lakes, and reservoirs) located within the Lease Zone areas and leases using Geographic Information Systems and USGS hydrology data.
- Information regarding aquatic species occurrence within the analysis area was obtained from a review of existing published sources, BLM RMPs, Forest Service LRMPs (forest plans), and file information from BLM, Forest Service, CPW, and USFWS.
- As part of the impact analysis, impact indicators were used to provide comparison among alternatives.
- There is considerable overlap of NSO and CSU stipulations for the same stream segments. In situations where there is overlap between multiple stipulations for the same stream segment, the longest stream length in miles was used in the analysis.
- Protection measures for Alternative 5 would include federal and state regulations related to the plugging and abandoning of producing wells, removal of roads, well pads, and ancillary facilities, and reclamation of all disturbed areas.

4.8.2 Stipulations Providing Coverage to Aquatic Resources

Six stipulations directly apply to aquatic habitat and species in the analysis area. The definition of these stipulations and applicability to Alternatives 1 through 4 are provided in **Table 4.8-1**. It is noted that these stipulations would not apply to Alternative 5.

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
NSO	Native Cutthroat Trout Habitat	No surface occupancy or use is allowed on the specified lands within 350 feet of occupied trout habitat. A modification may be granted if an environmental analysis demonstrates that a new road or pipeline added within the 350-foot buffer of an occupied native cutthroat trout stream has less impact to the cutthroat trout than an alternative route that avoids the buffer entirely.	X	X		

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
NSO	TEPC Populations and Habitats	No surface occupancy or use allowed on described lands for habitat areas used by aquatic species listed by the federal or state government as endangered or threatened, and federally proposed or candidate species. Habitat areas include occupied habitat or habitat necessary for the maintenance or recovery of the species. A modification may be granted, in consultation with the USFWS, if an environmental analysis demonstrates that the Proposed Action can be sited, conducted, or conditioned to remain compatible with the habitat protection and species recovery objectives.			X	X
NSO	Roadless Areas	No surface occupancy or use on the Battlement Mesa, Assignation Ridge, White River, and Pagoda Peak roadless areas for the purpose of protecting the roadless character of the areas.	X	X	X	X
CSU	Watersheds with CRCT and GBCT[2] Conservation Populations	Net density of roads cannot be increased in 6th level watersheds containing a conservation population of CRCT and GBCT. In cases where new roads are necessary for operations, an equivalent length of existing roads must be removed. Temporary roads (intended for less than 1 year) are excluded from this stipulation. A modification may be granted if an environmental analysis demonstrates that a new road or pipeline added within the 350-foot buffer of an occupied native cutthroat trout stream has less impact to the cutthroat trout than an alternative route that avoids the buffer entirely.			X	X
CSU	Sensitive Aquatic Species	Surface occupancy or use where aquatic species' habitats (fish and amphibians) listed as Sensitive by the Forest Service Rocky Mountain Region occur, special design, construction, mitigation, implementation, reclamation, reclamation, and monitoring measures may be required. A modification may be granted, in consultation with the USFWS, if an environmental analysis demonstrates that the Proposed Action can be sited, conducted, or conditioned to remain compatible with the habitat protection and species recovery objectives.			X	X
TL	CRCT Fisheries	No surface use is allowed during the exploration, drilling, and development activity from June 1 through October 1 in CRCT streams. This stipulation does not apply to operation and maintenance of production activities.	X	X		

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
TL	Boreal Western Toad	No surface use is allowed during the following time period April 15 through September 30. This stipulation does not apply to operation and maintenance of production facilities. The stipulation applies to lands within 1.5 miles of occupied western boreal toad breeding sites. A modification may be granted if an environmental analysis determines, through field surveys and data record searches and in consultation with CPW and the USFWS, that there are no known occupied or historically occupied western boreal toad breeding sites within 1.5 miles of lands proposed for activities.	X	X	X	X

[1] NSO = No Surface Occupancy; CSU = Controlled Surface Use; and TL = Timing Limitation.

[2] GBCT is not present within the Project area. However, CRCT (green lineage) is present and treated as GBCT at this time.

The following stipulations also would provide coverage for aquatic habitat although they were not designated specifically to protect that resource. The applicability to Alternatives 1 through 4 is noted in parentheses.

- NSO—Riparian/Wetland GMUGNF (Alternatives 1 and 2);
- NSO—Roadless Areas (Alternatives 1 through 4);
- NSO—Fen Wetlands (Alternatives 3 and 4); and
- NSO—Water Influence Zones (Alternatives 3 and 4).

4.8.3 Impacts Common to All Alternatives

The following types of potential impacts on aquatic species and habitat could occur from reasonably foreseeable oil and gas development:

- Loss or alteration of aquatic habitat could occur if there are no stipulations or regulations protecting aquatic habitat.
- Loss of aquatic species populations or reductions in abundance and diversity of aquatic species could occur in waterbodies where habitat is altered or removed.
- Effects of water quality changes such as increased sediment and other contaminants could affect aquatic habitat and species.
- Transfer of nuisance aquatic species could occur as a result of vehicle and equipment movement near drainages.
- Effects of flow alterations from oil and gas development on aquatic habitat and species would depend on the magnitude and duration of the flow change and the type of waterbody affected (i.e., intermittent vs. perennial stream, reservoir, or lake).
- Impingement and entrainment of game fish or special status fish species could occur due to surface water withdrawals.

The potential impacts on aquatic species and habitat listed in the first four bullets above also could result from the well plugging and abandonment and reclamation activities considered under Alternative 5.

Disturbance to Aquatic Habitat and Species

Alteration of habitat and subsequent effects on aquatic species would not occur directly in streams, rivers, or other waterbodies such as wetlands where there are stipulations requiring avoidance in buffer areas around the waterbody. There also would be protections afforded by compliance with federal and state regulations that limit disturbance to waterbodies through issuance of permits with environmental protection requirements. The relevant stipulations are discussed in the following sections as they apply to each of the alternatives.

There could be potential disturbance to aquatic habitat, if new roads or pipelines constructed to develop fluid minerals cross streams. Road or pipeline crossing locations have not been defined at this time but could occur on small- to mid-sized perennial streams. The WRNF LRMP (USFS 2002a) requires crossing techniques that would minimize adverse effects on stream habitat, as well as the restoration of disturbed areas to pre-construction conditions. The LRMP direction also provides additional protection for streams that contain pure genetic populations of CRCT and the following Conservation Agreement Species: bluehead sucker, flannelmouth sucker, and roundtail chub. New or widened stream crossings would not be allowed in streams with pure CRCT. In addition, no instream disturbance would be allowed during the spawning period (June 1 through September 1) of CRCT. Oil and gas development activities would be designed to avoid or mitigate impacts to the bluehead sucker, flannelmouth sucker, and roundtail chub that occur in the Green River.

If road or pipeline crossings are required in non-CRCT streams, construction may result in temporary disturbance to aquatic habitat by altering bottom substrates and possibly removing riparian vegetation. Vegetative cover along streambanks provides cover and shading for fish, bank stability, and increased food and nutrient supply as a result of deposition of insect and vegetative matter into the watercourse. Disturbance to streambank areas at stream crossing would represent a relatively small portion of the overall vegetative cover along the stream and juvenile and adult fish would likely move from the disturbance area. Bottom disturbance would result in mortalities to macroinvertebrates and possibly early life stages of fish. However, macroinvertebrate communities would likely recover within several months after disturbance.

Waterbody crossings by vehicles and equipment pose a risk of transferring invasive aquatic species between drainages, primarily the parasite that transmits whirling disease.

Water Quality Effects on Habitat and Species

Aquatic habitat for game and special status fish species could be negatively affected by water quality changes due to surface disturbance activities and potential fuel spills or leaks. Perennial streams with game and special status fish species are present in all of the lease zones. Accelerated erosion from surface disturbance may adversely impact aquatic habitats by increasing sedimentation in waterbodies. Actions including ground disturbance, vegetation removal, pipeline construction, and construction and use of access roads are the primary causes of erosion that can result in increased sedimentation and turbidity in streams. Natural events such as floods, fire, and drought conditions also can contribute to increased erosion. Changes in water quality resulting from surface disturbance within or near waterbodies would include increases in suspended sediment concentrations and turbidity. Sediment that is suspended or enters the waterbody from adjacent areas would be redeposited in areas in downstream areas. The extent of the sedimentation effect would depend on the flow conditions, substrate composition, stream configuration, and types of aquatic communities located within the affected areas. Refer to Section 4.5.1.3 in Water Resources for a detailed discussion of sedimentation effects on subwatersheds and surface water. Sedimentation also can affect water quality conditions by reducing dissolved oxygen, increase water temperature (Waters 1995). Fish species could be affected by

sedimentation in many of the perennial streams within the lease zones. Zones 2 and 3 contain most of the perennial stream habitat and game and special status fish species.

The effects of sedimentation on aquatic species would range from adverse effects on species behavior and physiological functions or important activities such as spawning and reproduction (Waters 1995). Excessive sedimentation also can alter important habitats by reducing depths in pools and covering spawning and rearing areas that are used by early stage development of fish. Over a long-term period, increased sediment loading also can reduce primary production and macroinvertebrate productivity (Waters 1995). The duration of sediment effects could range from short-term to long-term, depending on the duration of the surface disturbance activities and timeframe for stabilization.

Vehicle and equipment use, pipeline leaks, and failed well casings, or fuel and lubricant storage near waterbodies would pose a potential risk to aquatic biota. If fuel or other contaminants reached a waterbody, aquatic species could be exposed to toxic conditions from chemical residues within or on substrates in waterbodies. Impacts to aquatic species could range from lethal to sublethal effects and result in direct mortalities or reduced health. The magnitude of impacts would depend on the volume of spilled fuel, flow conditions, channel configuration, timing of cleanup and remediation, and species present in the affected area.

Implementation of a SPCC Plan would reduce the potential occurrence of or damage from spills.

Water Quantity Changes and Effects on Habitat and Species

Water use for drilling and completion activities, hydrostatic testing, and dust control could affect stream flows, if water sources are derived from or connected to surface water. As part of subsequent NEPA analyses at the APD stage of permitting, the water sources and connections to surface water would be evaluated for each site-specific oil and gas development project. If the water sources are connected to surface water, flow reductions could occur and affect the amount of available habitat for aquatic species. Negative effects on fish species could occur if the magnitude of the flow change alters a substantial portion of habitat needed for the various life stages of development.

In October 2008, the BLM completed a Programmatic Biological Assessment (PBA) for water depletion activities associated with BLM's fluid minerals program (including Forest Service leases) in the Colorado River basin in Colorado (BLM 2008b). In response to BLM's PBA, the USFWS issued a Programmatic Biological Opinion (PBO) (ES/GJ-6-CO-08-F-0006) on December 19, 2008, which concurred with BLM's determination that water depletions are "Likely to Adversely Affect" the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker (USFWS 2008a). Likewise, reasonably foreseeable oil and gas development also is likely to adversely affect designated critical habitats for these endangered fish along the Yampa, White, Colorado, and Gunnison rivers. However, the USFWS determined that water depletions from the Colorado River basin are not likely to jeopardize the continued existence of the Colorado pikeminnow, humpback chub, bonytail, or razorback sucker, and are not likely to destroy or adversely modify designated critical habitat. The PBA and PBO were written to remain in effect for up to 15 years or as long as an average annual depletion of 4,046 acre-feet per year is not exceeded. In the event this amount is exceeded, the BLM would reinitiate Section 7 consultation on a new depletion amount. Water use associated with federal fluid mineral development is tracked and reported annually. Because water use for reasonably foreseeable oil and gas development considered under this EIS has been through previous Section 7 consultation, there would be no new depletions counted from any of the alternatives.

As part of the Recovery Program for the Upper Colorado River fish species, a one-time payment is required for the average annual depletion volume in acre-feet that exceeds 100 acre-feet. The depletion fee is established each fiscal year after it has been determined that the Recovery Program is making sufficient progress toward recovery of the federally endangered fish species regarding ESA compliance for water withdrawals. The BLM has committed to offset the impacts of reasonable foreseeable future

development by soliciting a one-time payment from an industry group (USFWS 2008a). Based on average annual depletions of 4,046 acre-feet per year over a 15-year period (2009-2024) and the Fiscal Year 2009 depletion fee of $18.29 per acre-foot, a one-time payment of $74,001.34 was made to the Recovery Program.

Entrainment and Impingement Effects from Surface Water Withdrawals

The withdrawal of water from the permitted streams could result in the entrainment and impingement of early life stages of fish. The extent of the potential impact would depend on the timing and location of water withdrawals in the streams. Entrainment of young fish could occur in portions of the stream that are used as nursery areas that consist of shallow areas along the margin of streams, side channels, or backwaters.

Conservation measures identified in the PBO would be required to be implemented for any water withdrawals for oil and gas development in the analysis area. Water withdrawals taken directly from the Colorado, White, Yampa, and Gunnison rivers, which contain occupied and critical habitat for the four federally endangered fish species, must be implemented by individual oil companies, as listed below.

- Avoid entrainment by pumping from off-channel locations that are not connected to the mainstem portion of the river.
- If the pump head must be located in the river channel where larval fish are known to occur, additional measures must be applied. These measures prescribe the location of the pump, the amount of pumping between June 1 and August 15, and the timing of pumping.
- Screen all intake pumps with 0.25-inch or finer mesh.
- Report any fish impinged on screens to the USFWS.

Impacts Identified in the WRNF Final EIS

Impact issues that were identified for aquatic systems in the WRNF Final EIS (USFS 2014a) include the potential effects of future oil and gas development on aquatic habitat and species from road crossings; increased sedimentation from road and well pad surfaces; increased stream flow magnitude due to compacted surface run-off; and chemical pollutants such as fuels and industrial chemicals (USFS 2014a, p. 220). Impact indicators for the analysis consisted of the projected number of wells; projected number of well pads; acres of long-term disturbance watershed sensitivity; and acres available for leasing not covered by NSO stipulations (USFS 2014a, p. 220). The analysis identified the acres of surface occupancy by alternative and the relative sensitivity of three groups of subwatersheds to oil and gas development: 1) CRCT subwatersheds; 2) bluehead sucker/flannelmouth sucker/roundtail chub subwatersheds; and 3) mountain sucker subwaterseds (pp. 226 and 227). Seven subwatersheds (Thompson Creek, Middle Riffle Creek, Beaver Creek-Colorado River, Cache Creek-Colorado River, Wallace Creek, Morapos Creek, and Outlet North Fork White River) were considered high sensitivity for CRCT (p. 226). Two subwatersheds (West Divide Creek and Rifle Creek) were considered high sensitivity for bluehead sucker/flannelmouth sucker/roundtail chub (USFS 2014a, p. 227). In addition, four subwatersheds (West Rifle Creek, Morapos Creek, and Coal Creek) were high sensitivity for mountain sucker (USFS 2014a, p. 227). The acres of surface occupancy for CRCT subwatersheds ranged from 2,770 to 27,309 acres (USFS 2014a, p. 226). The No Action Alternative had the highest potential to affect sensitive fish and amphibians, federally listed fish species, and management indicator species.

4.8.3.1 Alternative 1 (No Action Alternative)

Under Alternative 1, stipulations would be applied as they were issued in the 1993 EIS/ROD (USFS 1993a). Two NSO stipulations would apply to aquatic habitat and species: riparian/wetland and CRCT habitat. Information related to the RFD zone, lease, and area protected in terms of acres and

linear stream miles is provided in **Table 4.8-2**. Aquatic habitat and species would be protected to a limited extent in Lease Zones 2 and 3. In Lease Zone 2, the riparian and wetland stipulation would apply to aquatic habitat in 3 acres in the headwaters of Middleton Creek. No fish are known to occur in this stream. This stipulation would be less than 1 percent of the lease where it would be applicable. In Lease Zone 3, the NSO Cutthroat Trout stipulation would be applied in seven leases. This stipulation would apply to a total of 599 acres in Lease Zone 3 or approximately 7 percent of the total combined area in the seven leases. In terms of stream miles, approximately 4.3 miles of CRCT habitat would apply to this stipulation. Five of the leases in **Table 4.8-1** show that no stream miles would be directly covered by stipulations. This means that the cutthroat trout stream does not pass through the lease, but upland areas adjacent to the stream are part of the buffer protection area. A portion of the drainage area would be covered by the NSO stipulation. Streams that would be affected by the NSO Cutthroat Trout stipulation would include North Thompson, Middle Thompson, and the South Branch Middle Thompson creeks. The CRCT populations in these streams consist of blue lineage in Middle Thompson Creek and a mixture of blue and green lineage in North Thompson Creek. It is suspected that the green lineage also is present in the South Branch Middle Thompson Creek. The Middle Thompson Creek also is considered a core conservation population.

Table 4.8-2 Stipulations for Aquatic Habitat and Species under Alternative 1

Zone	Lease No.	Stipulation Type	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	070013	NSO	Riparian/Wetland—GMUGNF	Middleton Creek	<0.1	<1
3	066691	NSO	Cutthroat Trout	North Thompson Creek	0.5	30
3	066694	NSO	Cutthroat Trout	North Thompson Creek	<0.1	<5
3	066696	NSO	Cutthroat Trout	Middle Thompson Creek	1.6	56
3	066697	NSO	Cutthroat Trout	Middle Thompson Creek	1.2	42
3	066701	NSO	Cutthroat Trout	South Branch Middle Thompson Creek	0.5	29
3	066712	NSO	Cutthroat Trout	North Thompson Creek	0.4	24
3	066909	NSO	Cutthroat Trout	North Thompson Creek	0.1	6
				Total NSO	**4.3**	**56[1]**
3	066701	TL	Cutthroat Trout	South Branch Middle Thompson Creek	1.1	64
3	066711	TL	Cutthroat Trout	Park Creek	0.3	NA[2]
3	066908	TL	Cutthroat Trout	Yank Creek	1.0	71
3	066909	TL	Cutthroat Trout	Yank Creek	0.2	14
				Total TL	**2.6**	**8[1]**

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

The TL stipulation for CRCT would apply to three streams, Park Creek, Yank Creek, and South Branch Middle Thompson Creek, in Zone 3. The stipulation would restrict surface disturbance from June 1 through October 1 in 2.6 stream miles. No streams within the zones would apply to boreal toad habitat.

The NSO stipulation for roadless areas would provide coverage to minimize adverse impacts to aquatic habitat and species, although it was not designed for aquatic resources. The NSO roadless stipulation would apply to 1.6 miles of CRCT (green lineage) habitat in Cache Creek (Zone 2).

A CTL stipulation on future oil and gas development would be applicable to Middle Thompson, West Divide, Park, Camp, and Cache creeks.

There are no stipulations that would apply to aquatic habitat and species in Zones 1 and 4 and some of the perennial streams are not subject to stipulations in Zones 2 and 3. Compliance with existing federal and state regulations and permits (e.g., CWA Section 404/401 permits) related to protection of streams and waterbodies would be required, depending on the site-specific location. Due to the lack of lease stipulations along some of the perennial streams, there could be negative effects on aquatic habitat and species. The extent of potential impacts on aquatic habitat and species would vary depending on the lease zone and whether stipulations would be in effect to minimize impacts (**Table 4.8-3**). There would be limited or no negative impacts on aquatic habitat and species in Zones 1 and 4 due to a lack of perennial streams and important aquatic species. The highest risk of potential impacts would be in Zone 3 where 28 miles of perennial stream habitat and 4 streams with game fish or special status species would not be subject to lease stipulations. Potential impacts also could occur in 6 perennial stream miles and 3 streams with game or special status species in Zone 2.

Table 4.8-3 Streams Not Subject to Stipulations under Alternative 1

Lease Zone	Miles of Perennial Streams[1]	Streams with Game Fish Species	Streams with Special Status Species	Streams with CRCT – Conservation Population (Yes or No)
1	0	None	None	None
2	6	West Divide Creek Beaver Creek Owens Creek	West Divide Creek Beaver Creek Owens Creek	West Divide Creek (Y) Beaver Creek Y) Owens Creek (N)
3	28	Fourmile Creek Little Rock Creek West Divide Creek East Divide Creek	Little Rock Creek West Divide Creek East Divide Creek	Little Rock Creek (Y) West Divide Creek (Y) East Divide Creek (N)
4	<1	None	None	None

[1] Miles of perennial streams within lease zone with no stipulations for protecting aquatic habitat and species.

Special status species that could be affected by projected future oil and gas development include CRCT and bluehead sucker in Zone 2 and CRCT, bluehead sucker, flannelmouth sucker, roundtail chub, and northern leopard frog in Zone 3. Streams containing CRCT are listed in **Table 3.8-2**. Potential habitat for the northern leopard frog occurs in East Divide Creek.

Portions of the subwatersheds that extend beyond the lease zone boundaries and their perennial stream habitat and associated game and special status species also could be affected by future oil and gas development, if there are no stipulations covering aquatic habitat and species. **Appendix A, Tables A-2** through **A-5** identifies these streams and species by lease zone.

The majority of the disturbance under Alternative 1 would occur in Zone 2, representing approximately 76 percent of the overall disturbance from future oil and gas development. Development in Zone 3 would be approximately 12 percent of the overall disturbance. Development in Zones 1 and 4 would be less than 10 percent of the total disturbance. For context, the estimated area of disturbance from projected

future oil and gas development would be less than 0.1 percent of the HUC12 analysis area. Surface disturbance could result in alteration of aquatic habitat and water quality changes involving increased sediment and potential spills or leaks into streams with no stipulations. In total, development activities could adversely affect up to approximately 34 miles of perennial streams that contain game or special status fish species (**Table 4.8-3**). There would be no negative effects from oil and gas development under Alternative 1 on North Thompson, Middle Thompson, and the South Branch Middle Thompson creeks in Zone 3, as a result of implementation of NSO and TL stipulations for cutthroat trout.

The total water use for well drilling under Alternative 1 would be approximately 366 acre-feet over the 20-year period of development (annual average of 18.3 acre-feet per year). The total completion water use would be approximately 3,959 acre-feet (198 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 39.6 acre-feet per year could be from groundwater or surface water sources that are not recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM. Drilling water would be used in all four lease zones, with the largest quantity in Zone 2 (total of 211 acre-feet or annual average of 10.5 acre-feet per year).

4.8.3.2 Alternative 2

The effects of developing reasonably foreseeable future oil and gas within the lease zones under Alternative 2 on aquatic habitat and species would be the same as that discussed for Alternative 1. No additional stipulations would provide coverage to minimize adverse effects to aquatic habitat and species in the 8 leases with modifications to address inconsistencies with the 1993 WRNF Oil and Gas Leasing ROD (USFS 1993a).

4.8.3.3 Alternative 3

Under Alternative 3, additional stipulations would be applied to leases compared to Alternative 1. Two NSO stipulations would apply to aquatic habitat and species (Native Cutthroat Trout Habitat and TEPC Aquatic Species). By implementing these two NSO stipulations, aquatic habitat and CRCT would apply to 3.4 miles in Zone 2, 25.0 miles in Zone 3, and 0.4 mile in Zone 4 (see **Table 4.8-4**). No aquatic habitat would be subject to resource-specific NSO stipulations in Zone 1. Protection to aquatic habitat would be provided to the following streams:

- Zone 2—West Divide, Owens, Beaver, and Cache creeks
- Zone 3—East Willow, Little Beaver, Little Rock, West Divide, Fourmile, North Thompson, Freeman, South Branch Thompson, Middle Thompson, Porcupine, Park, Beaver Dam, Camp, Lava Boulder, Park, and Yank creeks
- Zone 4—Milk Creek

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	066915	Native Cutthroat Trout Habitat	West Divide Creek	0.4	71
	066916	Native Cutthroat Trout Habitat	West Divide Creek	0.1	19
	066917	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Owens Creek	<0.1	100
	066920	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Creek	0.6	NA[1]

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	067544	Native Cutthroat Trout Habitat	Cache Creek	0.6	27
	070014	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	1.3	59
	070015	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**3.4**	**44[2]**
3	058835	TEPC Aquatic Species	East Willow Creek	0.1	3
	05836	TEPC Aquatic Species	East Willow Creek	0.7	23
			Little Beaver Creek	0.6	40
	058837	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Little Rock Creek	0.1	100
			West Divide Creek	2.0	33
			Unnamed	1.0	20
		TEPC Aquatic Species	Little Beaver Creek	0.3	20
			West Divide Creek	0.8	13
	058838	TEPC Aquatic Species	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Native Cutthroat Trout Habitat	West Divide Creek	2.3	38
			Willow Creek	0.1	14
	058840	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	0.9	18
	058841	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	1.2	24
	066687	TEPC Aquatic Species	Fourmile Creek	0.2	10
	066691	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.5	30
	066693	TEPC Aquatic Species	Freeman Creek	0.1	14
	066694	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	<0.1	<6
	066695	TEPC Aquatic Species	South Branch Thompson Creek	<0.1	<6
	066696	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Middle Thompson Creek	1.6	56
	066697	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Middle Thompson Creek	1.2	42
	066701	TEPC Aquatic Species	South Branch Thompson Creek	1.7	100
	066702	TEPC Aquatic Species	Porcupine Creek	1.5	100
	066707	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Park Creek	0.4	30

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	066708	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.1	20
	066710	TEPC Aquatic Species	Fourmile Creek	1.4	67
			Unnamed	0.1	NA[1]
	066711	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Park Creek	0.9	68
	066712	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.4	24
	066908	TEPC Aquatic Species	Yank Creek	0.6	43
	066909	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.7	42
			Total Zone 3	**25.0**	**70**[2]
4	066948	TEPC Aquatic Species	Martin Creek	0.4	80

[1] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

[2] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

Approximately 44 percent of the total miles of named perennial streams in Zone 2 would apply to NSO stipulations, 70 percent in Zone 3, and 80 percent in Zone 4. No perennial streams in Zone 1 contain game or special status species.

Applying the GMUGNF NSO stipulation for riparian/wetlands would result in a 0.1-mile section of Middleton Creek in Lease Zone 2 being restricted from surface disturbance. This stream is not occupied by CRCT or other special status aquatic species.

Two CSU stipulations would be applied to streams in Zones 2, 3, and 4 that contain sensitive aquatic species and watersheds with Colorado and greenback cutthroat conservation populations (**Table 4.8-5**). In total, the CSU stipulations would apply to 6 miles in Zone 2, 34 miles in Zone 3, and 0.5 mile in Zone 4. The CSU stipulations would apply to the same streams as listed for the NSO stipulations except that the stream lengths would be longer for the CSU stipulations, affording less restrictive constraints on surface disturbance that would still reduce the potential risk to the resource. One timing limitation stipulation for boreal toad breeding sites would be applied to Park Creek (0.5 mile).

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	061121	CSU-Sensitive Aquatic Species	West Mamm Creek	0.8	27
			Unnamed	0.1	42
	066915	CSU-Sensitive Aquatic Species	West Divide Creek	0.4	71
	066916	CSU-Sensitive Aquatic Species	West Divide Creek	0.1	6
	066917	CSU-Sensitive Aquatic Species	Owens Creek	<0.1	100
	066920	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Creek	0.6	100
	067147	CSU-Sensitive Aquatic Species	Middle Mamm Creek	1.2	100
	067543	CSU-Watersheds with CRCT/GBCT Conservation Populations	Unnamed	0.5	100
	067544	CSU-Sensitive Aquatic Species	Cache Creek	0.6	27
	070014	CSU-Sensitive Aquatic Species	Cache Creek	1.3	59
	070015	CSU-Sensitive Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**6.0**	**78[1]**
3	058835	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	1.5	50
	058836	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	CSU-Sensitive Aquatic Species	Little Beaver Creek	0.4	27
			Little Rock Creek	0.1	100
			West Divide Creek	3.2	53
			Unnamed	2.5	50
	058838	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.8	26
			West Divide Creek	1.3	43
			Willow Creek	0.7	100
			West Divide Creek	0.9	15
	058840	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	1.0	20

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	058841	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	1.2	24
	066687	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Fourmile Creek	0.2	9
	066691	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	0.5	30
	066693	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Freeman Creek	0.7	100
	066694	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	<0.1	<6
	066695	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	South Branch Middle Thompson Creek	<0.1	<6
	066696	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Middle Thompson Creek	1.6	56
	066697	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Middle Thompson Creek	1.2	42
	066701	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	South Branch Middle Thompson Creek	1.7	100
	066702	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Porcupine Creek	1.5	100
	066707	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Park Creek	0.4	30
			Beaver Dam Creek	0.4	25
	066708	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Dam Creek	1.2	75
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.5	100
	066710	CSU-Sensitive Aquatic Species	Fourmile Creek	0.2	9
			Unnamed	0.2	100
		CSU-Watersheds with CRCT and GBCT Conservation Populations	Unnamed	1.5	NA[2]

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
	066711	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	Park Creek	0.9	68
		TL-Western Boreal Toad Breeding Sites	Park Creek	0.4	30
	066712	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	North Thompson Creek	0.4	24
		TL-Western Boreal Toad Breeding Sites	North Thompson Creek	0.3	18
	066908	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	Yank Creek	1.2	86
	066909	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	North Thompson Creek	0.7	42
			Yank Creek	0.2	14
	066913	CSU-Watersheds with CRCT and GBCT Conservation Populations	Unnamed	0.2	100
			Total Zone 3	**34.4**	**100[1]**
4	066948	Sensitive Aquatic Species and GBCT Conservation Populations	Martin Creek	0.5	100

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

Areas within the HUCs but outside of the lease zones would be protected by the CTL designation under Alternative 3. The CTL designation would close designated areas to future oil and gas leasing and development along approximately 44 miles of perennial stream habitat located outside of Zone 3. Habitat for game fish and special status aquatic species would be applied in Middle Thompson, North Thompson, South Branch Thompson, Park, West Divide, and Fourmile creeks and the Crystal River.

The NSO stipulation, TEPC Aquatic Species, would apply to boreal toad habitat and would avoid disturbance to the following boreal toad habitat: 43 acres in Zone 2; 541 acres in Zone 3; and 6 acres in Zone 4. This same NSO stipulation also is presented for boreal toad current range, which applies to 715 acres in Lease Zone 2. Incorporation of the GMUGNF NSO stipulations for high geological hazards, riparian/wetlands, and 60 percent steep slopes would result in an additional 73 acres being applicable to boreal toad current range. CSU and TL stipulations also would apply to boreal toad habitat in similar areas and acres.

Leopard frog habitat would be subject to NSO and CSU stipulations in the following areas: 595 acres in Zone 2, 4,255 acres in Zone 3, and 63 acres in Zone 4. Northern leopard frog habitat also would be

subject to the CSU stipulation for 929 acres in Zone 1, 3,434 acres in Zone 2, 8,373 acres in Zone 3, and 111 acres in Zone 4.

The aquatic resource-specific stipulations associated with Alternative 3 would apply to all perennial stream habitat in the lease zones that contain game fish and special status aquatic species. Habitat alteration or loss could occur in some streams that they do not contain game fish or special status aquatic species, such as West Mamm, Middle Mamm, and Cottonwood creeks in Zone 2 and portions of streams within Zones 2 and 3 where special status aquatic species are not present. It is estimated that 56 percent of perennial stream miles in Zone 2 and 22 percent in Zone 3 would not be subject to stipulations related to aquatic resources.

Additional NSO stipulations related to roadless areas, water influence zones, and wetland or fen areas would restrict development along streams, although they were not designed to protect aquatic resources. These additional NSO and CSU stipulations could provide coverage for most of the stream segments that would not be subject to the aquatic resource-specific stipulations. For context, the estimated area of potential disturbance would be less than 0.1 percent of the total HUC12 analysis area associated with each of the zones. Surface disturbance could result in adverse impacts to aquatic habitat and water quality due to increased sedimentation and risks of spills or leaks into streams not covered by stipulations. In total, development activities could negatively affect up to 18 miles of perennial streams that contain game or special status fish species.

The total water use for well drilling under Alternative 3 would be approximately 364 acre-feet over the 20-year period of development (annual average of 18.2 acre-feet per year). The total water use for completions would be approximately 3,940 acre-feet (197 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 39.3 acre-feet per year could be derived from groundwater or surface water sources that would not be recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM.

4.8.3.4 Alternative 4 (Proposed Action)

Under Alternative 4, the same 2 NSO stipulations designated to cover aquatic habitat and species described for Alternative 3 would apply to aquatic habitat. Similarly, the GMUGNF stipulations would be applicable to the same aquatic resources and species, as discussed for Alternative 3. By implementing these two NSO stipulations, aquatic habitat and CRCT would be protected in 3.4 miles in Zone 2, 13.8 miles in Zone 3, and 0.4 mile in Zone 4 (**Table 4.8-6**). No habitat would be covered by NSO stipulations in Zone 1. Coverage of aquatic habitat from NSO stipulations would be the same as that listed for Alternative 3. Approximately 44 percent of the total miles of named perennial streams in Zone 2 would be protected by NSO stipulations, 43 percent in Zone 3, and 100 percent in Zone 4. No perennial streams in Zone 1 contain game or special status species.

Table 4.8-6 NSO Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	066915	Native Cutthroat Trout Habitat	West Divide Creek	0.4	72
	066916	Native Cutthroat Trout Habitat	West Divide Creek	0.1	18
	066917	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Owens Creek	<0.1	100
	066920	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Creek	0.6	100

Table 4.8-6 NSO Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	067544	Native Cutthroat Trout Habitat	Cache Creek	0.6	27
	070014	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	1.3	59
	070015	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**3.4**	**44**[1]
3	058835	TEPC Aquatic Species	East Willow Creek	0.1	3
	058836	TEPC Aquatic Species	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Little Rock Creek	0.1	100
			West Divide Creek	2.0	33
			Unnamed	1.0	20
		TEPC Aquatic Species	Little Beaver Creek	0.3	20
			West Divide Creek	0.8	13
	058838	TEPC Aquatic Species	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Native Cutthroat Trout Habitat	West Divide Creek	2.3	38
			Willow Creek	0.1	14
	058840	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	0.9	62
	058841	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	1.2	NA[2]
	066691	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	<0.1	<6
	066693	TEPC Aquatic Species	Freeman Creek	<0.1	<14
	066708	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.1	20
	066908	TEPC Aquatic Species	Yank Creek	<0.1	<7
	066909	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.1	6
			Total Zone 3	**13.8**	**39**[1]
4	066948	TEPC Aquatic Species	Martin Creek	0.4	80

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

Approximately 15 miles of perennial stream habitat within the HUC12 analysis area but outside the leases within Zone 3 also would be protected by being closed to leasing.

Because all or part of 25 leases would be closed to leasing within Zone 3 under Alternative 4, there would be no disturbance due to oil and gas development on approximately 44 miles of perennial stream habitat within this zone along Middle Thompson, North Thompson, South Branch Thompson, Park, West Divide, and Fourmile creeks and the Crystal River.

The two CSU stipulations applicable to sensitive aquatic species and watersheds with Colorado and greenback cutthroat conservation populations would be the same as that listed under Alternative 3, with the exception of Zone 3 in which more stringent limitations on impacts to aquatic habitat would result from the leases that would be cancelled (see **Table 4.8-7**).

Table 4.8-7 CSU Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	061121	Sensitive Aquatic Species	West Mamm Creek	0.8	45
			Unnamed	0.1	42
	066915	Sensitive Aquatic Species	West Divide Creek	0.4	71
	066916	Sensitive Aquatic Species	West Divide Creek	0.1	29
	066917	Sensitive Aquatic Species	Owens Creek	0.1	100
	066920	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Creek	0.6	100
	067147	Sensitive Aquatic Species	Middle Mamm Creek	1.2	100
	067543	CRCT/GBCT Conservation Populations	Unnamed	0.5	100
	067544	Sensitive Aquatic Species	Cache Creek	0.6	NA[1]
	070014	Sensitive Aquatic Species	Cache Creek	1.3	NA[1]
	070015	Sensitive Aquatic Species	Cache Creek	0.4	NA[1]
			Total Zone 2	**6.0**	**78[2]**
3	058835	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	1.5	50
	058836	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			Little Rock Creek	0.1	100
			West Divide Creek	3.2	53
			Unnamed	1.3	NA[1]

Table 4.8-7 CSU Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	058838	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.8	13
			West Divide Creek	2.3	38
			Willow Creek	0.7	100
	058840	Headwaters West Divide Creek	Unnamed	1.0	20
	058841	Headwaters West Divide Creek	Unnamed	1.2	24
	066691	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	<0.1	<6
		Thompson Creek	North Thompson Creek	<0.1	<6
	066693	Fourmile Creek	Freeman Creek	<0.1	<14
	066707	CRCT/GBCT Conservation Populations	Beaver Dam Creek	0.4	25
	066708	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.5	100
	066908	Thompson Creek	Yank Creek	<0.1	<7
	066909	Thompson Creek	North Thompson Creek	0.1	6
			Yank Creek	<0.1	<7
	066913	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	0.2	14
			Total Zone 3	**18.5**	**58[2]**
4	066948	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Martin Creek	0.5	100

[1] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

[2] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

The NSO stipulation, TEPC Aquatic Species, would apply to boreal toad habitat under Alternative 4 and avoid disturbance to the boreal toad habitat in the following amounts by zone: 2,118 acres in Zone 1; 3,813 acres in Zone 2; 1,159 acres in Lease Zone 3; and 48 acres in Lease Zone 4. CSU and TL stipulations also would provide protection to boreal toad habitat for similar areas and acres.

Leopard frog habitat would be subject to the resource-specific NSO and CSU stipulations by avoiding disturbance to the same acres of habitat in Zones 2 and 4 as described for Alternative 3. The NSO stipulation would apply to less leopard frog habitat (1,842 acres) compared to Alternative 3 (4,255 acres) because more area would be closed to leasing, resulting in more stringent limitations where leases are cancelled. The CSU stipulation under Alternative 4 would apply to the same acres of leopard frog habitat as described under Alternative 3 for Zones 1, 2, and 4, and less under the CSU stipulation because a large portion of Zone 3 would be closed to leasing.

The aquatic resource-specific stipulations associated with Alternative 4 would apply to all perennial stream habitat in the lease zones that contain game fish and special status aquatic species. The addition of the areas to be closed to leasing under Alternative 4 in combination with the NSO stipulation would minimize adverse effects to streams due to surface disturbance impacts. Habitat alteration or loss could occur in a limited number of streams that do not contain game fish or special status aquatic species, such as West Mamm, Middle Mamm, and Cottonwood creeks in Zone 2.

Similar to Alternative 3, additional NSO stipulations such as those designated to protect roadless areas, water influence zones, and wetland or fen areas would restrict development along streams, although they were not designed to protect aquatic resources. These additional NSO and CSU stipulations could provide coverage for most of the stream segments that would not be subject to the aquatic resource-specific stipulations. For context, the estimated area of potential disturbance would be less than 0.1 percent of the total HUC12 analysis area associated with each of the zones. The impacts from reasonably foreseeable future oil and gas development would be similar to but less than that described for Alternative 3.

The total water use for well drilling under Alternative 4 would be approximately 339 acre-feet over the 20-year period of development (annual average of 16.9 acre-feet per year). The total water use for completions would be approximately 3,699 acre-feet (185 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 36.9 acre-feet per year could be derived from groundwater or surface water sources that would not be recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM

4.8.3.5 Alternative 5

Under Alternative 5, all leases would be cancelled, and producing wells would be plugged and abandoned. Existing wells, access roads, and ancillary facilities would be removed, and all disturbed areas would be reclaimed. Disturbance resulting from lease cancellations would be approximately 37 acres for pads and 39 acres for roads in Zone 2, and 1 acre from pads and 9 acres for roads in Zone 3. No surface disturbance would occur in Zones 1 and 4 because there are no existing wells.

After reclamation, there would be no potential alteration of aquatic habitat from disturbance related to oil and gas development within the lease zones that could affect aquatic resources and habitat. As part of well abandonment and road reclamation activities, direct disturbance to aquatic habitat in the two streams, Beaver and West Divide creeks, containing CRCT would be restricted in compliance with federal regulations under the ESA.

There would be no water use or depletions under Alternative 5 related to well drilling or completion within the lease zones. There could be a small amount of water used for dust control during reclamation activities in Zones 2 and 3.

4.8.3.6 Summary of Impacts

In summary, the highest level of potential impacts to aquatic habitat and species would occur under Alternatives 1 and 2, as indicated by the percentage of perennial streams not subject to resource

stipulations (i.e., 100 percent in lease Zones 1 and 4; 44 percent for lease Zone 2; and 92 percent for lease Zone 3). Potential impacts would include habitat loss or alteration and negative changes in water quality. It is noted that there is very limited perennial stream habitat in lease Zones 1 and 4. In contrast, there would be no impacts to game fish and special status aquatic species under Alternatives 3 and 4, since streams that contain these species are subject to aquatic-focused stipulations. There could be impacts to a limited number of perennial streams that do not contain game fish or special status species under Alternatives 3 and 4. Potential water use from drilling and completion would negatively affect aquatic species if there are new depletions. The estimated volume of potential water use is similar for Alternatives 1 through 4, although Alternative 4 would be slightly higher than the other alternatives.

4.8.4 Cumulative Impacts

4.8.4.1 Cumulative Impacts Analysis Area

The cumulative impacts analysis area for aquatic resources is the same as the HUC12 analysis area. The downstream analysis area is defined as the perimeter of the subwatersheds that extend downstream of the lease boundaries.

4.8.4.2 Past Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

The impacts of Alternatives 1 through 5 on aquatic resources in the HUC12 subwatersheds would vary, with the lowest level of contribution resulting from oil and gas development under Alternatives 3, 4, and 5. The disturbance projected under each alternative would combine with past and present actions to total approximately 5,226 acres in the HUC12 subwatersheds (less than 1 percent of the CIAA). Details on the cumulative actions are described in the Cumulative Impacts Scenario, **Appendix B**. The types of impacts would consist of alteration or loss of perennial stream habitat, water quality changes from sediment input or contaminant spills into streams, and potential habitat reductions due to water use if water sources are linked to surface water.

Reasonably Foreseeable Future Actions

Oil and gas RFFAs would disturb approximately 14,854 acres in the HUC12 subwatersheds in and around Zones 1, 2, and 3. Future disturbance from oil and gas development in or near Zone 4 is estimated to be 43 acres. In total, these RFFAs would affect 2.5 percent of the CIAA. Estimated water use for oil and gas RFFAs is 22,304 acre-feet for drilling and 431,291 acre-feet for completions. Details on the cumulative actions are described in the Cumulative Impacts Scenario, **Appendix B**. Surface disturbance from non-oil and gas RFFAs would result in approximately 11,992 acres in the HUC12 subwatersheds (2 percent of the CIAA). This disturbance would result from vegetation treatments and hazardous fuels reduction projects. The types of cumulative impacts to aquatic habitat and species would be the same as listed for past and present actions.

4.8.4.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The impacts of Proposed Action and alternatives would combine with surface disturbance effects from past and present actions and oil and gas development RFFAs to affect between 3 and 6 percent of the CIAA. The alternative's contribution to surface disturbance to total cumulative impacts would range between 0 percent (Alternative 5) to 3 percent (Alternatives 1 and 2). Additional portions of the CIAA (up to 2 percent) could be affected by vegetation treatments and hazardous fuels reduction projects. The types of cumulative impacts to aquatic habitat and species would be the same as listed for past and present actions.

Total water use for drilling and completion under Alternatives 1 through 4 would range from approximately 339 to 366 acre-feet for drilling and 3,699 to 3,959 acre-feet for completion over the 20-year timeframe of development. This water use would combine with the estimated water use for oil and gas RFFAs for an average total water use over a 20-year period of approximately 5,428 acre-feet per year, using the same assumptions for water recycling and drilling water used to project the water usage under the alternatives. The contribution of water use from oil and gas development under Alternatives 1 through 4 with oil and gas RFFAs would be tracked and reported annually to the USFWS by the BLM.

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4.9 Cultural Resources

4.9.1 Analysis Assumptions and Approach to Analysis

4.9.1.1 Analysis Area

The analysis area encompasses the maximum extent of the lease boundaries.

4.9.1.2 Scoping Issues

Issues and concerns relevant to cultural resources that were raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development. Those issues not specifically addressed in this analysis include an explanation for excluding the discussion in parentheses following the issue.

- The Thompson Divide area was identified as a Traditional Cultural Property (TCP) during public scoping. Concerns were expressed over the cultural and health violations that will occur if the suspended oil and gas leases are not voided. (This area is not a recognized TCP so was not specifically discussed as a cultural resource. The health impacts in the analysis area are considered in other sections, such as Section 4.16.2, Human Health and Safety.)
- Commenters reminded the BLM that EO 13007 charges management of federal lands to accommodate access to, and ceremonial use of, sacred sites and to avoid adversely affecting the physical integrity of such sacred sites. (Compliance is assumed for all federal actions.)
- Concerns for heritage tourism, particularly related to the Redstone, the Coke Ovens, Elk Park, and the Thompson House in Carbondale. (All of these are located outside of the analysis area so are not addressed in this section.)
- Cultural resource sites are non-renewable resources, and they would lose integrity, heritage value, and potentially important information if they are developed.

4.9.1.3 Assumptions

The following assumptions were made for the analysis of cultural resources.

- Oil and gas leasing decisions do not authorize specific actions or ground disturbance and would have no direct impact on cultural resources. The surface disturbance that would occur under reasonably foreseeable development has the potential to affect cultural resources, but are only measurable at the time of development of the lease.
- Prior to development, preconstruction surveys would be conducted to identify any heritage resources that may be affected by a project, to identify which of those heritage resources are eligible for the National Register of Historic Places (NRHP), and to minimize unanticipated discoveries of unknown sites. These surveys would be required during the APD stage that would involve subsequent site-specific NEPA analysis before a permit to drill is issued. If eligible cultural resources (archaeological sites or TCPs are identified that require protection, the proposed locations of wells, access roads, or other facilities may be moved or mitigated according to federal requirements to avoid or minimize adverse direct or indirect impacts.
- Under all of the alternatives, the preferred management strategy for eligible cultural resources would be avoidance and protection of these sites from adverse effects. Eligible sites are non-renewable resources, and they would lose integrity, heritage value, and potentially important information if they were destroyed or altered without appropriate mitigation. It is assumed that all future oil and gas development in the analysis area would comply with all federal and state regulations, such as the National Historic Preservation Act; Archaeological Resources Protection

Act of 1979, as amended; EO 13007 (Indian Sacred Sites); and any terms and conditions associated with permits to drill.

- Measures would continue to be implemented in order to avoid the impacts to all eligible sites under federal jurisdiction. Treatments designed to minimize or mitigate adverse direct or indirect effects to eligible properties may include project relocation, redesign or modification, physical protection measures (including fencing or padding), stabilization, restoration, rehabilitation, documentation, monitoring, repair, and data recovery. Other measures may be required to protect or minimize adverse impacts to TCPs.
- The numbers of cultural resources covered by stipulations or affected assumes an even distribution of sites and density for each zone, based on the numbers presented in Section 3.9.3.

4.9.1.4 Impact Indicators Used for Analysis

Impact indicators for this analysis are based on acres of NSO stipulations that would protect cultural resources and the number of sites that may be affected by surface disturbance in relation to known cultural resources sites and site density.

4.9.1.5 Methods of Analysis

There are no stipulations that have been developed specifically to protect cultural resources. However, beneficial impacts would result from implementation of any NSO stipulations because that would minimize or prevent surface disturbance and result in avoidance of cultural resources. As a result, the NSO stipulation is the primary constraint on development considered in regards to minimizing impacts to cultural resources in Zones 1 through 4. The area of NSO stipulations is compared to the anticipated total sites in each zone based on the acreage and site densities that was presented in Section 3.9.

4.9.2 Stipulations Providing Protections to Cultural Resources

There are no resource-specific stipulations designed to protect cultural resources within the existing leases (the 1993 EIS does contain an NSO stipulation for Historic Sites, Open Lithic Scatters and Paleontological Sites; however it was not applied within the 65 existing leases). NSO stipulations implemented to protect other resources would serve to exclude ground-disturbing activities that have the potential to affect cultural resources should they be implemented. Therefore, implementing NSO stipulations would avoid adverse impacts to cultural resources.

4.9.3 Impacts Common to All Alternatives

Impacts from the development of oil and gas would consist of physical disturbance to cultural resources through such activities as ground disturbance, construction, demolition, erosion, and sedimentation. Indirect effects to cultural resources, such as visual impacts, noise, or other impacts to the setting of the cultural resources, also may occur. Under Alternative 5, leases would be canceled requiring disturbance of previously disturbed areas to plug and abandon wells, decommission roads, remove equipment and infrastructure, and reclaim disturbed areas. Following reclamation, impacts would be primarily beneficial because further surface disturbance for oil and gas development would not occur unless areas are leased in the future. The primary difference in the potential impacts under each alternative is the extent of reasonably foreseeable future development that would result in surface disturbance in Zone 3 and the effects of lease cancellation, which would exclude all oil and gas surface disturbance.

The preferred management strategy for eligible sites under all the alternatives would be to avoid and protect these sites from direct, indirect, and cumulative effects. Under all of the alternatives, federal guidelines under Section 106 of the National Historic Preservation Act require inventory, documentation, analysis, mitigation, avoidance, and monitoring when necessary.

Vandalism, inadvertent damage, or illegal artifact collection could occur as a result of increased access via newly constructed roads. New road construction would make cultural resources more accessible and studies have shown most vandalism occurs within close proximity to roads.

Impacts Identified in the WRNF Final EIS

According to the WRNF Final EIS (USFS 2014a), identifying land as open to oil and gas leasing has no direct effects on cultural resources, and any effects of leasing and potential future development would be measureable at the time of development of the lease. Adverse impacts may result from ground-disturbing activities that damage archaeological sites or disrupt cultural landscapes, while beneficial impacts may result from minimizing or preventing surface disturbance, and avoidance of archaeological sites, as well as from measures used to protect sites (USFS 2014a, p. 370). The impacts to cultural resources cannot be quantified without knowing the location of potential future surface-disturbing activities and the cultural resources that might be present. Some irreversible loss of sites may occur as a result of inadvertently damaged, destroyed, vandalized, or looted sites, once the roads are constructed and the earthmoving begins. Sites also may experience damage due to natural processes (USFS 2014a, p. 370).

4.9.4 Impacts by Alternative

4.9.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Alternative 1, the No Action Alternative, reaffirms the lease stipulations on the 65 leases as they were originally issued. Under this alternative, there are currently a total of 23,443 acres of NSO stipulations. Based on the predicted density of cultural resources sites (including TCPs) presented in Section 3.9.3 by zone, 276 cultural resources sites are anticipated to occur in these areas that would be subject to stipulations (see **Table 4.9-1**).

Table 4.9-1 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 1

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,110	202
2	9,820	39
3	3,448	34
4	65	0
Total	**23,443**	**276**

Of the 117 previously recorded cultural resources sites, 18 (13 in Zone 1 and 5 in Zone 2) would be covered by NSO stipulations. Of these 18 previously recorded sites, 2 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 416 new wells on 60 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (319 wells). The estimated total initial surface disturbance under Alternative 1 would be 892 acres, with the majority of disturbance occurring in Zones 2 and 3. Based on projected site densities by zone, it is possible that 6 sites could be affected by this development-related surface disturbance (see **Table 4.9-2**). In

compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-2 Comparison of Initial Surface Disturbance and Projected Cultural Resources Affected under Alternative 1

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	76	2
2	684	3
3	111	1
4	21	0
Total	**892**	**6**

4.9.4.2 Alternative 2

Stipulation Coverage

Alternative 2 would update 8 leases with 513 additional acres of NSO stipulations, and would serve to protect these areas that may otherwise be open to surface disturbance (**Table 4.9-3**). Based on the predicted density of cultural resources sites presented in Section 3.9.3 by zone, 281 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-2**).

Table 4.9-3 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 2

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,106	202
2	9,820	39
3	3,965	40
4	65	0
Total	**23,956**	**281**

Of the 117 previously recorded cultural resources sites, 18 (13 in Zone 1 and 5 in Zone 2) would be covered by NSO stipulations. Of these 18 previously recorded sites, 2 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

The projections for future oil and gas development and estimated associated surface disturbance are the same as that described for Alternative 1. The potential number of sites that could be affected also would be the same as stated for Alternative 1 and displayed in **Table 4.9-2**.

4.9.4.3 Alternative 3

Stipulation Protections

Under Alternative 3, there would be an increase in the extent of NSO stipulations. Under this alternative, there would be a total of 71,046 acres of NSO stipulations. Based on the predicted density of cultural

resources sites presented in Section 3.9.3 by zone, 670 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-4**).

Table 4.9-4 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 3

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,114	202
2	21,606	86
3	36,974	370
4	2,352	12
Total	**71,046**	**670**

Of the 117 previously recorded cultural resources sites, 80 (13 in Zone 1, 10 in Zone 2, 55 in Zone 3, and 2 in Zone 4) would be covered by NSO stipulations. Of these 80 sites, 10 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 413 new wells on 59 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (318 wells). The estimated total initial surface disturbance under Alternative 3 would be 886 acres, with the majority of disturbance occurring in Zones 1 and 2. Based on projected site densities by zone, it is possible that six sites could be affected by this development-related surface disturbance (see **Table 4.9-5**). In compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-5 Comparison of Initial Surface Disturbance and Cultural Resources Covered by Stipulations Affected under Alternative 3

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	77	2
2	684	3
3	39	1
4	21	0
Total	**886**	**6**

4.9.4.4 Alternative 4 (Proposed Action)

Stipulation Protections

Under Alternative 4, the extent of NSO stipulations would be less but there would be additional protection from surface disturbance from oil and gas development through the cancellation of all or part of 25 leases in a portion of Zone 3 that would be closed to leasing. The areas closed to leasing would exclude the possibility of surface disturbance for oil and gas development, so the acreage is combined with NSO acres for purposes of this analysis. Under this alternative, there would be a total of

74,743 acres of NSO stipulations combined with areas closed to leasing. Based on the predicted density of cultural resources sites presented in Section 3.9.3 by zone, 707 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-6**).

Table 4.9-6 Comparison of NSO/CTL Acreage and Anticipated sites Covered by Stipulations under Alternative 4

Zone	NSO/CTL Area (acres)	Anticipated Number of Sites
1	10,114	202
2	21,606	86
3	40,671	407
4	2,352	12
Total	**74,743**	**707**

CTL = Closed to Leasing.

Of the 117 previously recorded cultural resources sites, 81 (13 in Zone 1, 10 in Zone 2, 56 in Zone 3, and 2 in Zone 4) would be covered by NSO stipulations or in the area closed to leasing. Of these 81 sites, 10 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 383 new wells on 55 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (319 wells). The estimated total initial surface disturbance under Alternative 1 would be 821 acres, with the majority of disturbance occurring in Zones 2 and 1. Based on projected site densities by zone, it is possible that 5 sites could be affected by this development-related surface disturbance (see **Table 4.9-7**). In compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-7 Comparison of Initial Surface Disturbance and Cultural Resources Covered by Stipulations Affected under Alternative 4

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	77	2
2	684	3
3	39	0
4	21	0
Total	**821**	**5**

4.9.4.5 Alternative 5

All of the previously issued 65 leases would be cancelled under Alternative 5, and would include well closures and abandonment, reclamation of well pads, removal/burial of pipeline, and removal and reclamation of roads. While some disturbance would be associated with these activities, most, if not all, surface disturbance would occur in areas that were previously disturbed so it is unlikely that cultural resources would be disturbed. Prior to any surface disturbance, however, cultural resources surveys would be required to minimize the potential to adversely affect sites. Over the long term, the setting

would return to undisturbed conditions and the public access to these areas would be reduced, resulting in potentially beneficial impacts to cultural resources through the more natural settings and reduced public access that could lead to vandalism.

4.9.4.6 Summary of Impacts

The potential risks to cultural resources derive from the extent of surface disturbance and the relative protection through the limitation of surface disturbance under each alternative. For those alternatives where oil and gas development is projected (Alternatives 1 through 4), Alternative 4 would have the greatest extent of protection from surface disturbance and the fewest sites at risk from construction and development activities, while Alternative 1 would have the least protection and greatest risk. Alternative 5 would have the lowest potential adverse effects on cultural resources due to the low area of projected surface disturbance and the reclamation of existing disturbed areas. However, it is unlikely that sites that are eligible for the NRHP would be adversely affected under any alternative because federal regulations require site-specific surveys before surface-disturbing activities begin and avoidance or mitigation of eligible sites. There would be the potential for indirect effects if there is a change to the setting due to nearby surface disturbance and noise.

4.9.5 Cumulative Impacts

The CIAA for cultural resources includes the lease boundaries with a 2-mile buffer, considered as the area of potential effect (332,040 acres total).

4.9.5.1 Past, Present, and Reasonably Foreseeable Future Actions

The past and present actions that have affected cultural resources include any surface disturbance within 2 miles of the lease boundaries. There are 612 acres of quantifiable surface disturbance within the CIAA (see Section 4.1 and **Appendix B** for more details). While this includes such activities as oil and gas development, road construction, timber harvesting, livestock grazing, and vegetation treatments, compliance with federal regulations required cultural resources surveys to be conducted before these actions commenced. These surveys have contributed to the knowledge of cultural resources in the CIAA.

Section 4.1 and **Appendix B** provide a summary of the surface-disturbing RFFAs that are projected within the CIAA. The majority of the surface-disturbing activities projected within the CIAA for cultural resources are oil and gas development (7,586 acres of projected surface disturbance from RFFAs, or about 2 percent of the CIAA), especially within existing leases and established units. The CIAA also includes approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments. These treatments also would affect about 2 percent of the CIAA.

4.9.5.2 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The disturbance under the Proposed Action and alternatives would contribute between 0 percent (Alternative 5) and 5 percent (Alternatives 1 and 2) of the total surface disturbance anticipated from surface-disturbing past and present actions and RFFA activities within the CIAA; with consideration of proposed vegetation and hazardous fuels reduction treatments, the contribution of the Proposed Action and alternatives ranges from 0 percent (Alternative 5) to 3 percent (Alternatives 1 and 2). As directed by law, cultural resources inventories are conducted for any actions involving federal lands. The surveys for cultural resources required prior to surface disturbance would add to the knowledge of recorded sites in the region but would not be likely to increase the risk of adverse effects to sites eligible for the NRHP due to the practice of avoidance or mitigation.

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4.10 Transportation

4.10.1 Analysis Assumptions and Approach to Analysis

4.10.1.1 Analysis Area

The analysis area for direct, indirect, and cumulative impacts consists of the affected oil and gas leases and any off-lease area that might be used to access development areas within the leases, plus the regional road network spanning multiple counties.

4.10.1.2 Scoping Issues

Relevant issues and concerns raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development.

- Transportation route development on area roads, specifically in the Thompson Divide Area, where additional semi-trailer traffic may be a detriment to recreational and tourist activities in the area.
- Impacts from improvement of local roads to accommodate heavier truck traffic, could include increased erosion, mud and rock slides, cattle and wildlife hazards, decrease recreation use, more dust and air pollution, watershed pollution, and vegetation impacts.
- Increased traffic hazards on area roads from additional oil and gas development. There were specific concerns related to East Divide Road south of Silt, Four Mile Road southwest of Glenwood Springs, Thompson Creek Road and SH-133 near Carbondale, Coal Creek Road west of Redstone, and Midland and Grand Avenues in Glenwood Springs.
- Coordination with state and county transportation policies and regulations. (This concern is not addressed because it is not within the federal agency jurisdiction. Coordination for road use and access outside of federal land would be the responsibility of the lease operator.)

4.10.1.3 Assumptions

The following assumptions were used to facilitate the transportation analysis:

- Neither the Forest Service nor the BLM have the authority to require operators to use designated access routes not on federal lands. During the submittal, review, and approval process for an APD, the BLM and Forest Service would consider whether new ROW grants on BLM-administered land or special use permits on Forest Service-administered land are needed to cross federal land. Mitigation needed at the time of development such as avoidance of sensitive locations, road relocations, or special inventories would be analyzed at the APD stage of permitting, and mitigation measures or permits for access would be implemented through the use of COAs.
- Any new roads or improvements to existing roads or other changes to the Forest Transportation System would be in conformance with the Forest Plan, Forest Service and other applicable regulations (including the federal On-Shore Orders and WRNF Road Design standards) affecting road construction and use.
- Existing haul roads and NFS roads would be used to the extent possible for access to oil and gas leases.
- If existing roads or segments are relocated to improve access while reducing impacts, the unused portion would be fully decommissioned and reclaimed.

- During exploration, development, and production activities, roads would be managed in accordance with the current travel management plan, or as determined during site-specific environmental analyses.
- New roads could be considered single-purpose roads to be used and maintained by the operator for the production life of associated wells and closed to public motorized use. When no longer needed for oil and gas development, roads would be fully decommissioned and reclaimed.
- Additional environmental analysis would occur for future exploration and development of oil and gas resources at the APD stage of permitting when site-specific locations are known.
- Site-specific NEPA for future development on adjacent BLM lands for wells that access minerals within the leases under evaluation would be analyzed at the APD stage once locations are known.
- Operators would comply with applicable laws, regulations, and permits.
- The analysis assumes that the leasing decision would be followed by future oil and gas development.

4.10.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to transportation across the range of alternatives include the following:

- Miles of potential new roads required for oil and gas lease development.
- Estimated traffic related to drilling and production operations associated with the development of gas wells, well pads, pipelines, and access roads.

4.10.1.5 Methods of Analysis

The method of analysis incorporates the predicted miles of new road development and estimated traffic volumes under each alternative and compares that to existing values to determine the changes and level of impact.

4.10.2 Stipulations Providing Coverage for Transportation

There are no existing or proposed stipulations under any alternative that relate specifically to transportation. NSO stipulations implemented for other resources would serve to minimize traffic levels and access roads in areas with sensitive resources on the leases that need to be protected but may just move the oil and gas infrastructure (wells, pads, pipelines, and roads) and associated traffic to another location outside of the NSO or off the lease. NSO stipulations also would assist to preserve and retain the existing scenic integrity in the area, by keeping natural features intact. CSU stipulations would assist in minimizing adverse impacts to forest resources by enabling locations to be moved where there are concerns related to resource protection, but this may not be useful to manage traffic or access.

4.10.3 Impacts Common to All Alternatives

New roads would be constructed and added to the road network to access new oil and gas development, except under Alternative 5, which would cancel all leases. New roads would most likely be decommissioned and reclaimed once production is done, unless needed for other resource uses as determined by the Forest Service. Although it is a stated goal to fully reclaim roads once production is done, the potential would be present for reclamation efforts to experience varying levels of success or in some circumstances to be delayed.

Public travel can be impacted by increased traffic on roads, including temporary conflicts with normal traffic, decreased travel speeds, travel delays, and increased vehicle collision rates. The projected traffic could cause an increase in fugitive dust and noise and an increased risk of collision with wildlife.

The development phases include development (construction drilling and completion), operations/maintenance, and abandonment/reclamation. Depending on the phase of development, one could expect to encounter over-legal (overweight, over-width, or over-length) vehicles to serve oil and gas locations, in addition to other types of traffic. The construction, drilling and well completion phases would generate the most traffic and could be encountered throughout a daily 24-hour period. The total number of round-trips in addition to the anticipated average daily round-trips per well by development phase is shown in **Table 4.10-1**.

Long-term operations consist of the regular travel of employees involved in the operation and maintenance of producing wells and ancillary facilities such as compressors and pipelines. Vehicles used in maintenance and other operations activities mostly consist of pickup trucks, although heavy truck traffic could be encountered. Maintenance activities generally occur daily over the life of the anticipated well production (estimated to be 20 years).

Heavy truck traffic in oil and gas development areas can cause damage to roads and bridges. The WRNF requires operators to bring the structural section of a road to the standard necessary to accommodate operational traffic during all weather conditions. An operator must apply for and obtain an overweight permit and performance bond prior to hauling an over-legal load across a bridge structure on NFS lands.

Impacts Identified in the WRNF Final EIS

Impacts that were identified for transportation resources due to the potential effects of future oil and gas development and operations in the WRNF include increased traffic on roads that may result in temporary conflicts with normal traffic, travel delays, and increased vehicle collision rates (USFS 2014a, p. 315). Elevated oil and gas traffic could generate fugitive dust and noise as well as an increased risk of collision with wildlife. New single-purpose roads would be added to the local road network, although these roads may be closed to public motorized use. Heavy truck traffic associated with oil and gas development and operations could cause extensive damage to roads and bridges (USFS 2014a, p. 316). These impacts would be the most discernable during drilling and well completion phases when vehicle traffic could approach 50 round trips a day, per well. Transportation impacts would be less noticeable during the production and operations phase as traffic levels would decrease (USFS 2014a, p. 316).

4.10.4 Impacts by Alternative

Impacts by alternative for transportation were determined by considering the anticipated road construction as well as estimated increases in lease development traffic. Potential stipulations, such as big game TLs, also were noted, as road and pad construction could be limited to the timeframe outside the specified period of the year.

It is assumed that approximately 1 mile of new road construction would take place for each well pad. Exact placement of these roads and pads is unknown at this time; in some cases, pads may be located off the lease where minerals would be extracted through directional or horizontal wells.

The development phase consists of road and pad construction, drilling and completion activities. During this phase, average daily vehicle round-trips would be the highest and would result in the greatest level of impacts to transportation. The majority of vehicles used during this phase would be light trucks, followed by heavy truck traffic, and to a much lesser degree, over-legal vehicles.

Table 4.10-1 Estimated Traffic per Well By Development Phase

	Development			Completion		Operations and Maintenance		Abandonment and Reclamation	
	Road Pad Pipeline Construction	**Drilling Rig Up Rig Down**	**Drilling**	**Completion Mobilization**	**Completion**	**Production**	**Work-Over**	**Plug and Abandon Well**	**Reclaim Road and Pad**
Total Trips (Vertical/ Directional Wells)	114	21.7	130	137	240			25	28.6
Avg Daily Round Trips	40	19	13	48	12	5	5	5	10
Total Trips (Horizontal Wells)	114	22	780	137	360			25	29
Avg Daily Round Trips	40	19	13	48	12	5	5	5	10

Trips associated with the maintenance and operation stage of lease development would be much lower per well than during development, resulting in a corresponding decreased level of traffic. It is impossible to predict when and in what zone development would occur, and the associated concentrated traffic levels, because this is dictated by market conditions. Due to the low number of oil and gas development projected in the analysis area under each alternative, it may be that traffic levels would be concentrated on any single external access route at any one time. The total number of round-trips is presented to facilitate comparison between alternatives. Heavy truck traffic may be less noticeable on roads within the lease zones that currently experience this type of traffic because the associated impacts already are present and integrated into the transportation network.

4.10.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Traffic would be heaviest for most leases from May 1 to December 1 in order to account for Big-Game Winter TL stipulations attached to many leases. It is assumed that drilling and completion activities would not occur in winter or early spring; however, exceptions, modifications, or waivers could be granted on a case-by-case basis.

Impacts from Projected Future Oil and Gas Development

The potential impacts would be the number of new roads constructed in support of the projected number of wells that may be developed. If all leases under Alternative 1 were developed, up to 416 wells could be developed on up to 60 well pads with Zones 1 through 4. The majority of oil and gas development is projected to occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development. The impacts to the transportation system, therefore, would be the addition of up to 60 miles of road over the 20-year analysis timeframe.

The actual locations of well pads, roads, pipelines, and other associated infrastructure to be developed and the timing for development are unknown at this time. As a result, the amount of new roads constructed could be less than 60 miles because the assumption was made that there would be one access road to each well pad and did not take into account existing access roads that may be used. The length of access roads could be greater than 60 miles (or more than the average 1 mile per pad) should there be the need to reach well pads that are remote. Future proposed roads would undergo site-specific reviews and further NEPA analysis of impacts prior to approval of the road use plan and permits to drill. The road use plan may prevent duplicate roads and strive to reduce the overall length and network of new roads.

The amount of traffic generated by oil and gas development and production would be dependent on the number of wells drilled and completed in a given year. Under Alternative 1, the drilling and completion of 416 wells would occur over 20 years, resulting in an average of 21 wells drilled per year, although it is unknown what the actual pace of lease development would be.

Estimated maximum total development, operations and maintenance, and well abandonment and reclamation round-trips, as well as operations and maintenance average daily round-trips, are depicted by haul road for each zone in **Tables 4.10-2** through **4.10-5**. Estimated traffic levels for each haul road were tabulated by utilizing the RFD scenario for the potential number of wells to be developed on each lease. Increased traffic due to oil and gas activities on lands available for leasing would be more noticeable along Rio Blanco and Pitkin county roads than along western Garfield and eastern Mesa County roads because there are already high levels of existing oil and gas infrastructure and projected future development in Mesa and western Garfield counties.

Table 4.10-2 Alternative 1: Zone 1 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Mesa County Road (CR)-V[6]	Heavily utilized south from De Beque to the junction with CR T. Use is very light or nonexistent south of this junction until several miles north of Hwy 330 where oil and gas traffic increases.	17,866/894	70,080/192	1,032
Mesa CR-T[6]	Heavily utilized.	17,866/894	70,080/192	1,032
Garfield CR-306	Heavily utilized.	13,403/670	59,495/163	875

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: USFS 2010.

Table 4.10-3 Alternative 1: Zone 2 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Garfield CR-300[6]	Heavily utilized.	10,939/547	61,685/169	906
Garfield CR-302[6]	Heavily utilized to Battlement Creek.	10,939/547	61,685/169	906
Garfield CR-304/BLM 8157 and 8159	Heavily utilized.	10,939/547	61,685/169	906
Garfield CR-320[6]	Heavily utilized.	7,789/389	43,800/120	643
Garfield CR-301 and 309/USFS-845	Heavily utilized. Use on CR-309 becomes very light to nonexistent at the USFS boundary.	37,039/1,852	209,875/575	3,079
Garfield CR-317	Heavily utilized.	7,789/389	43,800/120	643
USFS-824[6]	Heavily utilized.	7,789/389	43,800/120	643
USFS-818	Heavily utilized.	23,870/1,194	134,685/369	1,978
Garfield CR-319	Heavily utilized.	23,870/1,194	134,685/369	1,978
Garfield CR-315	Heavily utilized.	33,054/1,653	187,245/513	2,747
Garfield CR-331[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Garfield CR-342[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Mesa CR-330E[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
USFS-816[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Mesa CR-330[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Garfield CR-344[6]	Heavily utilized.	48,362/2,418	273,020/748	4,012
Mesa CR-79[6]	Heavily utilized to SGI compressor station. Use is then light.	48,362/2,418	273,020/748	4,012
USFS-814.1[6]	Nonexistent. Restricted bridge.	48,362/2,418	273,020/748	4,012

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: USFS 2010.

Table 4.10-4 Alternative 1: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,212/161	58,765/161	262
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M and USFS-321[8])	Heavily utilized.	9,572/479	53,290/146	781
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	12,977/649	72,270/198	1,059
Pitkin County CR–3D/USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	1,028/51	5,840/16	86

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: USFS 2010.

Table 4.10-5 Alternative 1: Zone 4 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Rio Blanco CR 15/Moffat County 45	Lightly utilized	6,427/321	36,500/100	536
Rio Blanco CR-48[6]	Nonexistent	6,427/321	36,500/100	536
Rio Blanco CR-51/USFS-252[6]	lightly utilized	6,427/321	36,500/100	536

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: Mobley 2014; USFS 2010.

Most oil and gas development is projected for Zone 2, which would lead to a proportionately increased level of road and well construction and maintenance traffic. Zone 1 is projected to experience the next highest level of road construction, well development, and maintenance traffic, followed by Zones 3 and 4. As detailed in **Table 4.10-2** and **4.10-3**, Mesa CRs V and T would potentially incur higher traffic levels than other Zone 1 haul roads should traffic be concentrated on a single road based on RFD scenarios. Elevated use of haul roads would potentially increase traffic levels as well on SH-300 near Collbran, adding an increase in noise an increased risk of vehicle collisions or accidents, and potentially higher road maintenance costs. Within zone 2, estimated round-trips per year would range from 389 to 2,887 over a 20-year period depending on the route as depicted in **Table 4.10-3**.

Roads in Zone 3, although projected to be utilized lightly by heavy truck traffic for oil and gas development and production, serves mostly recreation users and homeowners, so impacts from additional oil and gas development along sensitive potential haul routes, such as Four Mile Road (CR-117) and Jerome Park/Thompson Creek Road (CR-108), may be more noticeable than on more heavily traveled roads. Impacts could include temporary conflicts with normal traffic, travel delays, decreased travel speeds, and increased vehicle collision rates with other vehicles or with wildlife and livestock. Increased heavy truck traffic may reduce recreational and tourist activities in recreation-intensive areas, such as the Thompson Divide area. These impacts would be more noticeable during development phases when industrial traffic would be heavier. **Table 4.10-4** portrays estimated traffic levels for Zone 3 roads, based on RFD scenarios. Well development activities could potentially result in total estimated 9,572 round-trips on Four Mile Road (CR-117), and then subsequently through the city of Glenwood Springs over 20 years. There is no available existing traffic data for Four Mile Road (CR-117) to evaluate the estimated percent increase in average daily traffic; however, it assumed during the lease development phase that a maximum of potentially 50 average daily round-trips per well and a total of 146 average daily round-trips for all wells during operations and maintenance would be added to existing traffic levels.

Municipal concerns from the cities of Glenwood Springs and Carbondale have been cited related to where potential haul roads intersect with the municipal road networks in and near town. These concerns are centered on whether the existing level of service, road capacity, and structural road and bridge limitations are adequate to accommodate increased industrial traffic and whether this new traffic would cause safety issues in the use of Midland Avenue, the 27th Street roundabout, the 27th Street (Sunlight) Bridge, and the SH-82 bridge in Glenwood Springs. Concerns for Midland Avenue also include poor road surface condition, high rockfall probability, pedestrian and biker safety, and the incompatibility of heavy truck traffic with school traffic and student crossing areas. Concerns surrounding Four Mile Road (CR-117) outside of Glenwood Springs include the incompatibility of heavy truck traffic on a road that services mostly residential and recreational users within the Four Mile-Thompson Divide area, as well as the potential cost of increased maintenance resulting from increased heavy truck traffic.

Along Thompson Creek Road (CR-108) well development activities also would potentially result in 50 average daily round-trips per well and a total of 198 average daily round-trips for all wells during operations and maintenance would be added to existing traffic levels over the 20-year development period. This would result in an increase of average daily traffic along Thompson Creek Road (CR-108) of 52 percent during lease development (assumes one well is developed a year) and an increase 204 percent of average daily traffic when operations and maintenance traffic for all wells to be developed is incorporated and compared to existing traffic levels portrayed in Section 3.10.

Coal Creek Road (USFS 307) also could potentially see traffic level increases associated with lease development, and operations and maintenance of 81 percent and 26 percent, respectively, as compared to the existing levels detailed in Section 3.10. Traffic on Thompson Creek Road (CR-108) and Coal Creek Road (USFS 307) would then pass through the Carbondale.

Additionally, within Zone 3, East Divide Road (CR-313/USFS 801/812) may be considered an alternative haul route. This route is unsuitable for industrial heavy traffic and is not considered a viable access route by the Forest Service.

Within Carbondale, concerns were centered on road degradation of city streets such as Main Street and SH-133, as well as safety concerns for some haul roads such as Thompson Creek Road (CR-108) that pass through school zones and sensitive watersheds. Sensitive watersheds could be susceptible to contamination in the event of spills and accidents. Furthermore, there are safety concerns regarding the structural capability of local bridges and their ability of handling large truck traffic, such as the Thompson Creek Road (CR-108) bridge over the Crystal River. Road structural concerns also exist with the potential for road damage from spring thaw periods. Road limits are at times imposed by local authorities to attempt to reduce damages. Pitkin County identified concerns regarding the potential use of Coal Creek Road, such as whether it has the capacity to enable use by heavy trucks in its current condition and the potential damage to extensive road reclamation that has been done in the area.

There are three Rio Blanco County roads serving Zone 4 which could be expected to handle the maximum total development round-trips shown in **Table 4.10-5**. Oil and gas development traffic would increase along SH-13, SH-133, and SH-82, as well as US-6 and possibly I-70. At the highest level of per well average daily vehicle round-trips associated with lease development (50), this increase in traffic levels would be negligible on these highways when compared to current traffic levels portrayed in **Table 3.10-1**.

These levels would fluctuate depending on the timing of development and would occur over a period of 20 years. Spreading new road construction and development associated traffic over a 20-year timeframe would result in an incremental increase in traffic levels and a more modest elevation in corresponding impacts. Consultation and coordination by operators with state, county, and local governments and agencies would serve to further lessen impacts to area roads and resources.

4.10.4.2 Alternative 2

Stipulation Coverage

Under Alternative 2, 8 leases would be affected by minor changes to stipulations, but these changes would not affect transportation more than described for Alternative 1 because the projected amount of new development would be the same.

Impacts from Projected Future Oil and Gas Development

Should leases be developed under Alternative 2, the estimated number of potential well pads and wells would be the same as under Alternative 1. This would result in similar impacts to transportation resources from an increase in the number of new roads and increased traffic levels as under Alternative 1.

Sensitive local roads and areas, including but not limited to Four Mile Road (CR-117), Midland Ave in Glenwood Springs, Thompson Creek Road (CR-108), Coal Creek Road (USFS-307), and SH-133 in Carbondale, would experience the same level of lease development and production-related truck traffic as detailed under Alternative 1. Estimated traffic levels by haul road and zone are detailed in **Tables 4.10-2** through **4.10-5**.

4.10.4.3 Alternative 3

Stipulation Coverage

Under Alternative 3, the acreage under NSO, CSU, and TL stipulations would greatly increase when compared to Alternatives 1 and 2. The increase in stipulations would more greatly affect where and when roads could be constructed.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, approximately 413 wells are projected to be developed on 59 pads. Should leases be developed under Alternative 3, the estimated number of potential well pads would be the same as under Alternatives 1 and 2, except in Zone 3, where the projected number is lower. This would result in slightly less impacts to transportation resources in Zone 3, which is the location of the roads of concern identified by residents and municipalities. Estimated traffic levels under Alternative 3 by haul road are shown in **Table 4.10-6**.

With the additional stipulations being described under this alternative, specific sensitive local roads and areas, such as Thompson Creek Road (CR-108) and SH-133 in Carbondale, would potentially experience a slightly lower level of development and production related traffic than under Alternatives 1 and 2. Under Alternative 3, it is estimated projected traffic levels across all phases of lease development on Thompson Creek Road (CR-108) would decrease by approximately 15 percent when compared to Alternatives 1 and 2. These levels, shown in **Table 4.10-6**, would fluctuate depending on the timing of development and would occur over a period of 20 years, resulting in an incremental increase in traffic levels and types of traffic. Traffic levels on sensitive roads Four Mile Road (CR-117) and Coal Creek Road (USFS 307) are anticipated to stay the same as under Alternatives 1 and 2.

Table 4.10-6 Alternative 3: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,212/161	58,765/161	262
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	9,572/479	53,290/146	781
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	10,985/549	60,955/167	893
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	1,028/51	5,840/16	86

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on F**igure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

4.10.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Under Alternative 4, the acreage of NSO, CSU, and TL stipulations would be the same in Zones 1, 2, and 4, compared to Alternatives 1 and 2. Due to the cancellation of all or part of 25 leases and the designation as closed to leasing surrounding them in Zone 3, Alternative 4 would more greatly limit where and when roads could be constructed in Zone 3.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, approximately 383 wells would potentially be developed on 55 well pads. Should leases be developed under Alternative 4, the estimated number of well pads would be less than Alternatives 1, 2, and 3 in Zone 3. This would result in fewer impacts to transportation resources and a decrease in traffic levels and new roads relative to Alternatives 1, 2, and 3, as is reflected by the reduction in round-trips and average daily vehicle round-trips, shown in **Table 4.10-7**.

Table 4.10-7 Alternative 4: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,405/170	18,980/52	278
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	1,456/73	8,030/22	120
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	0/0	0/0	0/0
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	0/0	0/0	0/0

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

Sensitive local roads and areas, including but not limited to Four Mile Road (CR-117) and Midland Ave in Glenwood Springs would experience substantially lower levels of truck traffic, when compared to Alternatives 1, 2, and 3, resulting from the majority of Zone 3 under Alternative 4 due to the cancellation of leases. The few leases in Zone 3 that would be open to leasing would be accessed either by Zone 2 haul roads or Zone 3 haul roads, such as Four Mile Road (CR-117). Estimated traffic levels on Four Mile Road (CR-117) would decrease by 85 percent during all phases of leasing development under Alternative 4, when compared to Alternatives 1, 2, and 3. Thompson Creek Road (CR-108), Coal Creek Road (USFS 307), and SH-133 in Carbondale would not experience any lease development truck traffic under Alternative 4. **Figure 2-13** shows areas that would be closed to leasing in Zone 3 under Alternative 4.

4.10.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Under Alternative 5, there would be no potential for future development within the 65 leases because all leases would be cancelled. Leases currently in production would be plugged and abandoned and well pads and roads would be decommissioned and reclaimed. As noted in **Table 4.10-1**, traffic associated with these activities would result in approximately 5 average daily round-trips over a 5-day period for plugging and abandoning activities, and 10 average daily round-trips over a 20-day period for reclamation activities, per reclaimed well (if they are all performed in the same year), resulting in minor short-term impacts to area roads similar to those of operations and maintenance. As shown in **Tables 4.10-8** and **4.10-9**, no truck traffic associated with plugging and abandoning and reclaiming existing wells and pads would pass along roads of concern within the Thompson Divide area or the cities of Glenwood Springs and Carbondale.

4.10.4.6 Summary of Impacts

In summary, within the analysis area the maximum estimated new road construction would take place within Zone 2 under Alternatives 1 and 2. Additionally, the highest annual vehicle round-trips and total trips would take place within Zone 2 under Alternatives 1 and 2, potentially resulting in impacts such as decreased travel speeds, travel delays, and increased vehicle collision rates. Impacts to local areas and roads of concern near the Thompson Divide area, Glenwood Springs, and Carbondale would be greatest under Alternatives 1 and 2, although impacts would be spread along a 20-year development period. Alternatives 3 and 4 would produce slightly less impacts to transportation resources as a result of the potential development of fewer wells pads and associated wells. Alternative 5 would produce the least impacts of any alternative as existing wells are plugged and abandoned and lease pads and access roads reclaimed.

Table 4.10-8 Alternative 5, Zone 2 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Garfield CR-300[6]	Heavily utilized.	0/0	0/0	0
Garfield CR-302[6]	Heavily utilized to Battlement Creek.	0/0	0/0	0
Garfield CR 304/BLM 8157 and 8159	Heavily utilized.	0/0	0/0	0
Garfield CR-320[6]	Heavily utilized.	0/0	0/0	214
Garfield CR-301 and 309/USFS-845	Heavily utilized. Use on CR 309 becomes very light to nonexistent at the USFS boundary.	0/0	0/0	214
Garfield CR-317[6]	Heavily utilized to the USFS boundary.	0/0	0/0	54
USFS-824[6]	Heavily utilized.	0/0	0/0	54
USFS-818.1	Heavily utilized.	0/0	0/0	590
Garfield CR-319	Heavily utilized.	0/0	0/0	590
Garfield CR-315	Heavily utilized.	0/0	0/0	0
Garfield CR-331[6]	Heavily utilized.	0/0	0/0	3,055
Garfield CR-342[6]	Heavily utilized.	0/0	0/0	3,055
Mesa CR-330E[6]	Heavily utilized.	0/0	0/0	3,055
USFS-816[6]	Heavily utilized.	0/0	0/0	3,055
Mesa CR-330[6]	Heavily utilized.	0/0	0/0	0
Garfield CR-344[6]	Heavily utilized.	0/0	0/0	107
Mesa CR-79[6]	Heavily utilized to SGI compressor station. Use is then light.	0/0	0/0	107
USFS-814.1[6]	Non-existent. Restricted bridge.	0/0	0/0	107

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: Mobley 2014; USFS 2010.

Table 4.10-9 Alternative 5, Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	107
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	0/0	0/0	0
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	107
USFS-300.3 and 300.4[6]	Lightly utilized.	0/0	0/0	0
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	0/0	0/0	0
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/N Thompson Creek Road)	Lightly utilized.	0/0	0/0	0/0
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	0/0	0/0	0/0

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

4.10.5 Cumulative Impacts

4.10.5.1 Cumulative Impacts Analysis Area

The Cumulative Impacts Analysis Area (CIAA) for transportation is the 4 lease zones (80, 380 acres) as well as the regional road network (see **Figures 3.10-1** and **3.10-2**). This area includes multiple county roads currently serving existing oil and gas operations, as well as state and U.S. highways.

4.10.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines as well as other developments. Impacts to transportation from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent, and also would contribute to increased levels of traffic on the local and regional road network.

Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions would include oil and gas, as well as road, powerline, pipeline, reservoir, vegetation treatment, habitat improvement, and recreational trails projects. These projects also would contribute to increased levels of traffic on the local and regional road network. Impacts would be short-term ending upon project completion.

It is projected that 50,166 wells will be drilled on 6,830 pads across the WRNF and within the BLM CRVFO, GJFO, and WRFO. Development of these wells would produce approximately 4,681,210 round-trips during construction. Well development would increase road construction and further expand the regional road network. These estimates were derived from BLM and Forest Service planning documents. A more detailed breakdown of traffic estimates associated with these projected wells is located in **Table B-5** in **Appendix B**. Other surface-disturbing activities such as gravel mining in Garfield County would incrementally increase traffic levels on the regional road network contributing to slight increase in impacts to the regional road network.

Road projects, such as slated improvements to CR 5 in Rio Blanco County, would enhance travel safety and facilitate enhanced travel times for regional traffic. More information is located in **Appendix B**.

4.10.5.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

Transportation from the Proposed Action and alternatives are disclosed in Section 4.10.4. Development of the WRNF leases would contribute less than 1 percent to the cumulative oil and gas development in the region and the transportation associated with that development. If selected, Alternative 5 would remove operations traffic associated with 75 existing wells.

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4.11 Lands and Special Uses

4.11.1 Analysis Assumptions and Approach to Analysis

4.11.1.1 Analysis Area

The analysis area encompasses the four lease zones (see **Figure 1-1**).

4.11.1.2 Scoping Issues

The NEPA scoping process revealed an array of the public's concerns regarding impacts to lands and special uses. Relevant issues and concerns raised during scoping are detailed below.

- Oil and gas activities limiting or otherwise affecting existing or proposed land uses, such as private or residential property, livestock grazing, other zoned county uses, and conservation easements.
- Protection of Pitkin County property acquisitions and restoration activities, such as Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and Thompson Creek Mine, from inconsistent development and degradation.
- Consideration of Pitkin County land use code which places limits on oil and gas development in the Thompson Divide area.
- Consideration of the Mesa County Mineral and Energy Resources Plan.
- Stipulations to protect the environment from future pipeline construction and maintenance.

While these issues are addressed in general terms, the general nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing some issues in detail. Issues would be addressed in more detail at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Impacts to livestock grazing and ranching activities, as well as recreation, are addressed in Sections 4.14 and 4.13, respectively. The potential for impacts to the Jerome Park Conservation Easement and other viewsheds is discussed in Section 4.15, Scenic Resources. Section 4.17 addresses the potential for impacts to private or residential property.

4.11.1.3 Assumptions

The following assumptions were used to facilitate the lands and special uses analysis:

- Additional environmental analysis would occur for future exploration and development of oil and gas resources within the leases when site-specific proposals are submitted during the APD process.
- Site-specific NEPA for future development on adjacent BLM lands would be analyzed at the APD stage, as well as ROW applications for off lease, unit, or communitization agreement development, once locations are known.
- Lands proposed for leasing that contain communication sites, authorized under special use permits or communications use leases, have a CSU stipulation attached to the lease.
- Operators would comply with applicable laws and regulations for surface and subsurface development of resources.
- The analysis assumes implementation of the future projected oil and gas development for each lease derived from the RFDS scaled for each alternative.

4.11.1.4 Impact Indicators Used for Analysis

The following indicators used to measure potential impacts to lands and special uses:

- Lease stipulations in areas committed to other land uses.
- Amount of acreage within the analysis area that is precluded from surface disturbance from oil and gas development through lease stipulations,
- Acres in which land use may change from an existing use to oil and gas development based on the RFDS.

4.11.1.5 Methods of Analysis

The method of analysis for lands and special uses includes quantifying the extent to which, by alternative, the overall acreage committed to other land uses may potentially be impacted, identifying conflicts with land use plans or regulations, referencing potential impacts or conflicts with other land uses (grazing, recreation, etc.).

4.11.2 Stipulations Providing Coverage to Lands and Special Uses

Leased lands with NSO stipulations means infrastructure for oil and gas production associated with a leased parcel such as well pads, buildings, tanks, and drilling equipment must be placed outside of the stipulated area unless it can be proven that the resource for which the NSO was designated does not exist in that location. NSO equates to no ground disturbance for those activities within the stipulation boundaries in that particular lease. Access roads and collection pipeline corridors are not always authorized under a surface use plan but may be granted under other authorizations such as special use authorizations, ROWs, or road use permits subject to Forest Plan standards and guidelines. NSO stipulations, in some cases, would serve to preserve current land uses.

4.11.3 Impacts Common to All Alternatives

Should development occur, there would be surface-disturbing activities from construction of well pads, pipelines, and other associated activities, taking the place of current land uses.

Impact issues that were identified for land use in the WRNF Final EIS include the potential effects of existing as well as future oil and gas development and operations on potential authorizations such as utility lines, communication sites, and road use (WRNF Final EIS 2014, p. 377-378). Development of leaseholds may require special use authorizations, such as for third party pipelines, and would be subject to site-specific environmental analysis (WRNF Final EIS 2014, p. 377). Further lands and realty authorization and special use impact discussion can be found in USFS 2014, pages 377 and 378.

<u>Minerals</u>

Under all alternatives, any mineral development within the leases would be in accordance with USFS leasing and surface stipulations. There is no private mineral ownership within the leases. Should other mineral development actions be granted, oil and gas development would be required to avoid those areas. Impacts to mineral development also are discussed in Section 4.3, Geology, Minerals, and Paleontology.

<u>Rights-of-Way</u>

Under all alternatives, leasing stipulations would allow for some relocation of activities to avoid existing ROWs. Additionally, for safety reasons, all proposed ROW development would be required to observe requisite buffers between well pads and existing transmission lines. Development of leases may require special use authorizations or ROW grants for such infrastructure as roads and off-lease or off-unit pipelines transporting gas or water. The site-specific environmental analysis required when site-specific

proposals are submitted would identify mitigation measures and conditions of approval that would become part of any authorization issued. All future ROWs also would be designed to avoid any oil and gas development that occurs as a result of this leasing decision.

Valid Existing Rights

Under all alternatives, there would be no impact to any valid outstanding rights within the leases, as all rights would be honored when it is subsequently determined that the claim to such rights meet the criteria set forth in a respective statute granting such occupancy and use (USFS 2002a).

Communication Sites

There is one communication site, the Sunlight Base and Repeater, in Zone 3. Stipulations overlapping the communication site are detailed by alternative below. In all cases, leasing stipulations would allow for some relocation of activities to avoid the communication site.

County Land Use Plans and Zoning

Oil and gas development may affect existing or proposed land uses as defined by County Master Plans or other land use codes. Compatibility of reasonably foreseeable development with these land uses, while not required, is discussed by alternative below. Under all alternatives, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

The Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are outside the lease zone boundaries (see **Figure 3.11-1**). Development would not occur in these areas under any alternative.

As noted in Section 4.15, Scenic Resources, the Jerome Park Conservation Easement would be within a mile of some lease borders. The Cold Mountain Ranch, Mautz Ranch, Elk Park, and Redstone Coke Ovens conservation easements would be located about 5 miles east of the closest lease. The potential for visual impacts to the easements from reasonably foreseeable development would depend on the type of leasing stipulation present in the leases closest to the easement (discussed by alternative below), as well as site-specific conditions such as slope, aspect, terrain and vegetation in and around the site-specific location; and the amount of contrast between the natural and constructed landscape (see Section 4.15, Scenic Resources). Expected noise levels from oil and gas development and operation are discussed in Section 4.16, Human Health and Safety. Impacts to other special uses such as recreation and livestock grazing are found in Sections 4.13, and 4.14, respectively.

4.11.4 Impacts by Alternative

The identification of potential impacts to lands and special uses by alternative should leases be developed were determined by considering the acres within the leasing zones that are covered by each type of leasing stipulation. Analysis of potential impacts to lands and authorizations as well special uses are presented below by alternative.

4.11.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Under Alternative 1, approximately 24,443 acres within all the zones would be covered by NSO stipulations, limiting potential oil and gas development and impacts to current authorizations that may be affected by the construction of new infrastructure. Another 26,609 acres would be covered by TL

stipulations, 4,722 acres by CSU stipulations, and 30,960 acres by SLTs. CSU stipulations would reduce land use conflicts by allowing relocation of operations more than 200 meters. TL stipulations would be used to reduce seasonal conflicts with wildlife or other resources that may affect land use. Under SLTs, operations could be relocated up to 200 meters.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this disturbance and subsequent impacts to lands and realty authorizations and potential changes to special uses would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be under a NSO for slopes greater than 60 percent. If all stipulations were implemented, there would be no impact to the Sunlight Base and Repeater (located in Zone 3) because surface disturbance would be precluded in those areas through an NSO stipulation. If the NSO or slopes greater than 60 percent were to be exempted, there would be no constraints to development in this area beyond SLTs.

County Land Use Plans and Zoning

Zoning within Mesa County (Zone 1 and Zone 2) is intended to provide protection and continuation of agriculture and forestry protection, as well as the preservation of environmentally sensitive lands. Lease development activities may not be compatible with Mesa County zoning; however, NSO stipulations, which almost cover the entirety of Zone 1 would preclude surface disturbance in this zone, preserving the zoning intent. Approximately a third of Zone 2 would be under NSO stipulations, which would aid in compatibility with Mesa County zoning. Within Garfield County, application of NSO, CSU, and TL stipulations would complement county goals of properly regulating oil and gas activities and ensuring that effects on the natural environment are mitigated; however, increased haul road traffic on Four-Mile Road would contribute to increased noise to adjacent homes within the Oak Meadows and Springridge Reserve Planned Unit Development, potentially detracting from the residential setting. Similarly, lease development activity and associated traffic within Pitkin County zoning district RS-30 may conflict with the intent to “preserve agricultural operations and environmental resources, and preserve rural visual quality and character” (Pitkin County 2006). Application of NSO, CSU, and TL stipulations in Zone 3 would assist in reducing impacts to lands within the RS-30 zoning district, although residual impacts may still conflict with zoning intent. A Level 1 Travel Route CSU stipulation would be applied to portions of Four Mile Road crossing two existing leases. It is anticipated that application of NSO and TL stipulations within Zone 4 would minimize adverse agricultural impacts and would be in accordance with Rio Blanco County land-use policies. Additionally, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place. Under SLTs, operations could be relocated up to 200 meters, which may help in reducing impacts to lands and aiding in compatibility with zoning requirements.

Other Special Uses

Potential impacts to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are described under Impacts Common to all Alternatives. Under Alternative 1, some portions of the leases closest to Jerome Park, Cold Mountain Ranch, Mautz Ranch, Elk Park, and the Redstone Coke Ovens easements and the Thompson Creek Mine would have NSO stipulations; potential for visual impacts would be determined during site-specific NEPA. Section 4.10, Transportation, discloses reasonably foreseeable traffic levels on Coal Creek

Road, Thompson Creek Road and SR-133. Elevated traffic levels would potentially increase noise and fugitive dust to portions of the easements that are adjacent to the roadways; however, traffic would be intermittent and would not be expected to impede the values for which the easements were designated or inhibit restoration activities within the Thompson Creek Mine site. Additionally, traffic levels near the easements would fluctuate depending on the timing of development and would occur over a period of 20 years.

4.11.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting lands and special uses under Alternative 2 would be similar to Alternative 1 with the exception of minor changes to eight leases. The types of stipulations are discussed in Section 4.11.2.

Impacts from Projected Future Oil and Gas Development

Impacts from projected future oil and gas development and the subsequent impacts to land use changes and authorizations would be the same under Alternative 2 as under Alternative 1, with the exception that stipulations within eight leases in Zone 3 would be enhanced, offering an increased level of restrictions on where lands and realty authorizations may occur.

Communication Sites

The Sunlight Base and Repeater would be under a NSO for slopes greater than 60 percent, the same as under Alternative 1. Stipulations on the adjacent lease also are NSO for slopes greater than 60 percent.

County Land Use Plans and Zoning

Potential conflicts with county land use plans and zoning would be similar to those under Alternative 1, except that a Level 1 Travel Route CSU stipulation would be added to Lease 066706, so that all portions of Four Mile Road that cross the three existing leases would be covered by this CSU. Site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

Impacts would be the similar to Alternative 1, except that there would be slightly more NSO stipulations in leases close the Jerome Park Conservation Easement further limiting the potential of oil and gas development and subsequent potential visual impacts to areas within the viewshed of the Jerome Park Conservation Easement. Visual impacts would be determined during site-specific NEPA.

4.11.4.3 Alternative 3

Stipulation Coverage

Under Alternative 3, approximately 71,045 acres within all the leasing zones would be covered by NSO stipulations, limiting potential development. Another 54,992 acres would be covered by TL stipulations and 80,379 acres by CSU stipulations.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, the potential exists for approximately 413 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 886 acres and long-term surface disturbance of 384 acres. The majority of this disturbance and subsequent impacts to lands and realty authorizations and potential changes to special uses would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be under a CSU specific to communication sites. This stipulation would assist in minimizing conflicts between oil and gas development and communications site by allowing relocation of leasing activities by more than 200 meters when required.

County Land Use Plans and Zoning

Under Alternative 3, three less pads would be constructed in Zone 3, lessening potential conflict between lease development and Garfield and Pitkin county plans and interests. NSO acreage under Alternative 3 within Zones 2, 3, and 4 would increase substantially, and CSU and TL stipulations also would be added to additional acreage further lessening the potential for conflicts with Garfield, Pitkin, and Rio Blanco county plans and zoning. Conformance with Mesa County planning and the Mineral & Energy Resources Master Plan in Zone 1 would be the same as discussed under Alternative 1; increased NSO acreage within Zones 2 would lessen potential for conflicts. Additionally, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

Potential impacts to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are discussed under Section 4.11.3, Impacts Common to All Alternatives.

Some portions of the leases closest to the conservation easements would be covered by NSO stipulations. The leases in the northeastern portion of the Zone 3 (closest to the Roaring Fork Valley and Carbondale) would generally not have NSO stipulation applied to them but would be covered by CSU stipulations. The potential for visual impacts would be determined during site-specific NEPA. Section 4.10, Transportation, discloses reasonably foreseeable traffic levels on Coal Creek Road, Thompson Creek Road and SR-133. Increased haul road traffic on Coal Creek Road and Thompson Creek Road in addition to increased lease development traffic levels on SR-133, would contribute to increased noise and fugitive dust to the portions of these easements that are adjacent to the roadways, although traffic levels and subsequent noise and fugitive dust would be slightly less under this alternative. Traffic would be intermittent and would not be expected to preclude activities within these easements or inhibit restoration activities within the Thompson Creek Mine site. Additionally, traffic levels near the easements would fluctuate depending on the timing of development and would occur over a period of 20 years.

4.11.4.4 Alternative 4 (Proposed Action)

<u>Stipulation Coverage</u>

Under Alternative 4, approximately 46,283 acres within all the leasing zones would be covered by NSO stipulations, limiting potential changes to existing lands and special uses authorizations and limiting future lands and special uses authorizations. Another 51,920 acres would be covered by CSU stipulations and 40,847 by TL stipulations. An estimated 28,460 acres would be closed to leasing, which would exclude oil and gas development and associated changes to land uses.

<u>Impacts from Projected Future Oil and Gas Development</u>

Under Alternative 4, the potential exists for approximately 383 wells to be drilled from 55 well pads. These actions could potentially result in initial surface disturbance of 821 acres and long-term surface disturbance of 356 acres. The majority of this disturbance and subsequent impacts to land use changes and lands and special uses authorizations would occur in Zone 2, followed by Zones 1, 3, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be within areas that would be closed to leasing, which would be a benefit to this authorization by negating the potential for potential oil and gas development and associated impacts to this authorization from construction of new infrastructure.

County Land Use Plans and Zoning

Should leases be developed under Alternative 4, the estimated number of potential well pads would be less than Alternatives 1, 2, and 3, with the reduction in well pads and wells occurring in Zone 3, as the majority of Zone 3 would be closed to leasing. This would completely negate the potential in Pitkin County for conflict between lease development activities and Pitkin County plans and interests. The potential for conflicts with Mesa, Garfield, and Rio Blanco county land use plans and zoning within Zones 1, 2, and 4 would be the same as under Alternative 3. Site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in additional county mineral development plans, if in place.

Other Special Uses

Under Alternative 4, there would be no effect from visual impacts or haul road fugitive dust and noise to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine as leases closest to these areas would be cancelled. Lease cancellation within substantial portions of Zone 3 would result in no lease development traffic along adjacent haul roads such as Coal Creek Road and Thompson Creek Road.

4.11.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations in the analysis area because all leases would be cancelled. Existing wells, wellpads, roads, and pipelines would be removed and reclaimed, which would result in future returns to the land uses that existed before oil and gas development and the limitation on future development.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, ground-disturbing activities would take place to plug and abandon 75 existing wells and decommission roads, well pads, and other ancillary facilities, such as tanks and burners. It is projected that approximately 86 acres of surface disturbance on previously disturbed land would occur from these actions, with the majority taking place in Zone 2. This disturbance would result in short-term disturbances to existing land uses but would not preclude future lands and special uses authorizations. These lands would be available for land uses other than fluid mineral extraction.

Any visual impacts or haul road fugitive dust and noise to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine from reclamation activities and traffic would be temporary. Lease cancellation in all lease zones also would negate the potential conflicts with Mesa, Garfield, Pitkin, and Rio Blanco county land use plans and zoning. Decommissioning of existing facilities and subsequent reclamation of the land would return the land to a state that could be more complementary with land use plans and zoning.

4.11.4.6 Summary of Impacts

In summary, when compared to Alternative 1, Alternatives 3 and 4 contain the most stipulations, which would limit where and when lands and special uses authorizations may be modified or issued and how

land uses would change. Land use impacts could result from potential lease development conflicts with both nearby easements and reclamation areas as well as county plans and zoning.

The potential for impacts to Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine would be the greatest under Alternative 1 due to the greatest amount of proposed development and least amount of stipulations precluding surface disturbance. As compared to Alternative 1, Alternative 5 would have the least amount of impact, followed by Alternatives 4, 3, and 2, in that order.

Potential conflicts with county zoning would potentially be greatest under Alternative 1, as this alternative contains the lease amount of acreage under NSO, which would preclude surface disturbance and lessen potential non-conformance with county plans and zoning. As compared to Alternative 1, Alternative 5 would have the least amount of impact, followed by Alternatives 4, 3, and 2, in that order.

4.11.5 Cumulative Impacts

4.11.5.1 Cumulative Impacts Analysis Area

The Cumulative Impacts Analysis Area would be the same as the analysis area described in Section 4.11.1.1 (80,380 acres).

4.11.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines. Impacts lands and special uses authorizations from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the CIAA. There are no RFFAs which would result in surface-disturbing activities within the CIAA for lands and special uses. There are approximately 6,000 acres of vegetation treatment and hazardous fuels projects with countervailing impacts to lands and special uses within the lands and special uses CIAA. This is 7 percent of the CIAA. These projects, such as South Rifle Habitat Enhancement Project and the East Sopris Fuels Reduction Project, would reduce hazardous fuels that could threaten existing or proposed land uses.

4.11.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

The Proposed Action and alternatives would contribute between 0 (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long-term surface-disturbing activities within the CIAA. If selected, Alternative 5 would eliminate surface disturbance and traffic that could affect existing or proposed land uses.

4.12 Special Designations

4.12.1 Analysis Assumptions and Approach to Analysis

4.12.1.1 Analysis Area

The analysis area for special designations consists of any special designation area intersecting the 65 leases or any off-lease area that might be used for accessing the leases.

4.12.1.2 Scoping Issues

During the public scoping process, the following issues and concerns related to Special Designations were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required. The text in parentheses following some of the scoping issues provides a rationale for those that could not be addressed in this EIS.

- Impacts to the resource values contained in RNAs or potential RNAs.
- Compliance with the 2001/2012 Roadless Rule as some leases were issued after the rule was established.
- The Colorado Roadless Rule (CRR) does not prohibit oil and gas development, and exempts leases sold before July 2012.
- Impacts to the scenic values of SH-133/West Elk Loop, a Designated Scenic and Historic Byway.
- Impacts to wilderness qualities and undisturbed/unfragmented habitat within designated roadless areas (Baldy Mountain inventoried roadless area (IRA); Clear Fork IRA; East Divide/Four Mile Park IRA; East Willow IRA; Housetop Mountain IRA; Huntsman Ridge IRA; Mamm Peak IRA; and Thompson Creek IRA). (These IRAs were designated prior to the Colorado Roadless Rule, which takes precedence. These IRAs were therefore not addressed in the analysis because they no longer apply to Forest Service management.)
- Impacts to segments of Thompson Creek and Crystal River that are eligible for Wild and Scenic River Designations. (As noted in Section 3.12.3.5, there are no Wild and Scenic Rivers or eligible sections within the Analysis Area, as the nearest eligible section is located at a distance of 1.2 miles. Impacts to Wild and Scenic River values would be determined during site-specific NEPA analysis.)

4.12.1.3 Assumptions

The following assumptions were used to facilitate the special designations analysis:

- Additional environmental analysis would occur for future site-specific exploration and development of oil and gas resources.
- Site-specific NEPA for future development on adjacent BLM lands would be analyzed at the APD stage once locations are known.
- Operators would comply with applicable laws and regulations.
- The analysis assumes that the leasing decision would be followed by future oil and gas development per the RFD scenario.

- Application of the 2001 Roadless Rule and its exceptions for surface disturbing activities is unsettled. To provide a conservative bases for assess impacts of Alternatives 1 and 2, this analysis assumes that surface disturbing activities will be allowed.

4.12.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to special designations across the range of alternatives include the following:

- Acres of projected surface disturbance from oil and gas development in special designation areas.
- Acres of areas special designation areas protected/not protected by lease stipulations.

4.12.1.5 Methods of Analysis

The method of analysis for Special Designations includes quantifying the extent overall acreage may potentially be impacted, identifying conflicts with land use plans or regulations, referencing potential impacts or conflicts with other areas (grazing, recreation, etc.), and quantifying the potential opportunity lost to manage to protect those values for which they were designated.

4.12.2 Stipulations Providing Coverage to Special Designations

Leased lands with NSO stipulations means infrastructure for oil and gas production associated with a leased parcel (well pads, buildings, tanks, and drilling equipment) must be placed outside of the areas restricted by this stipulation. NSO equates to no ground disturbance for those activities within the stipulation boundaries of that particular lease. The NSO stipulations apply only to those activities authorized under the surface use plan. Access roads and pipelines are not always authorized under a surface use plan so the locations may be granted under special use authorizations or road use permits subject to Forest Plan standards and guidelines. Access roads could not be constructed in designated roadless areas for new leases issued after the promulgation of the CRR. The CRR does not preclude development on existing leases, as is detailed in Section 3.12.2.3. NSO stipulations, in some cases, would serve to preserve current land uses and maintain the integrity of special designations.

CSU stipulations would assist in maintaining the natural setting and the integrity of special designations. CSU stipulations also serve as a moderate constraint to maintain natural resource values.

TL stipulations would assist in focused limitations for certain seasonal activities, such as hunting. This would be considered a moderate constraint that limits the time of year when development could occur.

4.12.3 Impacts Common to All Alternatives

Stipulations vary for Colorado Roadless Areas (CRAs) and the Lower Battlement Mesa RNA under each alternative. Of the lands that have a NSO stipulation associated with them, no surface effects would occur. Lands that do not have a NSO stipulation may experience some surface disturbance.

Impacts from oil and gas development would be more pronounced during construction, especially if the disturbance would occur in the interior of a CRA. CRAs where development would occur could experience a higher potential for fragmentation of plant and animal communities and habitat, and subsequent lessening of diversity, compared to those areas where mineral development would not occur. Natural appearing landscapes within CRAs and RNAs would have the potential to be compromised where development occurs, as roads, pipelines, and well pads all require vegetation manipulation with long-term impacts. If a lease is developed and roads are constructed in a CRA, the integrity of the CRA may be compromised and potentially lead to the loss of a CRA and its availability for future consideration for recommended wilderness, depending on the density of development. The

density of development is expected to be the greatest within Zone 2 with the potential development of 46 well pads. Well pad construction within the remaining zones would be substantially lower, ranging from two to seven pads depending on the zone. Activity and roads associated with lease development could produce added noise and distraction, further affecting roadless characteristics of CRAs and the naturalness of RNAs.

Impacts Identified in the WRNF Final EIS

Impacts that were identified for special designations in the WRNF Final EIS include the potential effects of future oil and gas development and operations on CRAs and RNAs. Impacts under alternatives where leases are allowed to continue under lease terms would result from increased well development that may affect roadless and natural characteristics (USFS 2014a, p. 360 – 361, 348 – 349). Alternatives where leases become available for lease with new, more restrictive, stipulations would experience greater coverage for CRAs and RNAs and would result in fewer impacts to roadless and natural characteristics (USFS 2014a, p. 360 – 361, 348 – 349).

4.12.4 Impacts by Alternative

Impacts by alternative for special designations were determined by considering where special designations may be covered by stipulations that were developed specifically for protection of the resource. The analysis takes into account the types of stipulations that were developed to cover other resources that also may minimize adverse impacts to special designations.

Tables 4.12-1 and **4.12-2** show acres of stipulations by RNA and CRA, respectively. Analysis of potential impacts to the Lower Battlement RNA as well as CRAs is presented below by alternative. The Lower Battlement RNA only occurs within Zone 1.

Table 4.12-1 Stipulations Overlapping the Lower Battlement RNA by Alternative in Zone 1

Stipulation Type	Alternative 1 (% of analysis area)	Alternative 2 (% of RNA in Leases)	Alternative 3 (% of RNA in Leases)	Alternative 4 (% of RNA in Leases)
Zone 1				
NSO	100	100	100	100
CSU	0	0	100	100
TL	1	1	52	52
SLT	0	0	0	0

Table 4.12-2 Stipulations Overlapping CRAs by Alternative in Zones 1 to 4

Stipulation Type	Alternative 1 (% of CRAs intersecting Leases)	Alternative 2 (% of CRAs intersecting Leases)	Alternative 3 (% of CRAs intersecting Leases)	Alternative 4 (% of CRAs intersecting Leases)
Zone 1				
NSO	100	100	100	100
CSU	0	0	100	100
TL	0	0	37	37
SLT	0	0	0	0

Table 4.12-2 Stipulations Overlapping CRAs by Alternative in Zones 1 to 4

Stipulation Type	Alternative 1 (% of CRAs intersecting Leases)	Alternative 2 (% of CRAs intersecting Leases)	Alternative 3 (% of CRAs intersecting Leases)	Alternative 4 (% of CRAs intersecting Leases)
Zone 2				
NSO	49	49	100	100
CSU	1	1	100	100
TL	42	42	88	88
SLT	15	15	0	0
Zone 3				
NSO	5	6	56	35
CSU	3	5	56	35
TL	15	19	39	27
SLT	79	75	0	0
CTL	0	0	0	65
Zone 4 (There are no CRAs within Zone 4)				
NSO	0	0	0	0
CSU	0	0	0	0
TL	0	0	0	0
SLT	0	0	0	0

4.12.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

As detailed in **Table 4.12-1** under Alternative 1, all of the lands leased in the Lower Battlement RNA are protected with a NSO stipulation. The majority of NSO stipulations pertain to slopes greater than 60 percent and bighorn sheep habitat. There is potential for development to occur where there is no NSO stipulation within the RNA. Because there is no resource-specific NSO stipulation designed to protect the RNA, it is possible that development could occur should the operator obtain an exception, waiver, or modification to the lease stipulation.

Under Alternative 1, leases within the CRAs would be developed under the existing terms and stipulations of the lease. Without any resource-specific NSO or CSU stipulations designed to cover roadless areas, the CRAs may be affected by future development, although leases issued after July 2012 would follow CRR and therefore development would be restricted.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 60 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance.

Stipulations for CRAs within Zones 1 through 4 are shown in **Table 4.12-2**. Depending on the density, oil and gas development within or adjacent to a CRA could lead to compromising the characteristics that for which the roadless area was designated. Depending on the extent and location of future oil and gas

development, portions of the RNA, including areas of the RNA adjacent to the leasing zone, could be compromised, altering the characteristics for which the RNA was set aside. Additionally, development within an RNA could compromise the characteristics for which it was designated. However, it should be noted that the projected future density of oil and gas development is low, so adverse effects to these Special Designations may be dispersed and minor.

SH-133/West Elk Loop, a Designated Scenic Byway, would be located nearly 3 miles east of the closest lease. Some of the portions closest to SH-133 would be covered by NSO stipulations and, in general, the leases closest to the scenic byway would be located on the opposite sides of ridgelines.

4.12.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting RNAs and CRAs under Alternative 2 are essentially the same as Alternative 1 despite the minor additional stipulations in 8 leases, as displayed in **Tables 4.12-1** and **4.12-2**.

Impacts from Projected Future Oil and Gas Development

Impacts on Special Designations from projected future oil and gas development would be the same under Alternative 2 as under Alternative 1.

4.12.4.3 Alternative 3

Stipulation Coverage

Stipulations affecting RNAs and CRAs under Alternative 3, as compared to Alternatives 1 and 2, may serve to better maintain the integrity of special designations. Under this alternative, a NSO would be applied to all RNA and CRA acreage, affording the maximum amount of coverage through stipulations. Access roads could not be constructed in designated roadless areas for leases issued after the CRR. The NSO would preclude development on leases during exploration and development. It is important to note that the NSO stipulations apply only to those activities within the leases, and access road construction off the leases may occur under special use authorizations or road use permits.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, approximately 413 wells would potentially be developed resulting in 886 acres of initial disturbance and 384 acres of long-term disturbance. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance.

As shown in **Tables 4.12-1** and **4.12-2**, there would be a NSO stipulation for all RNA and CRA acreage, minimizing adverse impacts to RNA natural characteristics and CRA roadless characteristics. Ground disturbance would be minimized to RNAs and CRAs within their respective boundaries, but some ground disturbance may occur through activities authorized under special use authorizations or road use permits. Drilling would be off-site, outside of RNAs and CRAs. Some development could occur along the boundaries and directional drilling could occur under the RNA and roadless area, but the RNAs and CRAs and their respective characteristics would be maintained as there would be no development within them. Where exterior boundary development could potentially occur along RNAs and roadless areas, edge effect may occur in these instances where noise and traffic would be associated with this type of development. Impacts to the SH-133/West Elk Loop Designated Scenic Byway would be similar to Alternatives 1 and 2.

4.12.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Stipulations affecting CRAs and RNAs under Alternative 4 may serve to preserve current land uses and maintain the integrity of special designations. Stipulations under Alternative 4 would be similar to those under Alternative 3, except where leases would be designated as CTL and cancelled within Zone 3. The lease cancellation would eliminate development within the CRAs in Zone 3.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, approximately 383 wells would potentially be developed resulting in 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of this disturbance would occur in Zone 2, followed by Zones 1, 3, and 4, in order from high to low disturbance area.

Impacts from future oil and gas development would be similar to Alternative 3 except in Zone 3 where some leases would be cancelled. As shown in **Tables 4.12-1** and **4.12-2**, there would be a NSO stipulation for all RNAs and CRAs, minimizing adverse impacts to RNA natural characteristics and CRA roadless characteristics. **Table 4.12-2** also shows the substantial increase in NSO and CTL acreage within Zone 3. Cancellation of Zone 3 leases would further remove the SH-133/West Elk Loop Designated Scenic Byway from closest lease.

4.12.4.5 Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled.

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, as all leases would be cancelled, ground-disturbing activities would take place to plug and abandon the existing wells and reclaim roads and other infrastructure. It is projected that approximately 86 acres of initial surface disturbance would occur from these actions, with the majority taking place in Zone 2. None of this disturbance would occur within the RNA or CRAs, or the SH-133/West Elk Loop Scenic Byway viewshed.

4.12.4.6 Summary of Impacts

In summary, the maximum net long-term disturbance due to oil and gas development across all alternatives, estimated based on the RFDS, would be less than 1 percent of the analysis area. Within the analysis area, the maximum potential adverse impacts to RNAs and CRAs would occur under Alternatives 1 and 2. Alternatives 3 and 4 would further increase stipulations offering enhanced levels of protection to RNAs and CRAs. Alternative 5 would produce fewer adverse impacts to Special Designations than all other alternatives existing wells would be plugged and abandoned, lease pads and access roads reclaimed, and future development would not occur. Impacts to the SH-133/West Elk Loop Designated Scenic Byway, would be similar under Alternatives 1 through 3, and greatly reduced under Alternatives 4 and 5.

4.12.5 Cumulative Impacts

4.12.5.1 Cumulative Impacts Analysis Area

The CIAA for special designations is the CRAs on the project leases in addition to the entire extent of RNA intersecting the 4 leases zones (64,864 acres).

4.12.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines as well as other developments. Impacts to special designations from past and present surface-disturbing activities are similar to those described in Section 4.12.3. There are 4 acres of quantifiable disturbance within the special designations CIAA. These actions also would contribute to increased levels of traffic on the local and regional road network.

There are no reasonably foreseeable future actions which would result in surface-disturbing activities within the CIAA for special designations. Approximately 3,000 acres within the special designations CIAA area would be a part of the South Rifle Habitat Enhancement Project. This would result in beneficial impacts to special designations within the CIAA as habitat improvements would foster a more natural setting.

4.12.5.3 Contribution of Proposed Acton and Alternatives to Cumulative Impacts

Aside from the RFDS analyzed for the 65 leases in Zones 1 through 4, there are no reasonably foreseeable future actions pertaining to oil and gas activities within the special designation CIAA.

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance within the leases. This is less than 1 percent of the 64,864 acre-CIAA but comprises most of the cumulative long-term surface disturbance within the CIAA.

As previously noted, the South Rifle Habitat Enhancement Project is projected to occur on 3,000 acres (5 percent) of the CIAA. If selected, Alternative 5 also would remove 75 existing wells within the leases (affecting less than 1 percent of the CIAA).These projects would have countervailing affects to special designations by retuning the area in and around special designations to a more natural setting.

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4.13 Recreation

4.13.1 Analysis Assumptions and Approach to Analysis

4.13.1.1 Analysis Area

The analysis area encompasses the WRNF and a small portion of the GMUGNF with an emphasis on the four lease zones (see **Figure 1-1**). The majority of the recreation that occurs within the lease zones is dispersed recreation, consisting mostly but not exclusively of hunting and hiking.

4.13.1.2 Scoping Issues

The NEPA scoping process revealed an array of the public's concerns with impacts to recreation. Relevant issues and concerns raised during scoping are detailed below:

- Effects to hunting, angling, and other recreational uses in the areas being analyzed, specifically, the sustainability of hunting and fishing opportunities.
- Downstream water uses, including the fishery on the Crystal River and the Gold Medal fishery on the Roaring Fork River.
- Potential effects to the number of recreationists that historically use all allowed or permitted areas.
- Effects of sound associated with potential oil and gas development on areas managed for quiet recreation and wildlife.

While many of the above issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. All issues listed above would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required. Impacts to downstream water uses are discussed in Section 4.8, Aquatics. Impacts from noise also are discussed in Section 1.16, Human Health and Safety.

4.13.1.3 Assumptions

The following assumptions were used to facilitate the recreation analysis:

- Leasing is a commitment of the resource for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions in support of the exploration or development of a lease. As a result of leasing, future exploration and development proposals could be brought forward that would be subject to additional site-specific environmental study and permitting requirements.
- Developed and on-the-ground recreation resources would be preserved on lands with NSO stipulations regardless of resource emphasis. Therefore, analysis and all subsequent tables in this section display the total of all NSO stipulations regardless of resource emphasis. CSU stipulations are identified to preserve recreation resources and serve as a moderate constraint to preserve those values if they are resource-specific stipulations. TL stipulations are generally not considered to provide direct benefit to recreational resources, but may result in a more natural setting and also may preserve the viability of big game herds or fish populations utilized in recreation activities.
- The standards for the Forest Plan Management Areas 1.31, 1.32, 3.31, 3.32, 4.3, and 4.32 would be met when approving future site-specific development proposals.

- Future increases in population in surrounding communities will increase the demand for recreation on NFS lands.
- Changes to recreation settings could occur from potential exploration, development, production, and reclamation activities in areas without NSO stipulations.
- In site-specific areas, there is potential for adverse effects to some Recreation Opportunity Spectrum (ROS) class objectives because those objectives may not be retained over the short or long term. This could result in an overall reduction in acres in the more primitive end of the spectrum and an increase of acres in the more developed end of the ROS.
- Operators would comply with applicable laws and regulations.
- The analysis assumes implementation of projected future oil and gas development based on scaling the RFDS to account for proposed lease stipulations under each alternative.

4.13.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to recreation resources across the range of alternatives include the following:

- Acres of surface disturbance, based on the RFDS, within each Management Area, by alternative and by lease.
- Acres of surface disturbance, based on the RFDS, within existing recreation opportunities as defined by winter and summer ROS Class objectives by alternative and by lease.
- Percent of Management Area and winter and summer ROS Class objectives under NSO by alternative and zone.

4.13.1.5 Methods of Analysis

Analysis focuses on the potential for future development of oil and gas leases to change the quantity and quality of recreation settings and opportunities. The analysis is done by analyzing the acres of existing recreation opportunities that may be affected and potential impacts to dispersed and developed recreation resources. The analysis also includes a qualitative discussion of potential impacts to dispersed and developed recreation resources and recreation special uses.

4.13.2 Stipulations Covering Recreation Resources

The rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS. The definition and purpose of the stipulations is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS (USFS 2014a) and in Appendix B of the 1993 Final EIS (USFS 1993). Within the WRNF forest, there are four NSOs, one CSU, and one TL stipulation specific to recreation resources, but only three apply within the analysis area:

- NSO – Authorized Sites and Facilities – 0.25 mile and CSU Authorized Sites and Facilities – 0.5 mile: All alternatives
- NSO – Summer Non-motorized Recreation: Alternatives 3 and 4 only
- TL – Snowmobile Corridor: Alternatives 1 and 2. Under Alternatives 3 and 4, this is revised to a CSU for Designated Winter Groomed Routes under Special Use Permit

NSO stipulations would preclude surface disturbance in the area in which they are applied, thus preserving the recreation experience, scenic integrity, safety of forest users, and the natural environment that initially made the area desirable for recreational use. CSU stipulations assist in preserving the recreational experience by requiring special design, construction, operation, mitigation, reclamation

measures, and monitoring. CSUs also allow the relocation surface-disturbing activities beyond 200 meters (656 feet) to preserve recreation values. TL stipulations provide focused coverage only during the time of year when recreational activities occur.

There are other resource-related stipulations that would minimize the potential impacts of oil and gas development on areas with high recreation value, even though they were not developed for that purpose. Resources closely correlated with recreation include, but are not limited to, the following:

- Big Game Habitat (NSO, CSU, and TLs under all alternatives but revised under Alternatives 3 and 4 to include additional habitat);
- Roadless Areas (NSO under all Alternatives, but revised under Alternatives 3 and 4 to address the 2012 CRR);
- RNAs (NSO under all alternatives but revised under Alternatives 3 and 4 to include the Lower Battlement Mesa RNA, which is in Lease Zone 1); and
- Sensitive Level 1 Travel Routes (CSU under Alternatives 1 and 2 and revised to CSU – High Concern Travel Ways or Use Areas under Alternatives 3 and 4).

There are additional NSOs that could overlay areas of high recreation value. However, if the resources these stipulations are designed to address are not found to occur on the leases, the stipulations would not be implemented.

4.13.3 Impacts Common to All Alternatives

4.13.3.1 Impacts Summarized in the WRNF Final EIS

Impact issues that were identified for recreation resources in the WRNF Final EIS include the potential effects of future oil and gas development and operations on the recreation settings, quality of visitor's experiences, and the quantity of recreation opportunities (WRNF Final EIS 2014, p. 292). The EIS also recognizes that changes related to the related intrinsic values to adjacent communities would be dependent on the level of development. Although opportunities to pursue a variety of recreation activities would remain, in some site-specific locations the quality and quantity of the recreation opportunities would likely change or diminish proportionately to the level of oil and gas development (WRNF Final EIS 2014, p 292). Types of recreation opportunities also could change, as post-leasing activities and physical disturbances could impair recreational experiences and adjacent community's sense of place (WRNF Final EIS 2014, p. 292-293). Furthermore, future oil and gas development may impair desired recreational conditions within forest management areas, as well as create long-term negative effects in terms of compatibility with Semi-primitive Non-motorized (SPNM) and Semi-primitive Motorized (SPM) ROS classes (WRNF Final EIS 2014, p 293). These impacts are described in further detail below.

4.13.3.2 Impacts to the Recreational Experience

Changes may result to recreational setting and quality of recreation experiences due to post-lease oil and gas development including construction, drilling, completion operations, and reclamation. The level of change to recreation settings, quality of visitor's experiences, quantity of recreation opportunities, and the related intrinsic values to adjacent communities would be dependent on the level of development in each zone. Stipulations, mitigation measures, conditions of approval, and best management practices developed during site-specific NEPA analysis and APD processing set the conditions under which the RFDS or connected actions may occur on lands available for lease.

Opportunities to pursue a variety of recreation activities across most of the leasing areas would remain after development occurs. However, in some site-specific locations, the quality and quantity of developed and dispersed recreation opportunities would likely change or diminish proportionately to the level of oil and gas development. This could result in shifts in patterns of recreational use as the type of recreation

opportunities sought by recreationists are affected by development activities, such as traffic, lights, and noise, causing recreational opportunities to be sought elsewhere during the most intensive stages of post-leasing oil and gas development. Post-leasing activities and physical disturbance within the landscape could impair visitor's recreational experiences and the adjacent community's sense of place.

For lands that are subsequently developed, adverse impacts to recreation resources would be greatest during the initial construction phases when vehicle traffic, human activity, and noise are the greatest. Adverse impacts may result from changes to the existing landscapes through introduction of new industrial features such as access roads, well pads, facilities, pipelines, and utility corridors. Associated impacts from initial disturbances could include noise, lights, dust, smell, construction equipment, and construction traffic. Changes in traffic volume during construction could negatively affect recreational users' experiences. These adverse impacts also would potentially affect lands adjacent to leasing areas, not to just the leasing areas themselves.

Changes to the recreational setting could occur during the operations and reclamation stages. Long-term impacts include landscape modifications such as well pads, roads, pipelines, power lines, and facilities. Routine maintenance activities could have the potential to adversely impact visitor experiences, although activity would be less and of shorter duration during this stage.

4.13.3.3 Impacts to ROS Class Characteristics

Mineral development activities in ROS classes SPNM and SPM could create long-term adverse effects in terms of compatibility with existing recreation activities, physical and social settings and the quality of the visitor experiences. In ROS classes that do not have stipulations precluding or limiting disturbance, post-leasing development could cause minor, short-term impacts during drilling and completion operations to long-term impacts to the recreational experience when wells are put into production. Impacts to the quality of recreational experiences would likely be negligible to minor within the leasing areas that have already been modified by surface disturbance and associated visual impacts and noise.

4.13.3.4 Impacts to Dispersed Recreation and Developed Recreation Sites

The values of developed recreation sites and facilities would be preserved through the application of stipulations across all alternatives or site-specific mitigation at the time of development. Opportunities to pursue a variety of dispersed recreation activities (e.g., trail-based motorized and non-motorized activities), would remain. However, the extent and quality of those dispersed recreation opportunities would likely change or diminish proportionately to the extent of active oil and gas development activities across all alternatives.

4.13.4 Impacts by Alternative

Impacts by alternative for the recreation resource were determined by considering where recreational uses may be preserved by stipulations that exist specifically for the resource. The analysis then takes into account stipulations that were developed to address a wide range of resources and may, by default, afford coverage to recreational uses.

Table 4.13-1 shows the percent of NSO stipulations within management areas with a recreational emphasis. There are no management areas with a recreational emphasis in Zones 1 and 4. Analysis of potential impacts to management areas as well other aspects of recreation are presented below by alternative.

Table 4.13-1 Percent of NSO Stipulations by Management Area

Management Area	Management Area Name	Stipulations	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Zone 2						
3.31	Backcountry year-round motorized	% of Management Area with NSO	36	36	93	93
3.32	Backcountry non-motorized with winter motorized	% of Management Area with NSO	100	100	100	100
Zone 3						
4.3	Dispersed Recreation	% of Management Area with NSO	0	0	83	0
		% of Management Area CTL	NA	NA	NA	100

4.13.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Under Alternative 1, NSO stipulations developed to address other resources would preclude surface disturbance in areas of high recreational value should they be implemented. These include NSO stipulations for roadless areas, bighorn sheep habitat, and slopes greater than 60 percent. The entirety of Zone 1 would be under NSO stipulations. Zone 2 would offer the second highest amount of acreage under NSO, followed by Zones 3 and 4. As shown in **Table 4.13-1**, within Management Area 3.31 (Backcountry-Year-round Motorized), 64 percent would be without NSO stipulations, which could affect the desired condition of the WRNF of maintaining a natural appearing landscape (USFS 2002). Within Management Area 3.32 (Backcountry Non-Motorized with Winter Motorized), 100 percent within Zone 2 would be under NSO stipulation. No acreage in Zone 3 for Management Area 4.3 (Dispersed Recreation) would be under a NSO stipulation.

A resource-specific NSO for Authorized Sites and Facilities would be applied to 108 acres in Zone 1. Within Zone 2, the portion of the leases closest to the Beaver Creek trailhead would be largely surrounded by SLT; the areas closest to Cayton trailhead would be NSO. Within Zone 3, a TL would be applied to 2 miles of Snowmobile Corridors, which would eliminate oil and gas development activity in designated corridors between December and April 1. A CSU stipulation for Sensitive Level 1 Travel Routes would constrain development near 97 miles of travel routes in Zone 2 and 3,360 miles in Zone 3. In all zones, TL stipulations would be in place to preclude surface disturbance in some portions of big game winter range from December 1 to April 14, which also would facilitate a more natural setting for winter recreational activities such as snowshoeing; however, this stipulation does not apply to operations and maintenance of production facilities.

Table 4.13-2 details stipulations by ROS classification for Zones 1 through 4 to show what ROS classifications may be covered and where there are areas used for recreation that could potentially be impacted because they would not be covered by stipulations. There could be potential adverse effects to SPNM and SPM ROS Class objectives because those objectives may not be retained over the short or long term due to the availability of these areas for surface-disturbing activities. Section 4.13 contains a description of ROS objectives. The greatest potential for adverse impacts from development would occur within the Summer ROS classification SPNM, where there is the greatest amount of acreage available for development without NSO stipulations. For winter ROS, the highest potential effects would be within

the SPNM classification where there is the greatest amount of acreage available for development without NSO stipulations.

Table 4.13-2 Stipulations by ROS Classification for Zones 1 to 4, Alternative 1

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
Zone 1 Summer ROS						
NSO	NA	NA	100	NA	100	NA
CSU	NA	NA	0	NA	0	NA
TL	NA	NA	0	NA	<1	NA
Zone 1 Winter ROS						
NSO	NA	NA	100	0	100	NA
CSU	NA	NA	0	0	0	NA
TL	NA	NA	0	0	<1	NA
Zone 2 Summer ROS						
NSO	NA	NA	1	34	50	0
CSU	NA	NA	21	11	0	0
TL	NA	NA	9	43	52	0
Zone 2 Winter ROS						
NSO	NA	NA	3	20	49	0
CSU	NA	NA	97	4	1	0
TL	NA	NA	43	45	54	0
Zone 3 Summer ROS						
NSO	NA	40	0	1	14	0
CSU	NA	10	3	7	2	0
TL	NA	10	6	14	23	0
Zone 3 Winter ROS						
NSO	NA	40	NA	0	0	0
CSU	NA	10	NA	5	0	0
TL	NA	10	NA	28	0	0
Zone 4 Summer ROS						
NSO	NA	NA	0	5	0	NA
CSU	NA	NA	0	0	0	NA
TL	NA	NA	0	57	26	NA
Zone 4 Winter ROS						
NSO	NA	NA	NA	3	0	NA
CSU	NA	NA	NA	0	0	NA
TL	NA	NA	NA	79	26	NA

Zone acreage is as follows: Zone 1: 10,114; Zone 2: 24,938; Zone 3: 42,767; Zone 4: 2,562.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this proposed disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area.

Under Zone 1, all surface disturbances would be precluded, thus preserving the values of the Summer and Winter Roaded Natural and SPNM ROS classes present in the Zone. Within Zone 2, 34 percent of Summer SPM and 50 percent Summer SPNM ROS classes, respectively, would be covered by NSOs; the NSO coverage of Winter ROS classes would be similar. Zones 3 and 4 would have little no coverage afforded to ROS winter or summer classes by NSO stipulations. Hunters utilizing GMU 42 for both deer and elk would experience the most disruption to hunting activities as the majority of Zones 1 and 2, as well as a portion of Zone 3 are within GMU 42. GMU 43 also overlaps a sizable portion of Zone 3 and would experience disruption as well to hunting activities. Hunters who have historically used these GMUs may choose to relocate to different GMUs during the most intensive phases of development, although hunters who relocate may return during the less intensive production and operation phase as development activity decreases. Developed trailhead recreation sites such as Babbish Gulch, Four Mile Complex, South Branch of Thompson Creek, Dexter Park, and Braderich Creek, and winter trailheads such as 2-Fourmile Complex, Marion Gulch, and Spring Gulch Nordic Ski Area are adjacent to Zone 3 and would potentially experience unnatural sound effects, dust, construction equipment traffic, and potential changes to the visual landscape. The Sunlight to Powderhorn snowmobile trail also would potentially experience these same impacts to the recreational setting. Zone 2 is the only zone that contains developed recreation sites, which consists of the Beaver Creek and Cayton trailheads; the portion of the leases closest to the Beaver Creek trailhead would be largely surrounded by SLT; the areas closest to Cayton trailhead would be NSO; however, nearby development and production activities could still result in recreationists relocating to a more natural setting. Similarly to hunters, historical users of both developed and undeveloped recreational resources, particularly within the Thompson Divide area, may choose to relocate recreational activities away from areas where lease development activities would result in unnatural sound effects, lights, dust, smell, construction equipment and traffic, as well as visual changes to the landscape. Some recreationists who relocate may return after the more extensive development phases are completed. The threat of spills and the subsequent potential for degradation of fishing opportunities is another potential recreation impact from lease development activities. Section 4.16 details the possibility of spills as well as potential measures to reduce spill risk.

These impacts would be lessened by development activities being spread along a 20-year timeframe, minimizing the chance of extensive lease development occurring concurrently.

4.13.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting recreational resources under Alternative 2 would the same as Alternative 1 with the exception of minor changes to eight leases in Zone 3. Types of stipulations are discussed in Section 4.13.2.

Table 4.13-1 details NSO coverage within management areas that have a recreational emphasis. Potential impacts under Alternative 2 would be the same as under Alternative 1, with the same amount of acreage under NSO stipulation for management areas within Zones 2 and 3. Changes to stipulations under Alternative 2 for Zone 3 Management Area 4.3 would include a slight reduction of CSU in regards to (0.2 acre) travel routes and the introduction of a TL for travel routes of 156 acres. All other stipulations for Management Area 4.3 in Zone 3 would remain the same. Ultimately, more coverage of recreation-related resources and activities would be afforded under Alternative 2.

Impacts to summer and winter ROS classifications from potential development would be similar under Alternative 2 as Alternative 1; with the exception that more acreage would be covered by NSO, CSU, and TLs under Alternative 2 in Zone 3. **Table 4.13-3** details Zone 3 stipulations coverage of the ROS classifications that could potentially be impacted. Stipulation in the other three zones would be the same as under Alternative 1.

Table 4.13-3 Stipulations by ROS Classification for Zone 3, Alternative 2

Stipulation Type	ROS Classifications					
	Urban (acres)	**Rural (acres)**	**Roaded Natural (acres)**	**SPM (acres)**	**SPNM (acres)**	**Primitive (acres)**
Zone 3 Summer ROS						
NSO	NA	40	3	3	16	0
CSU	NA	10	7	21	2	0
TL	NA	10	7	38	24	0
Zone 3 Winter ROS						
NSO	NA	40	NA	9	0	0
CSU	NA	10	NA	10	0	0
TL	NA	10	NA	33	0	0

Impacts from Projected Future Oil and Gas Development

Impacts from projected future oil and gas development would be the same under Alternative 2 as under Alternative 1, with the exception that stipulations within eight leases would be enhanced, offering an increased level of coverage to recreational resources in those eight leases.

4.13.4.3 Alternative 3

Stipulation Coverage

Table 4.13-1 details NSO coverage within management areas that have a recreational emphasis. Potential impacts under Alternative 3 would be less than under Alternative 1, as the majority of acreage within Management Area 3.31 (Zone 2) and Management Area 4.3 (Zone 3) would fall under NSO stipulations. NSO stipulations coverage within Management Area 3.32 (Zone 2) would remain the same.

Resource-specific NSO for Authorized Sites and Facilities would be applied to 125 acres in Zone 1, 2,823 acres in Zone 2 and 1,088 acres in Zone 3 and a CSU for Authorized Sites and Facilities would be applied to 406 acres, 6157 acres and 3,181 acres of Zones 1, 2, and 3, respectively. The NSO stipulation for Summer Non-motorized Recreation would be applied to 872 acres in Zone 2. Leases nearby the Beaver Creek and Cayton trailheads would be primarily NSO, thus preserving the values of developed recreation within the leasing zones. A CSU for Designated Winter Grooming would be applied to 3 miles of routes in Zone 2, 42 miles in Zone 3, and 4 miles in Zone 4. This stipulation would limit access on designated winter groomed routes to over-the-snow vehicles between mid-November and late May and would not allow plowing along these routes. Within Zone 3, a CSU stipulation for High Concern Travel Ways or Use Areas would be applied to 6,117 acres in Zone 2 and 18,943 acres in Zone 3 would constrain development near travel routes). In all zones, TL stipulations would be in place to preclude surface disturbance in some portions of big game winter range from December 1 to April 14, which also would facilitate a more natural setting for winter recreational activities such as snowshoeing during construction; however, this stipulation does not apply to operations and maintenance of production

facilities. Ultimately, more coverage for recreation-related resources and activities would be afforded under Alternative 3 than under Alternatives 1 or 2.

Table 4.13-4 details stipulations coverage by ROS classification for Zones 1 through 4. There could be potential adverse effects to SPNM and SPM ROS Class objectives. Impacts to summer and winter ROS classifications from potential development would be less under Alternative 3 than Alternative 1, as more acreage would be covered by NSO under Alternative 3, affording enhanced preservation of recreational resources and reducing impacts to ROS objectives.

Table 4.13-4 Stipulations by ROS Classification for Zones 1 to 4, Alternative 3

Stipulation Type	ROS Classifications					
	Urban (percent)	**Rural (percent)**	**Roaded Natural (percent)**	**SPM (percent)**	**SPNM (percent)**	**Primitive (percent)**
Zone 1 Summer ROS						
NSO	NA	NA	100	NA	100	0
CSU	NA	NA	100	NA	100	0
TL	NA	NA	00	NA	53	0
Zone 1 Winter ROS						
NSO	NA	NA	100	NA	100	0
CSU	NA	NA	100	NA	100	0
TL	NA	NA	00	NA	53	0
Zone 2 Summer ROS						
NSO	NA	NA	16	85	87	0
CSU	NA	NA	22	100	100	0
TL	NA	NA	10	87	92	0
Zone 2 Winter ROS						
NSO	NA	NA	75	96	84	0
CSU	NA	NA	100	100	100	0
TL	NA	NA	48	85	91	0
SLT	NA	NA	0	0	0	0
Zone 3 Summer ROS						
NSO	NA	30	9	94	88	0
CSU	NA	100	12	100	100	0
TL	NA	10	7	47	54	0
Zone 3 Winter ROS						
NSO	NA	30	NA	86	0	0
CSU	NA	100	NA	100	0	0
TL	NA	10	NA	59	0	0
Zone 4 Summer ROS						
NSO	NA	NA	0	88	57	NA
CSU	NA	NA	0	100	100	NA

Table 4.13-4 Stipulations by ROS Classification for Zones 1 to 4, Alternative 3

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
TL	NA	NA	0	100	100	NA
SLT	NA	NA	0	0	0	NA
Zone 4 Winter ROS						
NSO	NA	NA	NA	93	57	NA
CSU	NA	NA	NA	100	100	NA
TL	NA	NA	NA	100	100	NA

Note: Zone acreage is as follows: Zone 1: 10,114; Zone 2: 24,938; Zone 3: 42,767; Zone 4: 2,562.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, the potential exists for approximately 413 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 886 acres and long-term surface disturbance of 384 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area. Under Zone 1, all surface disturbances would be precluded, thus preserving the values of Summer and Winter SPNM ROS classes present in the zone. Within Zone 2, almost all Winter and Summer RN, SPM, and SPNM ROS classes would be covered by NSOs. Within Zone 3, almost all Winter and Summer SPM ROS class areas and Summer SPNM Class would be covered by NSO stipulations; Winter SPNM ROS class areas (which comprise about 125 acres) would not have NSO coverage. Within Zone 4, almost all Winter and Summer SPM, and over half of winter and summer SPNM ROS classes would be covered by NSOs.

Additionally, within Zone 3, specifically dispersed recreational activities such as hunting in GMU 42, use of the Sunlight to Powderhorn snowmobile trail, and adjacent summer and winter trailheads would experience less impact resulting from an increase in stipulations under Alternative 3 as well as a slight decrease in the number of anticipated wells and corresponding well pads.

4.13.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Table 4.13-1 details NSO stipulations within management areas that have a recreational emphasis. Potential impacts under Alternative 4 would be the same as Alternative 3 in Zones 1, 2, and 4. In Zone 3, 100 percent of Management Area 4.3 would be CTL. Ultimately, more coverage for recreation related resources and activities are afforded under Alternative 4 than Alternative 1.

Under Alternative 4, 29 miles of designated routes that are covered by a CSU for Designated Winter Grooming under Alternative 3 would be within the cancelled leases. The remaining 14 miles would continue to have the CSU stipulation applied to them. The 28,000 acres of leases that would be cancelled in Zone 3 also includes over half the areas previously covered by NSO and CSU stipulations for Authorized Sites and Facilities.

Table 4.13-5 details stipulations by ROS classification for Zone 3 in the form of stipulation acreage of the ROS classifications that could potentially be impacted. There could be potential adverse effects to SPNM and SPM ROS Class objectives. Impacts to summer and winter ROS classifications from potential development would be less under Alternative 4 as Alternative 1, as more acreage would be covered by

NSO and lease cancellations, affording enhanced coverage of recreational resources and reducing impacts to ROS objectives.

Table 4.13-5 Stipulations by ROS Classification for Zone 3, Alternative 4

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
Zone 3 Summer ROS						
NSO	NA	0	1	37	0	0
CSU	NA	0	1	39	0	0
TL	NA	0	1	24	0	0
CTL	NA	100	11	61	100	0
Zone 3 Winter ROS						
NSO	NA	0	NA	29	0	0
CSU	NA	0	NA	33	0	0
TL	NA	0	NA	26	0	0
CTL	NA	100	NA	67	0	0

Source: BLM 2014b.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, the potential exists for approximately 366 wells to be drilled from 55 well pads. These actions could potentially result in initial surface disturbance of 821 acres and long-term surface disturbance of 356 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area. Impacts would be the same as Alternative 3 in Zones 1, 2, and 4. Within Zone 3, lease cancellations would preclude development in about 30 percent of the summer SPM, 100 percent of Summer SPNM, and 67 percent of winter SPM ROS areas within the zone. With consideration of NSO stipulations and areas closed to leasing; surface disturbance would be precluded on 98 percent of Summer SPM and 100 percent of Summer SPNM areas (versus 94 and 86 percent under Alternative 3, respectively) and 95 percent of winter SPM (versus 86 percent under Alternative 3). As with Alternative 3, Winter SPNM ROS class areas (which comprise about 125 acres) would not be precluded from surface disturbance. Cancellation of leases in Zone 3 would result in a substantial reduction to potential recreation impacts specifically within the Thompson Divide area, as well as to hunters potentially utilizing GMU 43, and recreationists utilizing the Sunlight to Powderhorn snowmobile trail, and adjacent summer and winter trailheads. **Figure 2-13** shows areas that would be closed to leasing in Zone 3 under Alternative 4.

4.13.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, as all leases would be cancelled, ground-disturbing activities would take place to plug and abandon the existing wells and reclaim roads and other infrastructure. It is projected that approximately 86 acres of roads and well pads would be reclaimed, with the majority taking place in Zone 2. Approximately 10 acres of well pad and road

reclamation would occur in Zone 3. This disturbance would result in short-term impacts to recreational resources from noise, lights, dust, construction equipment, and construction traffic, ending when well pad and road reclamation activities are completed.

4.13.4.6 Summary of Impacts

In summary, within the analysis area the maximum net long-term disturbance in acres across Alternatives 1 through 4, estimate from the RFDS, is less than 0.8 percent of the detailed analysis area. Future surface-disturbing activities would occur under all alternatives and could affect or change the recreation setting as described by ROS classes depending on the density of site-specific locations and their duration. Under Alternatives 1 through 4 the potential for negative effects lies mostly within SPNM and SPM ROS Classes where characteristics of remoteness and naturalness would be vulnerable without stipulations precluding or limiting surface disturbance. Impacts to developed recreation areas and dispersed recreation could be mitigated through the application of NSO, CSU, and TL stipulations. Negative effects could be realized in some site-specific locations both short- and long-term.

The RFDS for Alternatives 1 and 2 could result in 892 acres of initial surface disturbance and 387 acres of long-term surface disturbance, bringing potential impacts to ROS Classifications, management areas with a recreational emphasis, and developed and dispersed recreation resources. Additional impacts resulting from noise, lights, dust, smell, construction equipment, and construction traffic associated with lease development could cause recreationists, particularly within the Thompson Divide area, to relocate to a more natural setting. These potential impacts would be lessened by the application of NSO, CSU, and TL stipulations, but given the amount of surface disturbance projected for each zone relative to the acreage of each ROS class that is not precluded from surface disturbance by NSO stipulations, the RFDS for Zones 2, 3, and 4 could be developed in any ROS class; in Zone 1, all surface disturbance would be fully precluded.

The RFDS for Alternative 3 would be almost the same (886 acres of initial surface disturbance and 384 acres of long-term surface disturbance); however, the potential for development would be minimized in most ROS Classes. Surface disturbance would be fully precluded in Zone 1 and NSO protections would generally be between 80 and 95 percent in all ROS classes in Zones 2, 3, and 4, reducing potential impacts to ROS Classifications, management areas with a recreational emphasis, and developed and dispersed recreation resources. A slightly less amount of acreage would be impacted within Zone 3, resulting in a corresponding reduction in recreation impacts when compared to Alternatives 1. Alternative 3 also would constrain development in and near authorized sites and facilities, summer non-motorized recreation areas, and designated winter groomed routes to a greater degree than Alternative 1.

The RFDS for Alternative 4 could result in 821 acres of initial surface disturbance and 356 acres of long-term surface disturbance In Zone 3, the combination of lease cancellations and NSO stipulations would decrease the acreage in which development would take place; the potential for development in all other zones would be the same as Alternative 3. This would result in substantially less impacts to recreational resources than under Alternative 1.

Alternative 5 would result in the least surface disturbance and the least impact to ROS classes, management areas with a recreational emphasis, and developed and dispersed recreation resources. This alternative would result in the least potential impacts to recreation resources than under any alternative.

4.13.5 Cumulative Impacts

4.13.5.1 Cumulative Impacts Analysis Area

The CIAA would be the same as the analysis area described in Section 4.13.1.1.

4.13.5.2 Past Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and present actions are broken into three surface-disturbing activities: fluid and solid mineral development, transportation corridors, and other development, such as ROWs for pipelines and telephone lines. Impacts to recreational resources from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the total leasing area.

Reasonably Foreseeable Future Actions

There are no reasonably foreseeable future actions which would result in surface-disturbing activities within the CIAA for recreation. Approximately 6,000 acres within the leasing area would be a part of the South Rifle Habitat Enhancement Project. This would result in beneficial impacts to recreation within the CIAA as habitat improvements would foster a more natural setting, conducive to the recreational environment.

4.13.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance. This is between 0 and 46 percent of the total cumulative long-term surface disturbance within the CIAA. With consideration of past and present actions, RFFAs, and alternatives, the total cumulative impact would affect less than 1 percent of the CIAA.

As previously noted, the South Rifle Habitat Enhancement Project would occur within the recreation CIAA, contributing to a more natural recreational setting. At 6,000 acres, this would occur on 7 percent of the recreation CIAA. If selected, Alternative 5 also would contribute to a more natural recreational setting by removing 75 existing wells within the leases.

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4.14 Livestock Grazing

4.14.1 Analysis Assumptions and Approach to Analysis

4.14.1.1 Analysis Area

The analysis area for livestock consists of the portion of the 19 grazing allotments overlapped by the 65 existing leases under evaluation within Zones 1 through 4 as described in Section 3.14 (see **Figure 3.14-1**).

4.14.1.2 Scoping Issues

Potential issues related to livestock grazing were identified during the project scoping meetings and will be analyzed quantitatively or qualitatively in this section. These issues include the following:

- Loss of forage due to an increase in roads, pipelines, and well pads;
- Compromised quality of forage vegetation due to the generation of fugitive dust emissions;
- Health concerns for livestock due to the generation of fugitive dust emissions;
- Loss of public land that can no longer support the same level of livestock grazing, compromising the viability of ranching operations;
- Increased establishment and spread of noxious weeds;
- Increased potential for trespass and illegal hunting;
- Increased calf-mother separation, and/or stress to calves from human presence and traffic resulting in lower weight gains and corresponding loss of income for livestock operators (loss of income is more fully discussed in Section 3.17, Socioeconomics);
- Increased difficulty in managing cattle due to roads, open gates, and damage to rangeland improvements;
- Livestock exposure to hydraulic fracturing fluids due to contaminated water; and
- Changes in perception of the public that local livestock is no longer grass-fed or free of chemicals, with resulting economics impacts to operations supplying high-end markets. (This issue is not analyzed in detail because it would be speculative to assume that there would be changes to the perception of the local beef industry in the absence of any incidents of livestock exposures).

4.14.1.3 Assumptions

The impact analysis assumes that operators will comply with existing laws and regulations. Additional assumptions include the following:

- Areas that receive reclamation would need a minimum of two years rest, or until the Forest Service decides that reclamation is successful, before they would be eligible for livestock grazing;
- Reclamation efforts would occur within one year of construction disturbance activities;
- Current allotment carrying capacities are appropriate and reflect the desired level for present and future livestock grazing;
- Short-term impacts are defined as less than 4 years;

- Despite variations in vegetation communities that exist within allotments, the impact analysis assumes uniform production for estimating reductions to forage from disturbance and an average of 12 acres per Animal Unit Month (AUM); and
- AUMs would be lost from short-term disturbances temporarily and from long-term disturbances permanently.

4.14.1.4 Impact Indicators used for Analysis

The indicator for quantitative impacts analysis to livestock grazing will be the short- and long-term loss of AUMs and potential reductions to permitted use for livestock operators.

4.14.1.5 Methods of Analysis

The impact analysis for livestock grazing is designed to address the nine scoping issues mentioned above to the degree possible. The methods for analyzing these impacts are as follows:

- Estimate acres of disturbance, associated loss of AUMs, and changes to permitted use resulting from short- and long-term surface disturbance within lease areas.
- Qualitatively discuss fugitive dust emissions resulting from anticipated construction activities, traffic, and associated health issues related to livestock.
- Qualitatively discuss the potential for invasion and spread of noxious weeds (invasive weeds are more fully discussed in Section 3.6, Vegetation).
- Analyze increased access to the analysis area based on estimated miles of new well pad access roads.
- Discuss potential for livestock to become exposed to chemicals related to oil and gas development. This topic also is discussed in Section 3.5, Water, and Section 3.16, Hazardous Materials and Human Health and Safety.

4.14.2 Stipulations Coverage Related to Livestock Grazing

There are no stipulations that apply specifically to livestock grazing or livestock grazing operations; however, any stipulations that overlap the lease area within a grazing allotment could restrict, modify, or preclude oil and gas development, resulting in a reduction or elimination of potential impacts to grazing allotments. Four categories of stipulations affect development within lease areas, but only NSO stipulations would reduce impacts to forage vegetation (see Section 1.1.5 for additional information regarding stipulations). CSUs can be used to impose constraints to specific activities, including the relocation of proposed facilities more than 200 meters from the originally proposed site in order to reduce impacts to designated resource values. The NSO stipulation is the most restrictive and precludes any surface-disturbing activity within the NSO boundary.

4.14.3 Impacts Common to All Alternatives

Impacts would vary by alternative, including those surface-disturbing activities that result in the short- or long-term removal of forage vegetation, changes to the permitted use within allotments, or change in access to water sources or other rangeland improvements. Many impacts may vary in quantity but would be common to all alternatives because they would result from similar operation, maintenance, or decommissioning and reclamation activities. In addition to the effects of surface disturbance resulting from reasonably foreseeable fluid mineral development, impacts common to all alternatives may include the following:

- Compromised quality of forage vegetation due to the generation of fugitive dust emissions;
- Potential health concerns for livestock due to the generation of fugitive dust emissions;

- Increased spread of noxious weeds;
- Increased potential for illegal hunting;
- Increased calf-mother separation, and/or stress to calves from human presence and traffic resulting in lower weight gains and corresponding loss of income; and
- Increased difficulty in managing cattle due to roads, open gates, and damage to rangeland improvements.

Any surface-disturbing activities and vehicular travel along unpaved roads have the potential to produce air-borne dust known as fugitive dust emissions. The deposition area would vary greatly depending on particle size and wind speed and direction. The degree and extent of effects would vary depending on wind, frequency of precipitation events, and the application and effectiveness of dust suppression techniques. It is reasonable to assume that vegetation occurring within the deposition area would receive dust settling on surface areas. Flat, horizontal, broad leaves would be affected more than thin vertical leaves or blades. This can affect plant health and vigor by impeding photosynthesis and proper growth and can adversely affect the palatability of forage vegetation. Although the affected vegetation would not be temporarily or permanently displaced, it would be less nutritious and desirable for livestock forage temporarily.

Fugitive dust emissions also have the potential to cause respiratory illness in cattle known as Bovine Respiratory Disease. This occurs when exposure to dust irritates the bronchial tubes and creates pneumonia type symptoms. Calves are more susceptible than older cattle. Livestock operators, especially those running cow/calf operations, may find it necessary to alter their grazing system to avoid exposing livestock to high volumes of dust.

Surface-disturbing activities as well as increased human presence have the potential to introduce or spread noxious or invasive plant species. Noxious weed species known to occur in the lease areas include knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), leafy spurge (*Euphorbia esula*), and tansy ragwort (*Senecio jacobaea*) (USFS 2011). The degree of impacts from the introduction or spread of noxious and invasive pant species ranges from providing competition to desirable forms of vegetation (sometimes to the extent of establishing large monoculture areas) to the toxic poisoning of livestock that graze upon them.

Under all but Alternative 5, access to the lease areas would require the construction of new roads so traffic volumes would increase from current conditions (see Section 4.10, Transportation). This could adversely impact livestock grazing operations in a few ways listed below that may result in a financial loss for livestock operators.

- The construction of new roads could result in damage to fences and gates, requiring the livestock operators to collect stray livestock.
- Additional roads may lead to accidental or intentional trespass and possibly even livestock theft.
- Increased traffic volumes would increase the potential for livestock/vehicle collisions and can result in calves being separated from their mothers or simply cause calves to become stressed resulting in reduced weight gain.

An average of 1 mile of road per well pad would be constructed. An estimated 5 miles of new roads would be constructed in Zone 1, 46 miles in Zone 2, 7 miles in Zone 3, and 1 mile in Zone 4. It is unlikely that road construction in Zones 1, 3, and 4 would have much of an effect on grazing allotments due to the relatively low mileage; however all of Zone 2 is overlapped by grazing allotments so all of the 46 miles of new roads would occur within allotments. Under Alternative 5 all roads would be reclaimed.

It also is possible that the construction of new roads could be a benefit to livestock operators, making access to the allotment and management activities more convenient. It is not uncommon for ranchers to request roads to be left unreclaimed on private property or for oil and gas developers to assist ranchers with constructing rangeland improvements through the use of their equipment.

Wherever oil and gas development occurs, there is the potential for accidents that result in the release of toxic substances that can range from relatively benign to highly toxic. Cases have been documented where contaminants (typically wastewater) have entered into water sources and exposed cattle developed health issues such as reproductive failure, trouble producing milk, and neurological damage. In a New Solutions article (Bamberger et al. 2012) several toxic releases related to oil and gas development were documented in detail. One case describes some livestock exposure to hydraulic fracturing fluid that resulted in the death of 17 cows in less than 1 hour. In another case, the liner of a wastewater impoundment failed and the wastewater flowed into a pasture and watering pond. Of the 140 cattle that were exposed to the wastewater 70 died and there was a high occurrence of stillborn calves and stunted growth. The 60 cattle kept on a separate pasture had no health issues.

4.14.4 Impacts by Alternative

The analysis of impacts by alternative will focus on assessing the acreage of lease/allotment overlap, surface-disturbing activities that could occur within the leases, and the area that potentially would be covered by NSO stipulations. None of the existing stipulations are designed to apply to livestock grazing, but would reduce impacts if they are implemented for other reasons if they limit surface disturbance in grazing allotments or move the locations of facilities away from productive forage. A stipulation could be waived if it is determined that the associated resource is not present, so the acreage of stipulations coverage could be reduced before development occurs, resulting in potentially higher impacts to grazing allotments. **Table 4.14-1** presents the acreage of overlapping lease areas and allotments and the percentage of the total allotment occupied by leases.

Table 4.14-1 Lease Area and Allotment Overlap per Zone

Zone	Allotment	Allotment/Lease Acreage of Overlap	% of Total Allotment	% of Total Zone
1	Wallace Creek C&H	48	<1	<1
2	Battlement Creek	500	10	100
	Beaver Creek C&H	795	17	
	Buzzard	476	4	
	Cache Creek C&H	4,998	48	
	Cheney Creek	180	4	
	Hunter C&H	2,753	46	
	Mamm Creek C&H	633	10	
	West Divide C&H[1]	14,540	26	

Table 4.14-1 Lease Area and Allotment Overlap per Zone

Zone	Allotment	Allotment/Lease Acreage of Overlap	% of Total Allotment	% of Total Zone
3	Coal Basin C&H	3,285	17	99
	East Divide C&H	5,500	29	
	Lake Ridge C&H	3,597	30	
	Muddy S&G	126	2	
	North Thompson/Four Mile C&H	19,059	51	
	Threemile C&H	923	21	
	West Divide C&H[1]	9,799	17	
4	Lantern Ridge S&G	2,561	29	100

[1] Total overlap for both Zones 2 and 3 equals 24,339 acres. This represents 43 percent of the total allotment acres.

C&H = Cattle and Horse Allotment; S&G = Sheep and Goat Allotment

4.14.4.1 Alternative 1 (No Action Alternative)

Under Alternative 1 the BLM would release the suspended leases and development would be allowed to occur according to the terms of the lease.

Stipulation Coverage

With the exception of the Threemile C&H allotment, all of the allotments that are overlapped by leases also are overlapped to some extent by NSO stipulations that could offer some form of reduction to impacts, as shown in **Table 4.14-2**. Areas covered by NSO stipulations account for approximately 19 percent of the allotment acreage within Zones 1 through 4. In the case where allotments are 100 percent covered by a NSO stipulation, oil and gas operators would have to horizontally drill to the targeted play from outside of the allotment boundary. NSO stipulations therefore do not guarantee that development will not occur within the associated allotments but surface development would be precluded in those areas, thus reducing impacts to forage vegetation.

Table 4.14-2 Alternative 1 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	135	27
	Beaver Creek C&H	795	381	48
	Buzzard	476	20	4
	Cache Creek C&H	4,998	4,903	98
	Cheney Creek	180	180	100
	Hunter C&H	2,753	1,670	61
	Mamm Creek C&H	633	633	100
	West Divide C&H[1]	14,540	1,884	13

Table 4.14-2 Alternative 1 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
3	Coal Basin C&H	3,285	809	25
	East Divide C&H	5,500	109	2
	Lake Ridge C&H	3,597	395	11
	Muddy S&G	126	14	11
	North Thompson/Four Mile C&H	19,059	1,620	9
	Threemile C&H	923	0	0
	West Divide C&H[1]	9,799	53	<1
4	Lantern Ridge S&G	2,561	65	3
	Total	**69,773**	**12,919**	**19**

[1] Total stipulations for both Zones 2 and 3 equal 2,918 acres. This accounts for 21 percent of the allotment/lease overlap area.

Impacts from Projected Future Oil and Gas Development

Surface disturbance for Alternative 1 would total 892 acres of short-term disturbance and 387 acres of long-term disturbance related to the construction, operation, and maintenance of well pads, access roads, and pipelines. **Table 4.14-3** shows the projected surface disturbance acreage per zone that would result from reasonably foreseeable oil and gas development under Alternative 1.

Table 4.14-3 Alternative 1 Surface Disturbance per Zone

		Short-term Disturbance (acres)	Long-term Disturbance (acres)
Zone 1	Well Pads	30	18
	Roads/Pipelines	46	15
	Total	76	33
Zone 2	Well Pads	273	160
	Roads/Pipelines	411	136
	Total	684	296
Zone 3	Well Pads	44	26
	Roads/Pipelines	67	22
	Total	111	48
Zone 4	Well Pads	9	5
	Roads/Pipelines	12	4
	Total	21	9
All Zones	**Total**	**892**	**387**

Less than 1 percent of Zone 1 is occupied by grazing allotments and of that, 100 percent of the allotment is overlapped by a NSO stipulation; therefore, it is unlikely that surface disturbance would have an impact on forage vegetation. However, if the total amount of disturbance were to occur within the allotment, it is estimated that there would be a loss of 6 AUMs due to short-term disturbance. As

development progresses, areas would be revegetated and only 3 AUMs would be lost to long-term disturbance. Zones 2 through 4 are 99 to 100 percent occupied by grazing allotments; therefore, it is reasonable to assume that surface disturbance will occur within allotments. The total amount of surface disturbance would equate to a loss of 57 AUMs for short-term disturbance and 25 AUMs for long-term disturbance in Zone 2, 9 and 5 AUMs for short- and long-term disturbance in Zone 3, respectively, and 2 and 1 AUMs for short- and long-term disturbance in Zone 4, respectively. Thirty-nine percent of Zone 2 is overlapped by NSO stipulations that may preclude development. It is possible that surface disturbance could occur off of the lease due to horizontal drilling. Zones 3 and 4 are 8 and 3 percent overlapped by NSO stipulations, respectively; therefore it is reasonable to assume that development could occur within allotments without being affected by stipulations. After consideration of all NSO stipulations, the potential for the invasion and spread of noxious weeds within allotments would be limited to Zones 2, 3, and 4 and would be most associated with 816 acres of initial disturbance within lease allotments covered by those zones.

4.14.4.2 Alternative 2

Under Alternative 2, the BLM would address inconsistencies between the 1993 WRNF ROD (USFS 1993a) and the lease stipulations by modifying the affected leases to include the stipulations as presented in the ROD.

Stipulation Coverage

Four allotments overlap with leases in Zone 3 that would be modified with additional acreage of stipulations. Approximately 3,302 additional acres of CSU, NSO, and TL stipulations would modify 8 existing leases as detailed in **Table 4.14-4**. These stipulations may translate to additional reduction to impacts for livestock and livestock grazing operations. The additional stipulation coverage would increase the total NSO coverage within allotments in Zone 3 to 8 percent; reducing the loss of AUMs by 43 and surface disturbance by 517 acres compared to the No Action Alternative.

Table 4.14-4 Alternative 2 Allotments with Additional NSO Stipulations

Zone	Allotment	Acreage of Lease Overlap	Additional Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
3	East Divide C&H	5,500	74	1
	North Thompson/Four Mile C&H	19,059	148	<1
	Threemile C&H	923	295	32

Impacts from Projected Future Oil and Gas Development

Surface disturbance associated with Alternative 2 would be the same as for Alternative 1 (see **Table 4.14-3**); however, an additional 517 acres of Zone 3 would be covered by NSO stipulations. This would increase the total area of the zone covered by stipulations to 8 percent and reduce the loss of AUMs by 43 compared to the No Action Alternative. It is likely that all RFDS development could still occur within allotments without being affected by stipulations; however it would reduce the overall area in which disturbance could occur, thereby restricting the spread of noxious weeds and dust.

4.14.4.3 Alternative 3

Under Alternative 3, the BLM would modify the 65 existing leases to conform to the stipulations identified for the Proposed Action in the 2014 WRNF Final EIS (USFS 2014a).

Stipulation Coverage

All of the allotment areas that are overlapped by lease areas in Zones 1 through 4 are 81 to 100 percent overlapped by NSO stipulations that could reduce impacts from surface disturbance. Overall, Zones 1 through 4 are 88 percent covered by NSO stipulations as detailed in **Table 4.14-5**. NSO stipulations may require oil and gas operators to horizontally drill to the targeted play from off the lease. This does not guarantee that development will not occur within the associated allotments, but surface development would be constrained to those areas that are not covered by NSO, thus reducing impacts to forage vegetation.

Table 4.14-5 Alternative 3 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	469	94
	Beaver Creek C&H	795	567	83
	Buzzard	476	466	98
	Cache Creek C&H	4,998	4,590	92
	Cheney Creek	180	180	100
	Hunter C&H	2,753	2,539	97
	Mamm Creek C&H	633	632	99
	West Divide C&H[1]	14,540	12,152	84
3	Coal Basin C&H	3,285	3,018	92
	East Divide C&H	5,500	5,266	96
	Lake Ridge C&H	3,597	3,318	92
	Muddy S&G	126	125	99
	North Thompson/Four Mile C&H	19,059	16,176	85
	Threemile C&H	923	658	99
	West Divide C&H[1]	9,799	7,960	81
4	Lantern Ridge S&G	2,561	2,352	92
	Total	**69,773**	**61,193**	**88**

[1] Total stipulations for both Zones 2 and 3 equal 20,112 acres. This accounts for 84 percent of the allotment/lease overlap area.

Impacts from Projected Future Oil and Gas Development

Surface disturbance would only occur within areas of allotments in the lease areas where there is no coverage by NSO stipulations. This would preclude development within the Wallace allotment in Zone 1 and the 910 acres of initial surface development in Zones 2 through 4 would have to occur within the 8,580 acres that are not covered by NSO stipulations, leaving 61,193 acres undisturbed and unaffected by the impacts mentioned above (by loss of AUMs, the spread of noxious weeds as well as dust and new or increased vehicular traffic). Development also could occur from outside the lease areas and still affect grazing allotments.

4.14.4.4 Alternative 4 (Proposed Action)

Under Alternative 4 the BLM would modify or cancel the 65 existing leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Draft ROD (USFS 2014b).

Stipulation Coverage

Several of the leases within the associated allotments would be cancelled or terminated thereby reducing the acreage of lease allotment overlap. All of the remaining allotment areas overlapped by leases in Zones 1 through 4 would be affected by NSO stipulations that could offer some form of reduction to impacts, as shown in **Table 4.14-6**. With consideration of NSO stipulations only, surface disturbance is reduced to between 71 to 100 percent. NSO stipulations may require oil and gas operators to horizontally drill to the targeted play from off the lease. This does not guarantee that development will not occur within the associated allotments, but surface development would be precluded in those areas, thus reducing impacts to forage vegetation.

Table 4.14-6 Alternative 4 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulation
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	469	94
	Beaver Creek C&H	795	568	71
	Buzzard	476	466	98
	Cache Creek C&H	4,998	4,590	92
	Cheney Creek	180	180	100
	Hunter C&H	2,753	2,539	92
	Mamm Creek C&H	633	633	100
	West Divide C&H	14,540	12,152	84
3	Coal Basin C&H[1]	46	46	100
	East Divide C&H[1]	4,051	3,816	94
	Lake Ridge C&H[1]	8	3	38
	Muddy S&G[1]	125	125	100
	North Thompson/Four Mile C&H[1]	265	256	97
	Threemile C&H[1]	3	3	100
	West Divide C&H	9,799	7,960	81
4	Lantern Ridge S&G	2,561	2,352	92
	Total	**41,874**	**36,158**	**86**

[1] Total acreage of leases within allotment has been reduced in Column 3 (Acreage of Allotment/Lease Overlap) to account for lease cancelations proposed under Alternative 4.

Impacts from Projected Future Oil and Gas Development

If surface disturbance were to occur within the lease areas the impacts would be similar as those discussed under Alternative 1; however, this alternative provides 71 to 100 percent NSO coverage for allotments in Zones 1 through 4 (over 36,000 acres). Surface disturbance would only occur within allotments in the lease areas where there is no coverage by NSO stipulations. This would preclude

development within the Wallace allotment in Zone 1 and the 744 acres of initial surface development in Zones 2 through 4 would have to occur within the 5,716 acres that are not covered by NSO stipulations. Alternative 3 provides a greater amount of NSO coverage; however, Alternative 4 proposes less surface disturbance which would greatly reduce the potential for the invasion and spread of noxious weeds and impacts from fugitive dust emissions.

4.14.4.5 Alternative 5

Under Alternative 5 the BLM would cancel all 65 leases, plug and abandon 75 wells, 16 well pads (totaling 38 acres), 48 acres of access roads, and all ancillary facilities and equipment in Zones 2 and 3.

Stipulation Coverage

Stipulations would not be necessary to reduce impacts to livestock grazing allotments from development as all leases would be cancelled and no development would occur in the foreseeable future.

Impacts from Projected Future Oil and Gas Development

Short-term impacts would occur due to plugging and abandoning well and well pads and reclaiming access roads. All disturbed areas would be reclaimed to pre-disturbance conditions. The Forest Service would be responsible for approval of reclamation methods and determining when reclamation is satisfactory. Impacts from the 86 acres of surface-disturbing activities required to remove infrastructure and implement reclamation in Zones 2 and 3 would be similar to the types discussed in Section 4.1.3, Impacts Common to All Alternatives; however, the exposure to these impacts would be for a much shorter duration. The extent of impacts would be the least of all alternatives and 86 acres (7 AUMs) of reclaimed areas within the grazing allotments would be available for grazing once reclamation is determined to be successful. Reclamation activities could initially result in the introduction and spread of noxious weeds; however successful reclamation would include eradication of noxious weeds.

4.14.4.6 Summary of Impacts

Oil and gas development under Alternatives 1 and 2 would have the greatest potential for impacts to livestock grazing operations within the analysis area due to the least amount of coverage from associated stipulations (25 and 30 percent and the lease areas, respectively). This does not necessarily equate to less surface disturbance under Alternative 2 compared to Alternative 1; however, it would influence where development would take place, some disturbance may occur off-lease or the same amount of disturbance may be concentrated into a smaller area. Under Alternatives 3 and 4, 100 percent of the allotments areas overlapped by leases would receive coverage from stipulations. Under Alternative 5 stipulations would not affect the associated allotments because no future development would occur and existing wells, pads and roads would be plugged, abandoned, and reclaimed with the intention of returning 86 acres to pre-disturbance condition.

4.14.5 Cumulative Impacts

4.14.5.1 Cumulative Impacts Analysis Area

The CIAA for livestock grazing consists of the 16 grazing allotments overlapped by the 65 existing leases under evaluation within Zones 1 through 4 in their entirety (308,666 acres).

4.14.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Within the CIAA for mineral development, past and present transportation corridors, and other development total 1,109 acres (<1 percent of the CIAA). The impact of all past and present actions would result in a long-term loss of 92 AUMs.

Reasonably Foreseeable Future Actions

Known RFFAs associated with oil and gas development would result in an estimated 599 acres of long-term surface disturbance within the grazing allotments overlapped by Zones 1 through 4 leases (<1 percent of the CIAA). This equates to a loss of about 50 AUMs. Of the 599 acres, 14 acres of long-term surface disturbance may result from recently approved or pending APDs within the next few years, resulting in a loss of about 1 AUM. NSO stipulations developed through the 2014 Final EIS would be applied to the associated allotments outside of the lease boundaries on Forest Service-managed lands.

There are no other activities that would result in surface disturbance within the allotments in the CIAA.

Projects with countervailing impacts would include any actions that would increase production or improve the quality of desirable vegetation for livestock grazing. Known projects include wildlife habitat improvements, hazardous fuels reduction treatments, oak brush thinning, and other vegetation treatments. These projects are estimated to result in 6,000 acres of short-term impacts; however, they are designed to provide long-term improvements.

4.14.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

With consideration of past, present and reasonably foreseeable future actions and the contribution of Alternatives 1 through 5, cumulative long-term surface disturbance in the CIAA would range from 1,795 acres to 2,524 acres (less than 1 percent of the CIAA under all alternatives), with a corresponding loss of AUMs ranging from 150 AUMs (if Alternative 5 were selected) to 210 AUMs (if Alternative 1 were selected). The contribution of the alternatives to cumulative AUM loss would range between 5 and 32 percent.

If chosen, Alternative 5 would have countervailing impacts within the lease areas from the removal and reclamation of well pads and access roads. A total of 86 acres would be reclaimed resulting in the estimated production of 7 AUMs. Of this 76 acres (6 AUMs) would be in Zone 2 and 10 acres (1 AUM) would be in Zone 1.

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4.15 Scenic Resources

4.15.1 Analysis Assumptions and Approach to Analysis

4.15.1.1 Analysis Area

The analysis area is composed of the 65 leases (lease area) which are divided into four zones within Mesa, Garfield, Pitkin, and Rio Blanco counties, south of I-70, between the towns of De Beque and Carbondale, except for one lease northeast of Meeker.

4.15.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for scenic resources were identified:

- Concern about impacts to the general landscape and rural character of the area and the impairment that oil and gas development is already contributing to some of the most remarkable scenery in the WRNF. Concerns focused on the Thompson Divide area, Crystal River Valley, the Elk Mountains, Roaring Fork Valley (located in and near Zone 3), and CRAs (located in portions of Zone 1, 2, and 3).
- Concern about impacts to the viewshed of the Jerome Park Conservation Easement, which currently provides views of Mount Sopris and other peaks in the Elk Mountains; the sandstone fins, and other features of the Thompson Creek Drainage; the Crystal River Valley from Thompson Creek Road; and Williams Peak. These areas of concern are in and near Zone 3.
- Concern for degradation of air quality and visibility (haze), fears that emissions resulting from construction and operations for oil and gas development would compromise the overall quality of the viewshed.
- Concern about impacts to the scenic integrity resulting from the proximity to recreational areas such as the Sunlight Ski Area and other outdoor recreation areas.
- Need for visual BMPs to preserve hunting, fishing, and dispersed recreational opportunities in the area. Examples include locating disturbance and equipment to minimize visual detection from adjacent areas, and painting equipment in neutral tones that match surrounding landscape.

While many of the issues are addressed in general terms, the general nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing some issues in detail. These issues would be addressed in more detail at the site-specific APD stage of permitting when additional NEPA analysis would be required.

4.15.1.3 Assumptions

For the purpose of the scenic resources analysis, the following assumptions were made regarding exploration and development of oil and gas leases as they relate to scenic resources.

- Oil and gas development cannot occur without use of drilling rigs and construction of roads, well pads, production facilities (such as compressor stations, tank batteries, treaters, and dehydrators), and pipelines.
- Night-time scenic characteristics would be affected at least temporarily if work proceeds 24 hours per day. Development would introduce flares from gas wells, rig and work area lighting, and traffic headlights that would be visible to Forest users during the evening hours.

- Roadways would alter the appearance of the landscape and how users circulate through the Forest, resulting in a change in visitor perceptions and views of the area.
- Modification of vegetation and soils cannot be avoided where development occurs.
- The impact analysis only evaluates the scenic resources within each lease, and does not extend beyond these boundaries. However, depending on the location of construction, surrounding vegetation, and other resources contributing to scenic quality, it is recognized that there is the potential for impacts outside of the lease area. Similarly, if stipulations preclude surface-disturbance within the lease, leases may still be developed through directional drilling from off-lease sites, and off-lease development may affect scenic resources within the lease area. The extent to which this would occur would need to be evaluated on a site-specific basis.

4.15.1.4 Impact Indicators Used For Analysis

The impact indicators used to evaluate scenic resources, as defined in the Forest Service Scenery Management System (SMS), are Scenic Attractiveness, Landscape Visibility and Scenic Integrity Objectives (SIOs) (USFS 1996). These indicators are designed to measure the quality of scenic landscape characteristics using predetermined metrics for each impact indicator category. Impacts to scenic resources are determined based on the percentage of stipulations designated cover the resource, and their potential for change caused by oil and gas development activities.

Scenic Attractiveness is measured based on the scenery class in which it falls (Class A, Class B, or Class C). Landscape Visibility consists of travelways and use areas, concern levels, and distance zones. Existing travelways and use areas are identified and classified in order to determine which existing observer positions to use in the Landscape Visibility analysis. Concern levels determines the relative importance of aesthetics to the public, this importance is expressed as concern Levels 1, 2, or 3. Distance Zones (Foreground, Middleground, and Background) are delineated from the travelways and use areas. Scenic Integrity is an indication of intactness and wholeness of the landscape. SIOs are used to describe the desired future condition for scenic quality and are described for each forest plan management area. Values are described as Very High, High, Moderate, Low, or Very Low[1]. A more detailed explanation of these indicators can be found in Section 3.15. Using Scenic Attractiveness, Landscape Visibility, and SIOs impacts are analyzed by determining the type and amount of coverage available for each category from stipulations, as well as the areas left open to surface disturbance and therefore essentially available for future oil and gas development (subject to site-specific approvals).

4.15.1.5 Methods of Analysis

Impacts to scenic resources depend on the visual contrast created between a proposed project and the existing landscape. This contrast can be measured by comparing pattern elements (form, line, color, and texture) and pattern character (dominance, scale, diversity, and continuity) of a proposed project with the existing landscape. It is possible to identify the extent to which the scenic character of an oil and gas facility will exhibit scenic contrast within the landscape, or its converse, scenic compatibility. This process includes review of the scenery inventory (Scenic Attractiveness, Landscape Visibility, SIOs, etc.) to determine the underlying scenic value on an area, and to assess the effects to the scenic value from a proposed project including changes to the landscape character and alterations to scenic integrity.

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[1] While not part of the SMS system, the limited data provided by the GMUGNF included a High/Moderate SIO classification.

Making lands available for oil and gas leasing does not involve any direct effects on scenery, as leasing does not authorize any surface disturbing activities. Future oil and gas development would be subject to site-specific environmental study and permitting requirements. No alternatives propose oil and gas development so this analysis relies on a RFDS that projects future potential surface disturbing activities in support of oil and gas development. Potential future development of oil and gas leases might result in impacts to scenery. Scenery will be measured in the percentage of acres of Scenic Attractiveness, Landscape Visibility, and SIOs potentially impacted. Impacts to Scenic Attractiveness, Landscape Visibility, and SIOs are evaluated by the type and amount of coverage provided to scenic resources by lease stipulations under each alternative. Within each alternative, the impact analysis is broken out for each of the three scenery inventory components by the four zones in the analysis area. The level of coverage provided to the resource is determined using the extent of resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within the analysis area.

Resource-specific NSOs and CSUs are stipulations that were designed specifically to limit the impacts of oil and gas development on a certain resource, in this case scenic resources. Because some resources tend to be closely correlated to scenic quality, this analysis also will evaluate NSO stipulations for resources determined to rely in some part on high scenic quality ("resource-related NSOs"). Because NSO stipulations prevent all surface disturbances within the boundary of that stipulation, only NSO stipulations relating to the visual quality of a particular resource (e.g., travel routes, recreation areas, etc.) are included in the resource-related portion of the analysis. Resource related CSUs are not considered in this analysis because application of the stipulation may still result in surface disturbance affecting scenic quality.

The final portion of the analysis presents the percentage NSOs overlapping the scenic resources within the analysis area. These stipulations would provide a level of coverage to scenic resources through the elimination of surface disturbance if the resources for which they were developed are found to occur within the leases. If the resources are found not to exist in the area, the operator may obtain a waiver or exception so the NSO stipulation would not be implemented. The coverage from NSOs not designated for scenic resources would be overestimated if not all stipulations are implemented.

Scenic Attractiveness impacts are analyzed based on stipulation coverage within Class A, Class B, and Class C areas, as well as where the lack of stipulations might allow for future oil and gas development. Any future development has the potential to lower the Scenic Attractiveness score, which could result in a downgrade of the Scenic Attractiveness class. Class A areas are not present within Zones 1 and 4, while Class C areas are not present at all within the analysis area. Class B areas are present within each of the four zones.

Impacts to Landscape Visibility are analyzed using distance zones within the three concern levels. Concern Level 1 is considered to be of high importance, Concern Level 2 is of medium importance, and Concern Level 3 carries low importance within this indicator category. Distance zones refer to the distance between the vantage point for a viewer and the area within the lease being observed. Foreground is up to 0.5 mile from the viewer, Middleground is up to four miles from the Foreground, and Background is 4 miles from the viewer to the horizon. The analysis considers where the lease area may be covered based on the visibility of an area from the point of perception. If an observer were to be located within a high quality scenic area, such as a sensitive travel route or recreation area, the lease areas covered by stipulations would be in the Foreground, Middleground, or Background of their vantage point. There are no Concern Level 1 Foreground or Concern Level 3 areas in Zone 1 and Zones 2 and 3 do not have any Concern Level 3 Background areas. The remaining Concern Levels, Distance Zones are present in all 4 zones.

SIO impacts are analyzed based on the level of stipulation coverage applied to SIO classifications. It is anticipated that potential impacts from oil and gas exploration activities would most likely exceed the SIO classifications for high quality scenic resources such as those in Very High, High, and Moderate areas. Impacts are analyzed to determine the level of coverage within the varying levels of importance of SIO categories. Zones 1, 2, and 4 do not have any Very Low SIO areas. Zones 2, 3, and 4 do not have any Very High SIOs, and Zones 3 and 4 do not have any High SIOs. Moderate and Low SIO areas are found within each of the four zones[2].

4.15.2 Stipulation Coverage of Scenic Resources

This oil and gas leasing analysis evaluates the effects of proposed lease stipulations that would minimize the potential impacts of oil and gas development on scenic resources. The definition of the purpose and implementation of each stipulation can be found in Appendix B of the 1993 WRNF Oil and Gas Leasing EIS (USFS 1993a) for Alternatives 1 and 2, and in Appendices A and B of the 2014 WRNF Oil and Gas Leasing Final EIS (USFS 2014a) for Alternatives 3 and 4. **Table 4.15-1** identifies the stipulations specific to scenic resources for each alternative.

Table 4.15-1 Lease Stipulations Specific to Scenic Resources

Stipulation	Alternatives 1 and 2 [1]	Alternatives 3 and 4 [2]
NSO		
High Scenic Integrity Objective Areas		X
CSU		
Sensitivity Level 1 Travel Routes	X	
Moderate Scenic Integrity Objective Areas		X
High Concern Level Travel Routes/Use Areas		X

[1] Alternative 1 and 2 have the same stipulations.

[2] Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all of part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

Definitions: NSO: No Surface Occupancy; CSU: Controlled Surface Use.

The one stipulation that is specific to scenic resources under Alternatives 1 and 2 is the Sensitivity Level 1 Travel Routes CSU. Alternatives 1 and 2 do not have any other resource-specific NSO stipulations.

There are three stipulations specifically developed to address scenic resources under Alternatives 3 and 4: High Scenic Integrity Objective Areas (NSO), Moderate Scenic Integrity Objective Areas (CSU), and High Concern Level Travel Routes/Use Areas (CSU).

There are other resource-related stipulations that would minimize the potential impacts of oil and gas development on scenic resources, even though they were not developed for that purpose. Three that are closely correlated with high visual quality are:

[2] A High/Moderate SIO classification is found only on the GMUGNF, and is located within Zone 3. It is anticipated that potential impacts from oil and gas exploration activities would most likely exceed the objectives for this classification.

- Roadless Areas NSO (under all Alternatives, but revised under Alternatives 3 and 4 to address the 2012 CRR);
- RNAs NSO (under all alternatives but revised under Alternatives 3 and 4 to include the Lower Battlement Mesa RNA, which is in Lease Zone 1); and
- 1B Management Areas – Downhill Skiing NSO (under Alternatives 1 and 2 only).

There are additional NSOs that could overlay areas of high visual quality. Depending on the alternative, these may include, but are not limited to, geology/soils (steep slopes and sensitive soils), water resources (water influence zones), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). However, if the resources these stipulations are designed to address are not found to occur on the leases, the stipulations would not be implemented.

4.15.3 Impacts Common to All Alternatives

Due to the nature of the leasing decision, the exact location and extent of oil and gas development within the analysis area is unknown. It is anticipated that scenic resources would most likely be impacted in areas where there is surface disturbance and facility construction, and that these development would occur in areas not covered by the High Scenic Integrity Objective Areas NSO stipulation. Depending on the amount of contrast created in relation to the existing landscape and the sensitivity of the existing landscape, visibility of constructed features such as roads, pipelines, well pads, drilling rigs, and other associated structures and infrastructure could affect the scenic quality of the analysis area. The structures, as well as any equipment necessary for operation would contribute to color, line, form, and texture contrasts between the man-made development and the natural surroundings.

If the well is unproductive and is plugged and abandoned, the analysis area would experience impacts to scenic resources until final reclamation is complete.

If a well is determined to be productive, the taller exploratory drilling rig would be replaced with a lower profile structure for long-term use on the active well. Portions of the initial surface disturbance would be reclaimed. Impacts from roads, pipelines, and portion of the well pad that is not reclaimed, and production facilities would persist for the life of the well (20 to 30 years), with additional time to achieve full rehabilitation.

During both construction and operation phases, fugitive dust from construction or transportation on unpaved roads could lead to short-term color contrasts where plumes become visible in the atmosphere, as well as contribute to poor visibility and haze, obscuring the landscape and viewsheds.

Lighting associated with drilling rigs, oil and gas operations, and transportation could degrade the visual quality of the area by creating light pollution and making the development more easily visible during nighttime hours. These impacts could range from moderate to major, and short-term to long-term. While Operators would need to meet all occupational safety requirements; they also are directed by COGCC rules to minimize lighting impacts per Rule 803 which states, “to the extent practicable, site lighting shall be directed downward and internally so as to avoid glare on public roads and building units within seven hundred feet.”

Project design and best management practices would be used to mitigate issues related to scenic resources at site-specific environmental analysis stage. Examples include locating disturbance and equipment to minimize visual detection from adjacent areas, and painting equipment in neutral tones that match surrounding landscape.

A very small portion of the WRNF also overlaps with the GMUGNF. Approximately 2 percent of the lease area is comprised of GMUGNF lands. Although much of the scenic inventory is missing for the GMUGNF, existing data indicates that these small portions of the GMUGNF within the lease area have low potential for occurrence of oil and gas resources. The development of the RFDS in these areas is therefore unlikely (USFS 2014a, page 43).

Impacts Identified in the WRNF Final EIS

As discussed in the EIS for Future Leasing on the WRNF (USFS 2014a, page 329 – 330), the amount of contrast created between project facilities and the surrounding landscape is defined by how the proposed changes contrast with the basic scenic elements of line, form, color, and texture. The primary concerns associated with energy development on the scenic quality of the WRNF are the visibility of constructed features including roads, pipelines, well pads, and associated infrastructure; the presence of seismic or drilling equipment and transportation on Forest roads surrounding mobilization to seismic testing or drill sites; the long-term presence of a production facility; and ground disturbance associated with the constructed features.

Exploratory drilling would result in strong scenic contrasts resulting from vegetation removal, soil disturbance, the addition of linear road and pipelines in undeveloped areas, and the presence of equipment that does not easily blend into the landscape. Road and pipeline construction and well pad development would likely result in moderate to major scenic contrasts. Impacts would include strong color contrasts between the lighter colored soil of the road or well pad and other areas of disturbance and the surrounding vegetation. Drilling rigs would introduce moderate to major line, form, and texture contrasts. Lighting associated with the drilling rig also could impact the aesthetics of surrounding areas within sight of the activity. The degree of degradation is dependent upon the amount of contrast between the natural and constructed landscape, the viewing distance, and the concern of the viewer for scenic quality. The scenic impacts of drilling would be greater in areas visible from Concern Level 1 travel routes or viewpoints. These moderate to strong direct effects would be temporary, lasting from approximately 2 to 3 months per well site (USFS 2014a, page 329).

4.15.4 Impacts by Alternative

The impacts to scenic resources by each alternative are analyzed by the percentage of lease area covered by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSO stipulations within the lease area. In addition, each alternative assesses the degree to which the resource may be impacted from the potential oil and gas development opportunities outlined in the RFDS.

4.15.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Alternative 1 is the No Action Alternative, and would reaffirm the lease stipulations on the existing 65 leases as they were originally issued. Under this alternative, the RFDS would include 398 vertical/directional wells and 18 horizontal wells. The potential for initial surface disturbance would be 892 acres, and the long-term surface disturbance would be 387 acres. There would be one stipulation specific to scenic resources:

- Sensitive Level 1 Travel Routes CSU—This stipulation would prevent the placement of collection facilities, well sites or exploration activity within routes that do not meet visual quality objectives (VQOs) and SIOs, as well as providing Forest visitors with quality experiences. The stipulation would require site clearings, collection facilities, structures, utilities and pipelines to be relocated when necessary to meet VQOs/SIOs. During the APD process, a visual site analysis would be completed to determine if vegetation, topography,

and proposed onsite design features would be sufficient to mitigate visual impacts. If the management practices are determined to be sufficient, the site will be accepted and relocation will not be required (USFS 1993a).

There would be no NSO stipulations specific to scenic resources under this alternative, but there would be two other NSO stipulations closely correlated with high scenic quality: Roadless Areas NSO and the 1B Management Areas—Downhill Skiing NSOs. However, these stipulations are not designed to address scenic resources, and if the protected resource is found not to exist on the ground, then the stipulation would not be implemented regardless of the level of scenic quality. The Roadless Areas NSO was developed to retain the roadless character of the area by precluding surface disturbance within the Battlement Mesa, Assignation Ridge, White River, and Pagoda Peak roadless areas. The 1B Management Areas—Downhill Skiing NSO was developed to preserve the investment of facilities within the site, the use authorized by permit, safety of the users, the natural environment that initially made the site desirable for the ski area, and the existing recreational experience. These lands are managed with an emphasis on providing for downhill or cross-country skiing on existing sites and maintaining selected sites for future skiing recreation opportunities (USFS1993a). The 1993 EIS does not identify any circumstances under which exceptions to either stipulation might be granted.

Additional NSOs that could overlay areas of high visual quality include, but are not limited to, geology/soils (steep slopes and sensitive soils), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). However, if the resources these stipulations are designed to address are not found to occur, the stipulations would not be implemented.

Scenic Attractiveness

Table 4.15-2 shows the extent of Scenic Attractiveness categories and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-2 Stipulation Coverage of Scenic Attractiveness under Alternative 1

Scenic Attractiveness Category	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Class A	0	0	0	0	0
Class B	9,623	0	0	12	100
Class C	0	0	0	0	0
Zone 2					
Class A	3,728	0	0	72	83
Class B	20,117	0	0	8	32
Class C	0	0	0	0	0
Zone 3					
Class A	1,089	0	0	0	51
Class B	41,542	0	8	0	7
Class C	0	0	0	0	0

Table 4.15-2 Stipulation Coverage of Scenic Attractiveness under Alternative 1

Scenic Attractiveness Category	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 4					
Class A	0	0	0	0	0
Class B	2,561	0	0	0	3
Class C	0	0	0	0	0

[1] Roadless Areas and 1B Management Areas – Downhill Skiing NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. With consideration of all NSO stipulations, there are 692 acres (approximately 41 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-2**, there would be limited coverage provided by resource-related NSO stipulations except for Class A areas within Zone 2. Within Zone 3, the resource-specific Sensitive Level 1 Travel Routes CSU stipulation would be applied along portions of CR-117; CR-313, and CR-300.3 (near Haystack Gate), and portions of CR-313 adjacent to East Divide Creek and the Garfield-Pitkin-Mesa county boundary.

With consideration of all NSO stipulations, half of Class A areas in Zones 2 and 3 would be precluded from surface disturbance if all NSOs were implemented. Class B areas within Zone 1 would be fully covered by any NSO stipulations, but would have minimal coverage in Zones 2, 3, and 4. As discussed in Section 4.15.3, the extent to which Scenic Attractiveness could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Landscape Visibility

Table 4.15-3 shows the extent of coverage provided to concern levels and distance zones through resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs by zone.

Table 4.15-3 Stipulation Coverage of Landscape Visibility under Alternative 1

Landscape Visibility	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Foreground 1	0	0	0	0	0
Middleground 1	219	0	0	2	100
Background 1	4,173	0	0	9	100
Foreground 2	813	0	0	53	100
Middleground 2	1,234	0	0	13	100
Background 2	461	0	0	3	100
Foreground 3	0	0	0	0	0
Middleground 3	0	0	0	0	0
Background 3	0	0	0	0	0

Table 4.15-3 Stipulation Coverage of Landscape Visibility under Alternative 1

Landscape Visibility	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 2					
Foreground 1	1,808	0	4	0	34
Middleground 1	7,035	0	0	8	20
Background 1	7,399	0	0	30	65
Foreground 2	4,608	0	0	19	39
Middleground 2	2,115	0	0	20	35
Background 2	222	0	0	21	32
Foreground 3	87	0	0	0	5
Middleground 3	6	0	0	0	30
Background 3	0	0	0	0	0
Zone 3					
Foreground 1	6,616	0	30	0	3
Middleground 1	19,604	0	4	0	5
Background 1	10,692	0	2	0	12
Foreground 2	3,707	0	3	0	18
Middleground 2	1,911	0	10	0	9
Background 2	311	0	2	0	5
Foreground 3	147	0	1	0	1
Middleground 3	146	0	3	0	6
Background 3	2	0	0	0	100
Zone 4					
Foreground 1	397	0	0	0	0
Middleground 1	856	0	0	0	1
Background 1	266	0	0	0	1
Foreground 2	206	0	0	0	0
Middleground 2	766	0	0	0	7
Background 2	52	0	0	0	1
Foreground 3	4	0	0	0	0
Middleground 3	2	0	0	0	0
Background 3	0	0	0	0	0

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 697 acres (approximately 42 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-3**, there is limited coverage provided by resource-specific CSU or resource-related NSO stipulations in any zone. NSO stipulations unrelated to scenic resources would fully

preclude surface disturbance within Zone 1, but generally do not limit surface development in important Landscape Visibility areas within the other zones. As discussed in Section 4.15.3, the extent to which Landscape Visibility could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Scenic Integrity Objectives

Table 4.15-4 shows the extent of SIO categories and percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs by zone.

Table 4.15-4 Stipulation coverage of Scenic Integrity Objectives under Alternative 1

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Very High	330	0	0	0	100
High	9,617	0	0	12	100
Moderate	26	0	0	0	100
Low	107	0	0	0	100
Very Low	0	0	0	0	0
Zone 2					
Very High	0	0	0	0	0
High	187	0	0	100	100
Moderate	4,592	0	0	48	68
Low	20,051	0	0	10	32
Very Low	0	0	0	0	0
Zone 3[2]					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	2,439	0	22	1	29
Low	40,117	0	7	0	7
Very Low	10	0	8	39	39
Zone 4					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	789	0	0	0	1
Low	1,772	0	0	0	3
Very Low	0	0	0	0	0

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

[2] Within Zone 3, there are 125 acres (less 1 percent of the analysis area) of the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, there are 14 acres (approximately 11 percent) of these areas that would be precluded from surface disturbance.

As shown in **Table 4.15-4**, with the exception of High SIOs in Zone 2, there would be limited coverage provided by resource-specific CSU or resource-related NSO stipulations in any zone. NSO stipulations unrelated to scenic resources would fully preclude surface disturbance within all SIOs in Zone 1, as well as the majority of the High and Moderate SIO areas in Zone 2. There are no High SIO areas in Zones 3 or 4 and implementation of other NSOs generally would not limit surface development for Moderate SIOs within these zones. As discussed in Section 4.15.3, the extent to which SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 1 comprises 417 wells on 60 well pads, resulting 892 acres of short-term disturbance and 387 acres of long-term surface disturbance, with consideration of roads and pipelines. Potential impacts are described in Section 4.15.3. The site-specific location of development would play a role in determining the impacts to scenic resources. In areas of lower scenic importance and sensitivity, future oil and gas exploration activities are not anticipated to substantially impact scenic resources in the area if BMPs are applied during design and construction. In areas of higher scenic importance and sensitivity, the degree to which these resources would be affected would be dependent on factors such as slope, aspect, terrain and vegetation in and around the site-specific location, as well as the amount of contrast between the natural and constructed landscape. Impacts may be short term to long term with minor to major adverse effects. Alternative 1 has no NSO stipulations specific to scenic resource, but resource-related and other NSO stipulations (if implemented) would preclude development of the RFDS in some higher scenic importance and sensitivity. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic researches within leases. These would be examined during the site-specific development phase. The potential for impacts to scenic resources from the RFDS is described by zone below.

Within Zone 1, Class B and High SIO areas are present in approximately 95 percent of the 10,114-acre zone. Approximately 43 percent of the zone is a User Concern Level 1 area (Middleground and Background distance zones) and 25 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Most of Zone 1 is within CRAs. There are no existing wells in this zone.

The Zone 1 RFDS comprises 36 total wells on 5 well pads (76 acres of short-term and 33 aces of long-term surface disturbance). With consideration of any NSOs, surface-disturbing activities associated with the RFDS could not be conducted on the Zone 1 leases. If some NSO stipulations are exempted to the degree that wells, well pads, roads, pipelines, and ancillary facilities could be constructed within the lease zone, resulting surface disturbance would comprise about 1 percent of the lease zone. If only resource-related NSOs were implemented, any or all of the RFDS could occur in Class B areas and Very High and High SIOs. Portions of the RFDS could occur in Moderate SIOs, and any or all of the RFDS could occur in any of the User Concern Level 1 and 2 distance zones. Potential impacts are described in Section 4.15.3. If these also were exempted, development would occur within portions of CRAs and depending on location, the views from CR-V and CR-T (located along the southwestern boundary of the leases) may be impacted. Development would not represent a large change to the overall landscape character within this zone if located in areas of lower scenic importance and sensitivity (Low SIO), but that may not be possible given the small percentage of Low SIO within the lease zone. Development of well pad, access roads, and pipelines would be inconsistent with the Forest Plan in Very High and High SIOs, and potentially in Moderate SIOs (which collectively cover 98 percent of the lease zone), even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 2, Class B and Moderate SIO areas are present in over 80 percent of the 24,938-acre zone. Approximately 65 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 27 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). The majority of the zone is within CRAs. Zone 2 contains 73 existing wells on 13 well pads, generally spread throughout the lease zone.

The Zone 2 RFDS comprises 319 total wells on 46 well pads, (684 acres of short-term and 296 acres of long-term surface disturbance). With consideration of any NSOs, on-lease development could occur in Class B areas, Moderate and Low SIOs, and all Concern Level 1 and 2 distance zones, as NSO stipulations cover 32 percent of the Class B areas and Low SIOs, 68 percent of Moderate SIOs areas, and between 20 and 65 percent of Concern Level 1 and 2 distance zones. No High SIO areas would be open to surface disturbance, but on-lease development could occur in 17 percent of Class A areas. Surface disturbance would be precluded in most, but not all, CRAs.

With consideration of only resource-related NSO stipulations, the potential for development areas of high scenic value would be somewhat increased. The southern lease zone boundary would be within one mile of Battlement Creek, Battlement Reservoir, Haystack Mountain, North Mamm Creek, and East Reservoir. The Beaver Creek trailhead would be adjacent to leases on the north side of the lease zone. Surface disturbance would not be permitted on the leases closest to these areas through the roadless area NSO stipulation, except for the portion of the lease closest to Battlement Creek (part of present-day CRAs), which would have standard leasing terms.

If resource-related NSO were exempted, on-lease development could occur within these or other portions of CRAs. Impacts to these and other visual important areas would be examined during site-specific NEPA analysis. If fully developed within the leases, the RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. However, it would quadruple the number of well pads and triple the number of wells within the lease, and it may not be possible to locate all well pads and ancillary facilities within areas of lower scenic importance and sensitivity (Low SIO) on leases that are predominately Moderate SIO (which are the leases closest to Battlement Creek, Battlement Reservoir, Haystack Mountain, North Mamm Creek, East Reservoir, and the Beaver Creek trailhead). Development of well pads, access roads, and pipelines may be inconsistent with the Forest Plan in Moderate SIOs even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 3, Class B and Low SIO areas are present in approximately 95 percent of the 42,766-acre zone. Approximately 86 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 14 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Most of the lease zone is within CRAs. There are 2 existing wells and three well pads in this zone, which are all located in the western portion of the lease zone.

The Zone 3 RFDS comprises 52 total wells on 7 well pads (111 acres of short-term and 48 acres of long-term surface disturbance). Most of the lease zone would have standard lease terms or timing limitations that do not address scenic resources. With consideration of all NSO stipulations, it is anticipated that a portion of the RFDS could occur in Class A areas since 49 percent would be open to surface disturbance, and that any or all of the RFDS may occur in Class B areas, since 93 percent of Class B areas would be open to surface disturbance. Any or all of the RFDS may occur in Moderate and Low SIOs since most of these areas would be open to surface disturbance. Portions of the GMUGNF High/Moderate SIO also would be available for surface disturbance. Any or all of the RFDS could occur in Concern Level 1 and 2 distance zones, since surface disturbance would not be permitted in only 5 to 18 percent of Concern Level 1 and 2 distance zones. The

resource-related roadless area NSO stipulation would generally not be applied to Zone 3 CRAs (see Section 4.12, Special Designations).

Within Zone 3, the Sensitive Level 1 Travel Routes CSU stipulation would provide moderate constraints to development in 22 percent of Moderate SIO and Foreground 1 areas. Operators may be required, during site-specific development, to submit a visual site analysis to determine if vegetation, topography, and proposed onsite design features would be sufficient to mitigate visual impacts and meet SIOs. These constraints would be applied along portions of CR-117 (Four-Mile Road) on 2 of the 3 leases crossed by the road; a small area where CR-313 and CR-300.3 intersect (near Haystack Gate), and portions of CR-313 adjacent to East Divide Creek and the Garfield-Pitkin-Mesa county boundary. All three roads are proposed haul routes (see **Figure 3.10.2**).

Sunlight Ski Area would be less than 1 mile from a lease located directly east of the resort, and 2 miles from the boundary of leases to the north and west of the ski area; additional leases would be located on the backside of the mountain. The leases to the north of the resort would be covered by some NSO areas, but most of the lease areas near the resort would not be constrained by NSO stipulations. The Jerome Park conservation easement and the Spring Gulch Nordic Ski area would be within a mile of some lease borders. Portions of some leases closest to the conservation easement would have NSO stipulations. Leases would be generally located on the opposite (west) side of ridgelines of portions of the easement. The Roaring Fork Valley would be located almost 4 miles northeast of the closest lease. The leases would not be covered by NSO stipulations, but would be generally located on the opposite side of a ridgeline. The Crystal River Valley and SH-133 (a scenic byway) would be located about 3 miles east of the closest lease. Mt. Sopris and the Maroon Bells Wilderness Area would be located about 6 miles east of the lease zone, while the Elk Mountain Range would generally be over 10 miles away from the lease zone. Some of the portions closest to the Crystal River Valley/SH-133 could be covered by NSO stipulations and, in general, the leases closest to these areas are generally located on the opposite sides of ridgelines.

Thompson Creek Road (CR-109) is generally located to the east of the lease zone, with a 0.3-mile section of the road crossing one of the easternmost leases. The lease area surrounding that section of road would be covered by NSOs. As noted previously, a CSU stipulation would be applied to portions of Four-Mile Road within two leases; however, the third lease would have standard lease terms. Impacts to these and other visually significant areas would be examined during site-specific NEPA analysis. If fully developed within the leases, the RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. This would represent a large increase in the number of wells and a moderate increase in the number of well pads. This development, along with increased transportation, may affect the general landscape character within this zone. Effects from development would be experienced particularly within the eastern portion of the zone (the Thompson Divide area, which currently has no wells and is within CRAs), unless located in areas of lower scenic importance and sensitivity (i.e., Low SIO, which comprises about 90 percent of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas (which collectively comprise about 10 percent of the lease zone) even if design criteria, mitigation measures, and BMPs are implemented. However, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located. Impacts to CRAs are discussed in Section 4.12, Special Designations.

Within Zone 4, Class B areas are present in over 99 percent of the 2,562-acre zone. Approximately 30 percent of the zone is a Moderate SIO area; the remainder is a Low SIO area. Approximately 60 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 40 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells within this zone.

The Zone 4 RFDS comprises 10 total wells on 1 well pad (21 acres of short-term and 9 acres of long-term surface disturbance). The zone would be primarily covered by standard lease terms or timing limitations that do not address scenic resources. It is anticipated that any or all of the RFDS may occur in Class B areas, any SIO area and any Concern Level 1 and 2 distance zone, since surface disturbance is generally not precluded in any lease area. RFDS development would comprise less than 1 percent of the lease zone and given the low number of wells and well pads, it would minimally affect the landscape character. Development may be inconsistent with the Forest Plan in Moderate SIOs; however, given the low number of proposed wells, it is assumed that Moderate SIOs can be avoided. There are no areas of concern identified in scoping comments that are within or near Zone 4.

4.15.4.2 Alternative 2

Stipulation Coverage

Alternative 2 would modify 8 of the 65 existing leases to address inconsistencies with the 1993 EIS and ROD. This alternative would add stipulations to these eight leases that were identified in the 1993 EIS and ROD, but not attached to leases as they were issued. Under this alternative, the RFDS would include 398 vertical/directional wells and 18 horizontal wells. The potential for surface disturbance would be 892 acres of initial disturbance and 387 acres of long-term disturbance.

NSO and CSU stipulations for scenic resources under Alternative 2 would be the same as discussed for Alternative 1 for Scenic Attractiveness. There are a few differences in regards to percentages of coverage provided by the resource-specific CSU, resource-related NSOs, and any NSO stipulations for Landscape Visibility, and SIOs for scenic resources within the analysis area. The differences between Alternative 1 and Alternative 2 stipulation are displayed in **Table 4.15-5** and **4.15-6**.

Table 4.15-5 Stipulation Coverage of Landscape Visibility under Alternative 2

Stipulation	Landscape Visibility	Alternative 1	Alternative 2
		Percent of Scenic Resources	
Zone 1			
Impacts between Alternative 1 and Alternative 2 are the same.			
Zone 2			
Impacts between Alternative 1 and Alternative 2 are the same.			
Zone 3			
Resource Specific CSUs	Foreground 1	30	**38**
Resource-specific CSUs	Middleground 1	4	**6**
Resource-related NSOs[1]	Foreground 1	0	**1**
Any NSOs	Middleground 1	5	**6**
Any NSOs	Background 1	12	**14**
Any NSOs	Middleground 2	8	**10**
Zone 4			
Impacts between Alternative 1 and Alternative 2 are the same.			

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 697 acres (approximately 42 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

Table 4.15-6 Stipulation Coverage of Scenic Integrity Objectives under Alternative 2

Stipulation	SIO Category	Alternative 1	Alternative 2
		Percent of Scenic Resources	
Zone 1			
Impacts between alternatives are the same.			
Zone 2			
Impacts between alternatives are the same.			
Zone 3[1]			
Resource-specific CSUs	Moderate	22	**36**
Resource-specific CSUs	Low	7	**8**
Any NSOs	Low	7	**8**
Zone 4			
Impacts between alternatives are the same.			

[1] Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, there are 14 acres (11 percent) of these areas that would be precluded from surface disturbance.

As shown in **Tables 4.15-5** and **4.15-6**, all of the differences between Alternative 1 and Alternative 2 are within Zone 3. Landscape Visibility and SIOs would provide a higher percentage of coverage to scenic resources under Alternative 2; however, the increase in coverage would be marginal across all categories. An exception lies within Moderate SIOs, where the Sensitive Level 1 Travel Routes CSU would provide 14 percent more coverage. As discussed in Section 4.15.3, the extent to which Landscape Visibility and SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 2 projects the same number of well pads and amount surface disturbance as Alternative 1, but projects one fewer well. The potential for on–lease development of the RFDS would be similar to Alternative 1 except that in Zone 3:

- The Level 1 Travel Route CSU stipulation would be added to Lease 066706, so that all portions of Four-Mile Road crossing the leases would be covered by this CSU; and
- A resource-related NSO (1B Management Areas-Downhill Skiing) would be applied to portions of Lease 066693, the closest lease to the Sunlight Ski Area (located less than 1 mile to the east).

Although the amount of the lease zone that would not permit surface disturbance if all NSO stipulations were implemented would be slighter higher than Alternative 1, the overall potential for development would still be similar: Most of the lease zone would have standard lease terms or timing limitations that do not address scenic resources. There would still be potential for a portion of the RFDS to occur in Class A areas, and any or all of the RFDS may occur in Class B areas, High/Moderate (GMUGNF), Moderate, and Low SIOs, as well as all of the Concern Level 1 and 2 distance zones.

Impacts to the key areas identified in scoping comments would be similar to Alternative 1, except that scenic quality in the Foreground 1 areas along Four-Mile Road and Middleground 1 distance zone located in the lease to the east of Sunlight Ski Area would be better maintained through

application of CSU and NSO stipulations. Impacts to these and other visually important areas would be examined during site-specific NEPA analysis.

4.15.4.3 Alternative 3

Stipulation Coverage

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in Alternative 2 from the 2014 WRNF Final EIS. Under this alternative, the RFDS would include 395 vertical/directional wells and 18 horizontal wells. The potential for surface disturbance would be an initial 886 acres of short-term and 384 acres of long-term disturbance.

The stipulations specifically designed to provide address scenic resources in Alternatives 3 include High Scenic Integrity Objective Areas NSO, Moderate Scenic Integrity Objective Areas CSU, and High Concern Level Travel Routes/Use Areas CSU. Descriptions of these stipulations and how they might affect the analysis area are as follows:

- High Scenic Integrity Objective Area NSO—Preserves the existing High scenic integrity in areas where the landscape character appears intact. Disturbance must remain consistent with the form, line, color, texture, and pattern of the landscape to ensure changes are not apparent.
- Moderate Scenic Integrity Objective CSU—Preserves the scenic resources and the character of the landscape. To meet SIOs, the Forest Service may require special analysis and mitigation plans for activities proposed along areas with Moderate SIOs. At the time operations are proposed, the lessee may be required to submit visual simulations and visual resource and interpretive assessments. In addition, they may be required to submit plans for Forest Service approval showing that all structures would have minor visual impacts to the surrounding landscape and meet the SIOs. A computer generated perspective may be required as part of the visual impact assessment.
- High Concern Travelways/Use Areas CSU—Preserves the existing landscape character and maintains the existing SIOs along the High Concern Level 1 travel routes in Foreground views. To meet SIOs in Foreground Views, the Forest Service may require special analysis and mitigation plans for activities proposed near High Concern Level 1 travel routes (highways, roads, railways, trails, waterways, vista points, trailheads, campgrounds, other recreation sites, etc.) as defined in the WRNF LRMP. At the time operations are proposed, the lessee may be required to submit visual simulations and visual resource and interpretive assessments. In addition, they may be required to submit plans to the Forest Service showing that all structures would have minor visual impacts to the surrounding landscape and meet the SIOs. A computer generated perspective may be required as part of the visual impact assessment.

An exception may be granted for the High and Moderate Scenic Integrity Objective Areas stipulations if an environmental analysis demonstrates, through a site-specific review, that the effects of the proposed activity will not cause the area to fall below the identified SIOs (High and Moderate). Exceptions may be granted for the High Concern Travelways/Use Areas CSU stipulation if an environmental analysis demonstrates that impacts from the proposed activity can be mitigated, or would be negligible to the recreation, scenic, and historic values, and not visible within 0.5 mile Foreground Views (USFS 2014a).

Under Alternative 3, there are two other resource-related stipulations that would minimize the potential impacts of oil and gas development on scenic resources, even though they were not developed for that purpose: Roadless Areas NSO and RNAs NSO. The Roadless Areas NSO exists for the purpose of preserving the natural features that contribute to roadless characteristics. The

RNAs NSO exists for the purpose of retaining the integrity of proposed and designated RNAs for research. For both NSOs, the 2014 Final EIS identifies no circumstances in which an exemption would be granted, but a modification may be granted in an environmental analysis determines that the boundary of the designated areas has been modified and the portion of the leasehold is no longer within these areas. A waiver may be granted if an environmental analysis determines the entire leasehold is no longer within the designated area (USFS 2014a).

Additional NSOs that could overlay areas of high visual quality include, but are not limited to, geology/soils (steep slopes and sensitive soils) and water resources (water influence zones), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). If the resources these stipulations are designed to address are not found to occur, the stipulations would not be implemented. However, many NSO stipulations overlay each other; thus, if one NSO stipulation is exempted, modified or waived, it is possible that the remaining NSOs might still be applied in areas of high visual quality.

Scenic Attractiveness

Table 4.15-7 shows the extent of Scenic Attractiveness categories and percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-7 Stipulation Coverage of Scenic Attractiveness under Alternative 3

Scenic Attractiveness Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Class A	0	0	0	0	0
Class B	9,623	100	0	100	100
Class C	0	0	0	0	0
Zone 2					
Class A	3,728	0	85	95	99
Class B	20,117	0	31	61	85
Class C	0	0	0	0	0
Zone 3					
Class A	1,089	0	95	93	100
Class B	41,542	0	49	55	86
Class C	0	0	0	0	0
Zone 4					
Class A	0	0	0	0	0
Class B	2,561	0	86	0	92
Class C	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. With consideration of all NSO stipulations, there are 1,448 acres (approximately 86 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-7**, the High Scenic Integrity Objective Area NSO would fully preclude surface disturbance within Zone 1. The Moderate Scenic Integrity Objective Area and High Concern Travelways/Use Areas CSUs would provide coverage to the majority of Class A areas within Zones 2 and 3, and Class B areas in Zone 4. Class B areas would receive the most coverage in Zones 2, 3 and 4 from any NSOs. As discussed in Section 4.15.3, the extent to which Scenic Attractiveness could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Landscape Visibility

Table 4.15-8 shows the extent of Landscape Visibility and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-8 Stipulation Coverage of Landscape Visibility under Alternative 3

Landscape Visibility Categories	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Foreground 1	0	0	0	0	0
Middleground 1	219	100	0	100	100
Background 1	4,173	100	0	100	100
Foreground 2	813	100	0	100	100
Middleground 2	1,234	100	0	100	100
Background 2	461	100	0	100	100
Foreground 3	0	0	0	0	0
Middleground 3	0	0	0	0	0
Background 3	0	0	0	0	0
Zone 2					
Foreground 1	1,808	0	100	56	90
Middleground 1	7,035	0	37	59	79
Background 1	7,399	0	40	74	89
Foreground 2	4,608	0	10	73	92
Middleground 2	2,115	0	16	62	93
Background 2	222	0	28	48	78
Foreground 3	87	0	15	5	47
Middleground 3	6	0	0	3	67
Background 3	0	0	0	0	0
Zone 3					
Foreground 1	6,616	0	100	20	79
Middleground 1	19,604	0	45	56	80
Background 1	10,692	0	28	70	91
Foreground 2	3,707	0	20	71	92
Middleground 2	1,911	0	38	53	90

Table 4.15-8 Stipulation Coverage of Landscape Visibility under Alternative 3

Landscape Visibility Categories	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Background 2	311	0	36	43	91
Foreground 3	147	0	12	24	91
Middleground 3	146	0	5	71	97
Background 3	2	0	0	0	53
Zone 4					
Foreground 1	397	0	100	0	100
Middleground 1	856	0	76	0	90
Background 1	266	0	81	0	99
Foreground 2	206	0	100	0	85
Middleground 2	766	0	38	0	89
Background 2	52	0	58	0	91
Foreground 3	4	0	100	0	100
Middleground 3	2	0	0	0	100
Background 3	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 1,454 acres (approximately 87 percent) of the GMUGNF lease area would be precluded from oil and gas development.

As shown in **Table 4.15-8**, the High Scenic Integrity Objective NSO would provide full coverage to lease areas within Zone 1. The resource-specific CSUs would provide full coverage for Concern Level 1 Foreground areas in Zones 2 and 3, while all Foreground areas would be precluded from surface disturbance in Zone 4. The remaining Landscape Visibility areas would experience the most coverage under any NSOs. As discussed in Section 4.15.3, the extent to which landscape visibility could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Scenic Integrity Objectives

Table 4.15-9 shows the extent of SIO categories and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-9 Scenic Integrity Objectives Coverage under Alternative 3

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Very High	330	0	0	87	100
High	9,617	100	0	100	100

Table 4.15-9 Scenic Integrity Objectives Coverage under Alternative 3

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Moderate	26	0	0	0	100
Low	107	0	0	0	100
Very Low	0	0	0	0	0
Zone 2					
Very High	0	0	0	0	0
High	187	0	0	99	100
Moderate	4,592	0	100	73	93
Low	20,051	0	21	62	85
Very Low	0	0	0	0	0
Zone 3					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	2,439	0	100	48	87
Low	40,117	0	44	57	86
Very Low	10	0	100	0	26
Zone 4					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	789	0	100	0	89
Low	1,772	0	55	0	93
Very Low	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, 100 percent of these areas would be precluded from surface disturbance.

As shown in **Table 4.15-9**, High SIO areas within Zone 1 would receive full coverage from the High Scenic Integrity Objective NSO. The remainder of Zone 1 areas would be fully precluded from surface disturbance through any NSOs. Resource-specific CSUs would provide full coverage to Moderate SIO areas in Zones 2, 3 and 4, as well as Very Low SIO areas in Zone 3. The majority of remaining SIO areas in Zones 2, 3 and 4 are covered by NSO stipulations. As discussed in Section 4.15.3, the extent to which SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 3 includes 413 wells on 60 well pads, resulting 886 acres of short-term disturbance and 384 acres of long-term surface disturbance. Potential impacts are described in Section 4.15.3. The site-specific location of development would play a role in determining the impacts to scenic resources. In areas of lower scenic importance and sensitivity, future oil and gas exploration activities are not anticipated to substantially impact scenic resources in the area if BMPs

are applied during design and construction. In areas of higher scenic importance and sensitivity, the degree to which these resources would be affected would be dependent on factors such as slope, aspect, terrain and vegetation in and around the site-specific location; and the amount of contrast between the natural and constructed landscape. Impacts may be short-term to long-term with minor to major adverse effects. Alternative 3 has one NSO stipulation and two CSU stipulations specific to scenic resource, but resource-related and other NSO stipulations (if implemented) would constrain development of the RFDS in some areas of higher scenic importance and sensitivity. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic researches within leases. These would be examined during the site-specific development phase. The potential for impacts to scenic resources is described by zone below.

Within Zone 1, Class B and High SIO areas are present in approximately 95 percent of the 10,114-acre zone. Approximately 43 percent of the zone is a User Concern Level 1 area (Middleground and Background distance zones) and 25 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells in this zone.

The Zone 1 RFDS comprises 36 wells on 5 well pads (78 acres of short-term and 33 acres of long term surface disturbance). Resource-specific and resource-related NSOs would effectively prevent development within this lease zone. Additional NSOs overlaying these stipulations also would prevent development in portions of the lease zone. If some NSO stipulations are exempted to the degree that some or all of the RFDS may be developed on the leases, the resulting surface disturbance would comprise about 1 percent of the lease zone, and would likely occur within CRAs. Impacts would vary depending on the exempted stipulations, but development would be inconsistent with the Forest Plan in Very High, High, and potentially Moderate SIOs (which comprise over 98 percent of the lease zone) even if design criteria, mitigation measures, and BMPs are implemented.

Within Zone 2, Class B and Moderate SIO areas are present in over 80 percent of the 24,938-acre zone. Approximately 65 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 27 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Zone 2 contains 73 existing wells on 13 well pads, generally spread throughout the lease zone.

The Zone 2 RFDS comprises 319 total wells on 46 well pads, (684 acres of short-term and 296 acres of long-term surface disturbance). Resource-specific NSOs would not preclude surface disturbance, and any or all of the RFDS could be developed in the leases areas. With consideration of only resource-related NSOs, any or all of the RFDS could still occur in Class B areas, User Concern Level 1 and 2 areas, and Moderate and Low SIOs; however, the majority of CRAs would be precluded from surface disturbance (see Section 4.12, Special Designations). If all NSO stipulations were implemented, most of the lease area would be almost fully covered against surface disturbance. If NSO situations are waived to the extent that the RFDS were to be developed on-lease, RFDS development would result in long-term surface disturbance in approximately about 1 percent of the lease zone. Impacts would vary depending on the location of exempted stipulations. Development may not represent a significant change to the overall landscape character within this zone if located in areas of lower scenic importance and sensitivity (Low SIO) and in areas where other well development is present, but that may not be practicable on leases that are predominately Moderate SIOs. Development in Moderate SIOs may be inconsistent with the Forest Plan even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 3, Class B and Low SIO areas are present in over approximately 95 percent of the 42,766-acre zone. Approximately 86 percent of the zone is a User Concern Level 1 area

(Foreground, Middleground, and Background distance zones) and 14 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are 2 existing wells and 3 well pads in this zone, all in the western portion of the lease zone (outside of the Thompson Divide area).

The Zone 3 RFDS comprises 49 total wells on 7 well pads (104 acres of short-term and 45 acres of long-term surface disturbance). Resource-specific NSOs would not preclude development of the RFDS in any lease area; however, the High Concern Travelways/Use Areas CSU would be applied to 100 percent of Moderate SIOs, 95 percent of Class A areas and 49 percent of Class B areas, 44 percent of Low and 100 percent of Very Low SIOs, and 100 percent of User Concern 1 foreground distance zones. The area covered by this stipulation would include the majority of the leases surrounding the Sunlight Ski Area, as well as the portions of CR-313 and CR-300.3 discussed under Alternative 1, but the stipulation coverage would be greatly expanded.

With consideration of only resource-related NSOs, any or all of the RFDS could still occur in some Class B areas and Moderate, Low, and Very Low SIOs. Development would not be permitted in most user concern levels and distance zones and CRAs (see Section 4.12, Special Designations). Under the coverage of any NSO stipulations, the potential for surface disturbance would be more limited but could still occur in Moderate, Low and Very Low SIOs. Some portions of the leases closest to the areas of concern discussed under Alternative 1 (Sunlight Ski Area, Jerome Park conservation easement, Crystal River Valley, Mt. Sopris) would be covered by NSO stipulations. The leases in the northeastern portion of the zone (closest to the Roaring Fork Valley and Carbondale) would generally not have NSO stipulation applied to them but would be covered by CSU stipulations. The lease area surrounding the Thompson Divide Road would be largely covered by CSU stipulations, and some nearby areas could be covered by any NSOs.

If fully developed on-lease, the Zone 3 RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. This would represent a large increase in the number of wells and a moderate increase in the number of well pads. This development, along with increased transportation, may affect the general landscape character within this zone, particularly within the Thompson Divide, unless located in areas of lower scenic importance and sensitivity (e.g., Low SIOs, which comprises about 90 percent of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas (which collectively comprise about 10 percent of the lease zone) even if design criteria, mitigation measures, and best management practices are implemented. However, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located.

Within Zone 4, Class B areas are present on over 99 percent of the 2,562-acre zone. Approximately 30 percent is a Moderate SIO area; the remainder of the lease zone is Low SIOs. Approximately 60 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 40 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells in the lease zone.

The Zone 4 RFDS comprises 10 total wells on 1 well pad (21 acres of short-term and 9 acres of long-term surface disturbance). Resource-specific NSOs would not preclude surface disturbance in any area of the lease zone; however, resource-specific CSUs would be applied to all Moderate SIOs, 50 percent of Low SIOs, most Class B areas, and all User Concern 1 and 2 foreground distance zones. With consideration of all other NSO stipulations, any or all of the RFDS could still occur in Moderate and Low SIOs and Class B areas. RFDS development would comprise less than 1 percent of the lease zone, and given the low number of wells and well pads, would minimally affect the landscape character. Development may be inconsistent with the Forest Plan in Moderate SIOs; however, given the low number of proposed wells, it is assumed that Moderate SIOs can be avoided.

4.15.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Alternative 4 is the Proposed Action and modifies or cancels the existing leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Final EIS. NSO and CSU stipulations for scenic resources under Alternative 4 would be the same as discussed for Alternative 3, except that all or part of 25 leases in eastern portion of Zone 3 would be cancelled. For the leases that are not cancelled under Alternative 4, the stipulations and potential for future oil and gas development would remain the same as those discussed under in Alternative 3.

Scenic Attractiveness

Table 4.15-10 displays the percentage of Scenic Attractiveness classes within the leases that would be cancelled under Alternative 4.

Table 4.15-10 Scenic Attractiveness within Cancelled Leases under Alternative 4

Scenic Attractiveness Class	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
A	1,088 / 3	100
B	27,370 / 64	66
Total	**28,458 / 67**	**—**

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. Less than 1 percent of this area would be cancelled under this alternative.

Landscape Visibility

Table 4.15-11 displays the percentage of Landscape Visibility within cancelled leases.

Table 4.15-11 Landscape Visibility within Cancelled Leases for under Alternative 4

User Concern Level, Seen Area and Distance Zone	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
Foreground 1	3,411 / 8	52
Middleground 1	10,241 / 24	52
Background 1	9,505 / 22	89
Foreground 2	3,218 / 7	87
Middleground 2	1,297 / 3	68
Background 2	173 / <1	56
Foreground 3	136 / <1	93
Middleground 3	145 / <1	99
Background 3	2 / <1	100
Total	**28,127 / 65**	**—**

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. Less than 1 percent of the GMUGNF lease area would be cancelled under this alternative.

Scenic Integrity Objectives

Table 4.15-12 displays the percentage of SIOs covered by cancelled leases under Alternative 4. There are no Very High or High SIOs within Zone 3.

Table 4.15-12 Scenic Integrity Objectives within Cancelled Leases under Alternative 4

SIO Category	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
Moderate	2,437 / 6	100
Low	25,981 / 6	65
Very Low	10 / <1	100
Total	**28,428 / 67**	**-**

Note: Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. Less than 1 percent of the GMUGNF High/Moderate area would be cancelled under this alternative

As shown in **Tables 4.15-10**, **4.15-11**, and **4.15-12**, the majority of Scenic Attractiveness, Landscape Visibility, and SIO areas in Zone 3 would generally be precluded from surface disturbance with the cancellation of leases under Alternative 4. As discussed in Section 4.15.3, the extent to which these three scenic resource categories could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 4 comprises 383 wells on 55 well pads, resulting 821 acres of short-term disturbance and 356 acres of long-term surface disturbance. Potential impacts are described in Section 4.15.3. Under Alternative 4, all or part of 25 leases in eastern portion of Zone 3 would be cancelled. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic resources within leases. Lease cancellations are therefore assumed to maintain scenic quality to a greater degree than NSO stipulations. The potential for impacts to scenic resources is described by zone below.

Within Zone 1, Zone 2, and Zone 4, the RFDS and impacts would be the same as under Alternative 3.

Within Zone 3, all or part of 25 of the leases would be cancelled in the eastern portion of the zone. These leases are closest to many of the areas of concern identified during scoping (CRAs, Sunlight Ski Area, Jerome Park conservation easement, Roaring Fork Valley, Crystal River Valley, Mt. Sopris, etc.). The Zone 3 RFDS would be reduced to 18 wells on 3 well pads (39 acres of short-term and 17 acres of long-term surface disturbance).

Within the remaining Zone 3 leases, resource-specific NSOs would not preclude on-lease development of the RFDS; however, the High Concern Travelways/Use Areas CSU would be applied to 100 percent of Moderate SIOs; 95 percent of Class A areas and 49 percent of Class B areas (as well as 44 percent of Low and 100 percent of Very Low SIOs; and 100 percent of User Concern 1 foreground distance zones. The area covered by this stipulation would include portions of CR-313 and CR-300.3, West Divide Creek, Flattop Mountain and other areas.

With consideration of resource-related NSOs, any or all of the RFDS could still occur in some Class B areas and Moderate, Low, and Very Low SIOs, while most user concern levels and

distance zones would be precluded from development. Most CRAs would be covered by NSO stipulations (see Section 4.12, Special Designations). With consideration of any NSO stipulation, surface disturbance would be more limited but could still occur in Moderate, Low, and Very Low SIOs. If fully developed on-lease, the RFDS would result in long-term surface disturbance in less than 1 percent of the lease zone. The development would represent a small increase in the number of well pads and a moderate increase in the number of wells, and would be located within some existing oil and gas development. This development may affect the general landscape character unless located in areas of lower scenic importance and sensitivity (e.g., Low SIO, which comprises the majority of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas; however, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located.

4.15.4.5 Alternative 5

Alternative 5 would cancel all 65 existing leases, and would plug and abandon existing wells; remove infrastructure; reclaim roads, well pads, and other ancillary facilities; and revegetate all areas of surface disturbance. The activities associated with well abandonment and reclamation would create 86 acres of surface disturbance.

There would be no future development under this alternative; however, there would be impacts to scenic resources from the surface disturbance required to plug and abandon the existing wells and reclaim any associated infrastructure. This alternative would require the plugging and abandonment of 75 wells and removal of all ancillary equipment (tanks, burners, etc.), as well as the reclamation and revegetation of 16 well pads and approximately 48 acres of access roads. All disturbances would occur in lease Zones 2 and 3; no surface disturbance would occur in Zones 1 and 4. Impacts would be similar to temporary construction impacts described in Section 3.15.3.

4.15.4.6 Summary of Impacts

<u>Alternative 1 (No Action)</u>

Under Alternative 1 there would be no resource-specific NSO stipulations. There would be one resource-specific CSU. Within Zone 1, if all NSOs were implemented, no portion of the RFDS (36 total wells on 5 well pads) could be developed on the leases. Within Zone 2, if all NSOs were implemented, it is anticipated that any or all of the RFDS (319 total wells on 46 well pads) could occur in Moderate and Low SIOs. Within Zone 3 there would still be potential for a portion of the RFDS (52 total wells on 7 well pads) to occur in High/Moderate, Moderate, and Low SIOs. A CSU designation specific to scenic resources would be applied to portions of Four-Mile Road and other travel routes. Within Zone 4, standard lease terms would allow on-lease development of the RFDS (10 wells on 1 well pad) in Moderate and Low SIOs. Development in Moderate SIOs may be inconsistent with the Forest Plan, and on some leases in Zone 2, it may not be possible to locate all new development within areas of lower scenic importance and sensitivity. In Zones 3 and 4, most leases contain areas with Low SIOs in which development would potentially be located.

<u>Alternative 2</u>

Alternative 2 would have the same potential impacts as Alternative 1 within Zones 1, 2, and 4. Within Zone 3, a CSU designation to specific to scenic resources would be applied to an additional portion of Four-Mile Road, and an NSO stipulation would be applied to a portion of the lease closest to Sunlight Ski Area. Impacts to the key areas identified in scoping comments would be similar to Alternative 1 except that scenic quality in the Foreground 1 areas along Four-Mile Road and the Middleground1 distance zone within the lease closest to Sunlight Ski Area would be better maintained through application of CSU and NSO stipulations.

Alternative 3

Under Alternative 3, there would be resource-specific NSO and CSU stipulations. Within Zone 1, resource-specific and general NSOs would not permit surface disturbance on most of the lease area. Any development of the RFDS (36 wells on 5 well pads) would have to occur off-lease. Within Zone 2, no resource-specific NSOs would constrain development; however, if implemented, general NSOs would preclude surface disturbance in most of the lease area. Development of the RFDS (319 total wells on 46 well pads) would likely have to occur off-lease. Within Zone 3, resource-specific NSOs would not preclude surface disturbance. General NSOs, if implemented, would not permit surface disturbance in portions of the lease area, but development of the RFDS (49 total wells on 7 well pads) could still occur in Moderate, Low, and Very Low SIOs. The High Concern Travelways/Use Areas CSU would be applied all Moderate and Very Low SIOs and in 44 percent of Low SIOs. Within Zone 4, the High Concern Travelways/Use Areas CSU would cover most high quality scenic resources, but the RFDS (10 wells on 1 well pads) could still occur in Moderate and Low SIOs.

Alternative 4 (Proposed Action)

Alternative 4 would have the same potential impacts as Alternative 3 within Zones 1, 2, and 4. Within Zone 3, 25 leases in the eastern half of the zone would be cancelled. The cancelled leases would be located in areas identified during scoping as having high scenic value. The High Concern Travelways/Use Areas CSU would cover most high quality scenic resources in the remaining Zone 3 leases, but the RFDS (18 wells on 3 well pads) could still occur in some Class B areas and Moderate, Low, and Very Low SIO areas.

Alternative 5

Under Alternative 5, there would be temporary impacts to scenic resources from the process of plugging and abandoning the 75 existing wells, reclaiming roads and well pads, and decommissioning ancillary facilities. The alternative would have 85 acres of short-term surface disturbance, but scenic resources would be maintained or improved over the long term.

Comparison

Alternative 1, the No Action Alternative, offers the least coverage of high scenic value resources. Alternative 5 offers the greatest opportunity to maintain or improve high scenic value resources over the long term through cancellation of all leases. Of the Alternatives proposing development, Alternative 4 offers the most coverage of high scenic value resources (through lease cancellations and application of resource-specific NSOs), followed by Alternative 3 (application of resource-specific NSOs) and Alternative 2 (which has slightly more coverage than Alternative 1).

Within each alternative, the small portion (approximately 2 percent) of GMUGNF land present within the lease area has a low potential for oil and gas development. In addition, if development were feasible, NSO and CSU stipulations would provide full coverage for all Scenic Attractiveness and Landscape Visibility classifications for each alternative. SIO coverage within the GMUGNF would follow the same impact analysis as discussed for the WRNF. Due to these factors, the development of the RFDS in the GMUGNF is unlikely.

4.15.5 Cumulative Impacts

4.15.5.1 Cumulative Impacts Analysis Area

The cumulative impacts analysis area (CIAA) for scenic resources is composed of the 65 lease areas (lease area), which are divided into four zones (Zone 1, 2, 3, and 4) and encompasses approximately 80,380 acres. The CIAA does not extend past the borders of these leases, and any scenic features beyond these boundaries have not been considered.

4.15.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and ongoing actions in the analysis area that influence scenic conditions may include road development, construction and maintenance of trails, off-highway vehicle use, the effects of water uses (stream diversion, reservoirs and dams, ditches, and spring developments), recreation use, livestock grazing and infrastructure such as fences and ponds, prescribed fire, timber harvest, invasive species, and mineral and energy development. Past and present actions with quantifiable surface disturbance primarily include fluid and solid mineral development, road development, and ROWs for pipelines and telephone lines. Within the CIAA for scenic resources, oil and gas development has impacted 38 acres, transportation corridors have impacted 91 acres, and ROW development has impacted 325 acres.

As discussed in Section 3.15, the forms, lines, colors, and textures of the landscape are mostly consistent with the natural scenery of the landscape, but are contrasted with ranches, residences, and existing oil and gas development. Other activities affecting the scenic landscape include sparsely distributed range improvements and unimproved roads associated with livestock grazing and range management. In addition, the analysis area is intersected by multiple transportation corridors (roadways and trails) that provide routes for the public to access the scenic and recreational resources within the analysis area.

Reasonably Foreseeable Future Actions

RFFAs are those for which there are existing decisions, funding, formal proposals, or which are highly probable based on known opportunities or trends.

RFFAs in the analysis area with the potential to influence scenic integrity include continued recreation; agricultural use and livestock grazing; prescribed burning and vegetation/habitat treatments management; timber harvests; and other infrastructure development such as roadway construction and decommissioning, pipeline construction, transmission line development, large culvert replacements, and communication sites. RFFAs with quantifiable surface disturbance or treatment acreage are summarized in Section 4.1 and are described in detail in **Appendix B**. There are no identified oil and gas–related or other surface-disturbing RFFAs within the Lease Area CIAA. There is an estimated 6,000 acres of proposed vegetation treatments within the Lease Area CIAA under the South Rifle Habitat Enhancement Project. Treatments include cutting sagebrush, oakbrush, and mountain shrub and prescribed fire for aspen, pinyon-juniper, and Douglas fir. Vegetation treatments designed to improve ecological conditions could indirectly enhance visual resources on a localized basis. However, in the short term, methods such as mechanical treatments or prescribed fire would directly create visual changes to landscape form, line, color, and texture. Impacts would range from minor to moderate, depending on the scope and magnitude of treatment and the methods used. In the long term, the potential for cumulative effects to scenic resources is anticipated to be minimal, as proposed treatments would affect about 7 percent of the analysis area and may ultimately enhance visual resources. All vegetation treatments on the WRNF lands would need to comply with 2002 Forest Plan.

4.15.5.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

With consideration of the 454 acres of past and present surface disturbance, the Proposed Action and Alternatives would contribute between 0 (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long term surface-disturbing activities within the CIAA. If selected, Alternative 5 could have countervailing effects on visual resources, through eliminating some past oil and gas-related disturbance.

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4.16 Hazardous Materials and Human Health and Safety

4.16.1 Hazardous Materials and Solid Waste

4.16.1.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for hazardous materials and solid waste consists of the individual lease tracts and routes that would be used for the transportation of hazardous materials.

Scoping Issues

The following issues concerning hazardous materials and solid waste submitted by cooperating agencies and the public during scoping:

- Types and amounts of hazardous materials that will be used for drilling, hydraulic fracturing, and other aspects of oil and gas development.
- Methods to be used for transportation, storage, and use hazardous materials (including drilling and fracturing processes) to reduce risk of adverse impact to physical, biological, and other resources).
- Methods to be used for disposal of contaminants, including produced water.
- Contingencies to handle unexpected contaminations such as naturally occurring radioactive materials or accidental spills and releases.

While the above issues are addressed in general terms, the qualitative nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Methods of analysis are discussed below. Hazardous Materials issues would be addressed at the APD stage of permitting, when NEPA analysis of a site-specific Plan of Development would be required.

Assumptions

Assumptions to be used in the analysis of impacts resulting from hazardous materials include the following:

- The magnitude of potential impacts will be generally proportional to the level of oil and gas exploration and production activity.
- Operators would comply with all laws and regulations related to hazardous materials.

Impact Indicators

The main impact indicators for hazardous materials and solid waste would be statistical data indicating expected number of accidents, releases, incidents per well/mile pipeline/miles of road or other salient indicator.

Methods of Analysis

For the analysis of hazardous materials, the methodology includes the following:

- Review the proposed activities (as identified in the RFDS) and identify potential for hazardous materials that would be utilized or produced or solid waste generated; describe how and where hazardous materials would be utilized during construction, drilling, and production operations.

- Describe the relationship between leasing stipulations and resource of concern to identify areas where hazardous material use would not be allowed.
- Apply statistical data indicating expected number of accidents, releases, incidents per well/mile pipeline/miles of road or other salient indicator to projected development.
- Review and summarize applicable rules concerning the transport, storage, handling and disposal of hazardous materials and solid waste. Describe how oil and gas operations would comply with all applicable regulations.

4.16.1.2 Stipulations Addressing Hazardous Materials

There are no stipulations that deal specifically with hazardous materials and solid waste.

4.16.1.3 Impacts Common to All Alternatives

Hazardous materials and solid waste have the potential to impact water and soil resources due to spills and mishandling of those materials.

Transport and Storage of Hazardous Materials

As outlined in Chapter 3.0, **Table 3.16-1** (Potentially Hazardous Materials Used or Stored in Typical Oil and Gas Well Drilling, Completion, and Production Operations), there are a large variety of hazardous materials are used or stored in oil and gas drilling and production. While amounts are not known, it is expected that the amount of many of hazardous materials would exceed threshold planning quantities. Types of chemicals or materials that may be trigger reporting requirements include cement and associated additives; silica; shale control additives; drilling mud and associated additives; deflocculants; lubricants; alkalinity and ph control material; produced hydrocarbons; and fuels. Where facilities meet the storage threshold for fuels and lubricants, operators would maintain a certified SPCC Plan that would define the procedures, responses, and cleanup in case of a spill of petroleum-based materials. Any release in excess of a reportable quantity would be reported to according to USEPA, COGCC, BLM, and Forest Service procedures.

Hazardous materials and substances used for drilling and completion would be transported to well sites by trucks and stored in compliance with applicable rules and regulations. Per BLM SPCC regulations, all storage tank batteries, treaters, dehydrators, and other production facilities that have the potential to leak or spill any oil, glycol, or other fluid that may constitute a hazard to public health or safety would be surrounded by an appropriate secondary containment system capable of holding the entire contents of the largest single tank in use plus freeboard, or to contain a minimum of 110 percent of the capacity of the largest vessel, or placed on or within a diversionary structure to prevent spilled or leaking fluid from reaching groundwater or surface waters. The appropriate containment and/or diversionary structures or equipment would be constructed to help prevent discharges from a primary containment system from draining, infiltrating, or otherwise escaping to ground or surface water prior to completion of cleanup. Other requirements to reduce the risk of contamination to the environment from drilling and completion activities include requirements for well casing to eliminate interactions between well holes and surrounding groundwater near the surface; blowout preventers to control the release of subsurface fluids; and liners for pits containing process water, drilling fluid, and drill cuttings.

Produced Water

Produced water and liquid condensate would be disposed of by trucking or piping the water to an authorized disposal well but also may be utilized in hydraulic fracturing operations. Disposal would be determined during the APD process. It is estimated that when the field is mature each vertical or directionally drilled well would produce approximately 38,000 barrels of fluids (water and condensate) over the life of the well and that each horizontally drilled well would produce approximately 75,000 barrels of fluids (water and condensate) over the life of the well.

Spill and Release Data

Recent released statewide statistics indicate that while although oil and gas activity and the number of spill incidents have increased, the total of volume of oil spilled in 2014 was similar to 1999 in volume, and spillages in terms of the percent of total volume produced has decreased (now at 0.003 percent of the volume of oil produced (COGCC 2015a). During that same time period, spills of produced water decreased both in amount (reduced by over 50 percent) and by percent of volume produced (now at 0.005 percent of the total volume of produced water; COGCC 2015a). In 2014, the U.S. Department of Transportation (USDOT)-Pipeline & Hazardous Materials Safety Administration (PHMSA) reported 2,485,426 miles of gas gathering, distribution and transmission pipelines in the U.S. and 305 ”significant incidents” (defined as those with a fatality or injury requiring in-patient hospitalization; $50,000 or more in total costs, measured in 1984 dollars; highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; or liquid releases resulting in an unintentional fire or explosion; (USDOT 2015). This translates into an incident rate of 0.0001 incidents per mile per year. Using this incident rate, there would statistically need to be about 8,200 miles of pipeline constructed as part of the development of the existing leases before one incident would occur. The RFDS for the existing leases does not include an estimate of miles of pipeline, however, the 2004 Final EIS estimated approximately 1 mile of pipeline per wellpad (USFS 2014a, page 200). For the purposes of a comparative analysis, this estimate is used in Section 4.16.1.4, Impacts by Alternative.

Naturally Occurring Radioactive Materials

As noted in Chapter 3.0, very few domestic oil and gas wells in Colorado have been identified as having oil-field naturally occurring radioactive materials (NORM) wastes (or technologically enhanced NORM [TENORM]) (USEPA 2015g). Earlier studies noted that TENORMs resulting from produced water and oil-field equipment within the analysis area is at background or marginally detectable (USGS 1999). As a result, TENORM from oil and gas production is thought to be low in the analysis area. However, as noted in Section 3.3, Geology and Minerals, there are numerous uranium occurrences in Township 2 North (T2N), Range 92 West (R92W), where the Zone 4 lease is located, which may increase potential of encountering NORM.

There currently exist no Federal regulations that specifically address the handling and disposal of TENORM. Increased industry awareness and understanding of the problem also has provided better control of TENORM and have reduced the radiation exposure to workers and the public. The USEPA identified the following current BMPs for handling TENORM:

- Sludges containing elevated TENORM are dewatered and held in storage tanks for later disposal.
- Produced waters are reinjected into deep wells. No added radiological risks appear to be associated with this disposal method as long as the radioactive material carried by the produced water is returned in the same or lower concentration to the formations from which it was derived.
- Pipes contaminated with scale are cleaned at pipe yards either by sandblasting them with high pressure water or by scraping out the scale with a rotating drill bit. The removed scale is then placed in drums and stored for later disposal.
- Contaminated equipment may be cleaned and reused by the petroleum industry; disposed; or, if radiation levels are sufficiently reduced, sold for recycle. If equipment cannot be further decontaminated to acceptable levels, it is sent to a landfill licensed to accept NORM materials.
- In some cases contaminated steel may be reprocessed via smelting. During the smelting process molten steel separates from the NORM, which vaporizes and is released as a gas. If the steel mill has pollution control equipment, most of the NORM is trapped in the baghouses and scrubbers. A typical smelting operation is capable of capturing 99 percent of the particulate releases (USEPA 2015g).

Both the oil and gas industry and state regulatory agencies are currently examining and regulating TENORM in oil and gas production facilities (USEPA 2015g).

Solid Waste

Solid waste would be disposed of according to the process that generated the waste. For instance, Exploration and Production exempt waste not injected into disposal wells will be disposed at permitted off-site disposal facilities. Other wastes (trash, rubbish, garbage) will be appropriately containerized and disposed of in off-site in a municipal solid waste landfill. Particular care would be taken to prevent scavenging by wildlife while such waste is on location.

4.16.1.4 Impacts by Alternative

The following provides a comparison that the different alternatives would have on impacts on hazardous materials and public health and safety.

Alternative 1 (No Action Alternative)

Stipulation Coverage

There are no stipulations under Alternative 1 concerning the handling of hazardous materials and solid waste. There may be NSO stipulations that would preclude gas development activities within portions of the leases. However, gas development may still be accomplished from surface locations outside of an NSO area. There is therefore no lessening of the risk of spills and releases; potential impacts would just be removed from the analysis area.

Impacts from Projected Future Oil and Gas Development

In the absence of stipulations, gas development activities associated with 417 wells on 60 wellpads would be carried out in accordance with applicable rules and regulations. Using the 2014 Final EIS estimate of 1 mile of pipeline per wellpad, there would be approximately 60 miles of pipeline required to develop the existing leases. With application of the spill rates described above, development of the RFDS would result in 0.007 significant pipeline incidents per year. Over a 30-year lifespan of the RFDS, assuming a continuation of the same incident rate, there would be 0.22 significant incidents. There would be an estimated 692,626,365 gallons (16,491,104 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 825 barrels of spilled produced water over the 20- to 30-year life span of the wells. Compliance with regulations and best management practices for the transportation and use of hazardous materials would lower the risk from spills and releases. Disposal of solid waste in accordance with applicable rules would reduce the potential for impacts to soil and water and public health and safety.

Alternative 2

Stipulation Coverage

Same as Alternative 1, but there would be slightly more NSO leasing stipulations that would preclude gas development activities within portions of the leases.

Impacts from Projected Future Oil and Gas Development

Same as Alternative1, but there would be approximately 416 wells developed on 60 well pads. Pipeline incident rates and produced water spill rates would be the same as under Alternative 1.

Alternative 3

Stipulation Coverage

There are no specific stipulations under Alternative 3 concerning the handling of hazardous materials and solid waste. There is an NSO stipulation for Public Water Supply Source Areas that would preclude surface disturbance within 2,300 feet on either side of a designated surface water source (extending upstream five miles from the intake location) and within a 1.5-mile radius of a designated well or similar feature serving as a public water supply (also see Section 4.5, Water Resources). There also is an NSO stipulation for WIZ that would preclude disturbance within the WIZ of perennial and intermittent streams, lakes, wetlands, and naturally occurring ponds (defined as a minimum horizontal width of 100 feet from each side of the water-dependent feature, but which may be wider in areas with well-developed floodplains). The groundwater CSU stipulation may require special analysis and mitigation plans for proposed activities where specific groundwater resources exist, including contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities; however this stipulation covers a relatively small amount of acreage as compared to the total lease acres in the four zones (**Tables 4.5-3** and **4.5-4**). It is important to note that if gas development is accomplished from surface locations outside of an NSO area, there is no lessening of the risk of spills and releases; potential impacts are just removed from the analysis area.

Impacts from Projected Future Oil and Gas Development

In the absence of NSO stipulations, gas development activities associated with 413 wells on 60 wellpads would be carried out in accordance with applicable rules and regulations. Regardless of other NSO stipulations, surface disturbance would be precluded near Public Water Supply Source Areas and WIZ. Additional mitigation would be required in areas with a CSU groundwater stipulation. Mitigations would be determined on a site-specific basis but could include contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface would not be allowed.

Pipeline incident rates would be the same as under Alternative 1. There would be an estimated 687,758,400 gallons (16,375,200 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 786 barrels of spilled produced water over the 20- to 30-year life span of the wells.

Alternative 4 (Proposed Action)

Stipulation Coverage

There are no specific stipulations under Alternative 4 concerning the handling of hazardous materials and solid waste. There are NSO stipulations for Public Water Supply Source Areas and WIZ and a CSU stipulation for Groundwater (all described under Alternative 3). As with Alternative 3, if gas development is accomplished from surface locations outside of an NSO area, there is no lessening of the risk of spills and releases; potential impacts are just removed from the analysis area; however, the cancellation of 25 leases under this alternative would eliminate any potential for spills in and around Zone 3 leases, and the reduction of overall development (a reduction in the total number of wells from 416 to 383), would statistically lower the risk of spills and releases overall.

Impacts from Projected Future Oil and Gas Development

In the absence of stipulations, gas development activities associated with 383 wells on 55 wellpads would be carried out in accordance with applicable rules and regulations. Surface disturbance would be precluded near Public Water Supply Source Areas and WIZ. Additional mitigation would be required for areas with a CSU groundwater stipulation. Mitigations would be determined on a site-specific basis but could include contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface would not be allowed.

Using the 2014 Final EIS estimate of 1 mile of pipeline per wellpad, there would be approximately 55 miles of pipeline required to develop the existing leases. With application of the spill rates described in Section 4.16.1.3. Impacts common to All Alternatives, development of the RFDS would result in 0.0067 significant pipeline incidents per year. Over a 30-year lifespan of the RFDS, assuming a continuation of the same incident rate, there would be 0.20 significant incidents. There would be an estimated 687,758,400 gallons (16,375,200 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 786 barrels of spilled produced water over the 20- to 30-year life span of the wells.

Alternative 5

Under Alternative 5, all leases would be cancelled. Existing wells would be plugged and abandoned. Although there is risk of release of hazardous materials during reclamation, this alternative minimizes the risk of spills and releases over the long term. Reclamation would have to be conducted in a manner that would not increase the risk of hazardous materials releases. As with the other alternatives, activities would be carried out in accordance with applicable rules and regulations, BMPs, and conditions that may be imposed by the authorizing officer.

Impact Summary

Activities conducted under any of the alternatives carry risks of spill and releases of hazardous materials and solid waste. In the absence of stipulations, activities would be carried out in accordance with applicable regulatory programs. The No Action Alternative would statistically present the greatest risk for spills, followed by Alternatives 2, 3, 4, and 5. The risks are much less under Alternative 5 in compared with the other four alternatives since the major hazardous material that would be used would be petroleum fuels and other chemicals and materials used in gas production would not be present.

4.16.1.5 Cumulative Impacts

Cumulative Impacts Analysis Area

As shown on **Table 2.7-1**, the CIAA for hazardous materials is the 65 existing leases and the routes that would be used for the transportation of hazardous materials.

Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions and RFFAs are described in detail in Section 2.7 and in **Appendix B**. There are no additional oil and gas development proposed within the leases, but it is projected that 50,166 wells will be drilled on 6,830 pads across the WRNF and within the BLM CRVFO, GJFO, and WRFO. Development of these wells may use same road network as the Proposed Action and Alternatives for the transportation of hazardous materials.

Contribution of Proposed Action and Alternatives to Cumulative Impacts

Gas development associated with both reasonably foreseeable future actions and the alternatives would contribute an additional risk of hazardous material and solid waste contamination, as well as safety concerns in the CIAA. However, gas well operators would be required to comply with applicable rules and regulations which would reduce the risk of spills and releases.

4.16.2 Human Health and Safety

4.16.2.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for this analysis comprises the individual lease tracts and routes that would be used for the transportation of hazardous materials.

Scoping Issues

The following issues were submitted by cooperating agencies and the public during scoping:

- Protection of public health and safety in and around the analysis area.
- Cumulative and combined impacts of potential exposures to hydraulic fracturing fluids, produced water, hydrocarbons, priority air pollutants associated with equipment operations, VOCs, fine particulates, and ground-level O_3.
- Impacts to emergency and health care services.
- Increased noise due to reasonably foreseeable development.
- Accidental wildfires caused by construction equipment or workers or well explosions or other causes; hazards faced by wildland firefighters responding to fires in industrial interface created by additional wells.

While the above issues are addressed in general terms, the qualitative nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Methods of analysis are discussed below. Human Health and Safety issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Assumptions

- Operators would comply with all laws and regulations related to hazardous materials.
- The magnitude of potential impacts would be generally proportional to the level of oil and gas exploration and production activity.

Impact Indicators Used for Analysis

- Statistical data indicating expected number of accidents or other salient indicator;
- Estimated average level of noise and attenuation information;
- Socioeconomic information regarding impact to emergency services; and
- Acres of disturbance.

Methods of Analysis

- Human Health Impacts: Qualitative discussion of studies and conclusions, relative comparison of development levels and leasing stipulations related to air quality, surface water and groundwater quality, and public water supplies, by alternative.
- Transportation Safety: relative comparison of transportation needs by alternative.
- Worker Safety: qualitative discussion of risks associated with oil and gas industry.
- Fire: qualitative discussion of risks associated with oil and gas development and BMPs that are typically imposed at the site-specific (APD) level as COAs to minimize these impacts; relative comparison of transportation needs by alternative.
- Noise: qualitative discussion of typical decibel levels associated with oil and gas development, attenuation information and BMPs that are typically imposed at the site-specific (APD) level as COAs to minimize these impacts.
- Emergency Services: Summary of socioeconomic analysis.

4.16.2.2 Stipulations Providing Protections to Human Health and Safety

There are no existing or proposed stipulations under any alternative that relate specifically to human health and safety. However, the NSO stipulation for Public Water Supply Source Areas included under Alternatives 3 and 4 would provide a level of protection to public water supply source areas as defined by the State of Colorado's Source Water Assessment and Protection (CSWAP) program areas by prohibiting or limiting surface occupancy or use within 2,300 feet from each side of a designated surface water source and extending 5 miles upstream from the intake location. For groundwater sources, the NSO stipulation is extended to all areas within a 1.5-mile radius of a designated public water supply well or similar feature serving as a public water supply. Additionally, a CSU stipulation for groundwater resources included under Alternatives 3 and 4 specifies special design, construction, operation, mitigation, or monitoring may be required where specific groundwater resources exist. These consist of aquifers used as defined by the USEPA under the Safe Drinking Water Act as groundwater used as a municipal water supply, currently being used as a source of drinking water (i.e., domestic water wells), or with less than 10,000 parts per million total dissolved solids; also see discussion of Underground Sources of Drinking Water contained in Section 4.5, Water Resources). Mitigation may include use of contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities, and disposal of wastewater into the subsurface would not be allowed.

All NSO stipulations would prohibit or limit surface development in the area to which the stipulation applies and may provide additional protections to human health and safety in those areas. Because CSU and TL stipulations generally provide restrictions to address only the specific resources for which they were developed, they are not assumed to necessarily minimize potential impacts to human health and safety and are not considered in this analysis.

4.16.2.3 Impacts Common to All Alternatives

Impacts to human health and safety from the leasing action alternatives would not occur from the approval of leases, but could occur upon additional approval(s) that allowed for the physical development of the leases. Although the types of impacts that may occur from oil and gas development are summarized below, the locations and timing of specific development is not known and cannot be predicted through the leasing action. Therefore, this section discloses the potential risks that are posed through the leasing action, and analyzes the type and level of leasing stipulations provided by each alternative.

<u>Health Impacts from Oil and Gas Development</u>

- In recent years, public concern has become heightened regarding emissions of chemicals to the atmosphere in conjunction with oil and gas production and potential contamination of freshwater aquifers, domestic or municipal water wells, and surface waters, particularly in relation to hydraulic fracturing. Similar concerns also have been expressed more generally in relation to oil and gas development. The following sections summarize information contained in the 2014 CRVFO Proposed RMP/Final EIS (BLM 2015k) regarding five studies related to health impacts from oil and gas development in or near the leasing area (Colborn et al. 2010; CDPHE 2010; Coons and Walker 2008; McKenzie et al. 2012; and Witter et al. 2008; see BLM 2015k, Chapter 3.0, pages 219-223). Colborn et al. 2010: This study noted that: 1) toxic chemicals are used during both the drilling and fracturing phases of gas operations, 2) long-term health effects that may not be immediately recognized, and 3) waste evaporation pits may contain numerous chemicals on USEPA's Superfund list. The study's findings cited the difficulty of developing monitoring programs. To protect public health, the study recommended full disclosure of the contents of all products, extensive air and water monitoring, a comprehensive human health study, and regulation of hydraulic fracturing under the Safe Drinking Water Act (Colborn et al. 2010). In Colorado, operators are required by the COGCC to maintain a list of the chemicals

used in hydraulic fracture of each well and to submit that information to an online data repository (fracfocus.org).

- Colorado Department of Public Health and Environment (2010f): Conducted on behalf of the Garfield County Public Health Department, this study used data collected from four monitoring sites located in proximity to oil and gas developments. The study concluded that "the estimated cancer risks associated with the six [contaminants of potential concern] are not likely to result in significant health impacts. For non-cancer (chronic and acute) health hazards, the study concluded that "overall, significant non-cancer health effects are not likely to occur." However, this does not mean that health risks from living in proximity to oil and gas activities do not exist. For example, the cancer risks show a low to moderate potential increase in cancers (1.1 to 1.7 additional cancers per 10,000 residents during a 70-year exposure duration). For non-cancer health risks, the "hazard quotient" (rating) ranged from 0.4 to 0.9, with values less than HQ = 1 indicating no "appreciable" health impacts. The study did not compare data for the four sites analyzed to air concentrations in locations remote from oil and gas activities in the county or elsewhere in the state.
- Coons and Walker 2008: A non-peer-reviewed study conducted on behalf of Garfield County, this study used hypothetical emission and exposure scenarios to calculate potential risks from emissions of natural gas and associated VOCs, including the known carcinogen, benzene. For example, USEPA calculated an acceptable lifetime (70-year) cancer risk range at distances extending approximately 500 meters (1,650 feet) downwind from an uncontrolled well with all of its natural gas production released directly to the atmosphere. By assuming a 93 percent capture rate, the authors estimated that USEPA's acceptable 70-year exposure risk for a 70-year duration would extend only 75 meters (246 feet) downwind from a well with uncontrolled emissions. During normal operations, however, the actual recovery rate of natural gas and associated benzene is greater than 99 percent, including capture and use of natural gas onsite to power equipment. During flowback shortly after completing a well and before production equipment is fully utilized, natural gas is required to be ignited and consumed ("flaring"), a process also that destroys associated VOCs. The authors similarly assumed uncontrolled releases of vapors from hydrocarbon fluids stored on the pad at 20 tons of VOCs per year. However, the COGCC requires emission controls on all sources exceeding 5 tons per year. Because their hypothetical exposures used atypically high emission rates, a 70-year exposure duration (compared with the 30-year life of most wells), and a location very close to a well pad and constantly downwind from the pad, the potential health consequences reported by Coons and Walker (2008) are substantial overestimates compared with reasonable scenarios for the public. Coons and Walker (2008) also addressed reported illness rates among residents of Garfield County for a variety of afflictions, with the result that data for the county are generally within or below the reported illness rates for three other counties (Mesa, Delta, and Montrose) with much lower levels of oil and gas development. In comparing cancer rates in Garfield County to Colorado as a whole, Coons and Walker (2008) found a significantly higher rate of all cancers combined in the county than statewide for males from 1992 through 2000 and for females from 1992 through 1998. However, these periods pre-dated the rapid expansion of oil and gas development that began in the early 2000s. In contrast, cancer risks in the county were no higher than statewide for the period 2001 through 2005, which included the initial expansion of oil and gas. The authors cautioned that cancer has a lag time from exposure to expression and that additional monitoring is needed. However, the assumptions used in their study (no or very low recovery of produced natural gas and associated compounds and a 70-year exposure duration in proximity to a well pad always upwind from the receptor) do not reflect likely exposures to the public. Acknowledging the limitations of their study, the conclusion by Coons and Walker (2008) included the following statement: "There is no health crisis in Garfield County, but there are some health trends that should be monitored. We cannot say conclusively that any of these health trends are directly related to the presence of natural gas industry activities or other factors." Similarly, as noted by several comment letters received by the BLM

following public review of the Draft RMP/Draft EIS, the authors were quoted in the Glenwood Springs Post Independent newspaper (June 18, 2008) as saying that "…there is not a 'health crisis' because of rapid natural gas development in the county."

- McKenzie et al. (2012): This study used monitoring data collected by the Garfield County Public Health Department from a fixed station "in the midst of rural home sites and ranches and [natural gas development] during both well development and production" as well as "grab samples" collected from the perimeters of four well pads, at distances of 130 to 500 feet from the well pad center. The data were extrapolated to include 5 years of well development (construction, drilling, and completion) at a pad followed by 20 to 30 years of production and maintenance activities (30 years total duration). Although the report did not indicate significantly elevated cancer or non-cancer health risks for any modeled receptors, it did show higher risks within 0.5 mile of an oil and gas well pad. The Colorado Oil and Gas Association issued a press release on March 21, 2012, disputing the findings of McKenzie et al. (2012), citing for example atypically high emissions rates used in the calculations, an atypically long development period for a typical pad (5 years versus 1 year or less), more stringent operating requirements than when the samples were collected, and calculated risks below acceptable risk levels as normally used by the USEPA.
- Witter et al. (2008): A non-peer-reviewed study conducted on behalf of Garfield County, this study concluded that "human health risks and social impacts are associated with oil and gas development." Witter et al. (2008) based this conclusion largely on the types of chemicals used in, or produced by, oil and gas activities, and not on documented release rates of those chemicals to the environment and exposure to the public. Thus, their study cataloged potential risks associated with uncontrolled exposures, at unspecified exposure rates, and for unspecified exposure durations. In summarizing the results of the Coons and Walker (2008) report, Witter et al. (2008) cited the higher combined cancer rate among Garfield County residents compared with statewide statistics, but did not mention that the trend was true only in the 1990s, as noted above, and did not extend into the period 2001-2005 during which natural gas production expanded. They also noted that Garfield County has higher rates than statewide of chronic obstructive pulmonary disease, asthma, and low birth weight, the first two of which are higher in Colorado than in the rest of the nation despite a lower rate of tobacco use and a relatively young and fit population here. The authors made no speculation as to the possible contributors to these trends. However, the fact that the large majority of county and statewide residents are in urban areas distant from oil and gas drilling and production activities strongly suggests that the higher incidences of chronic obstructive pulmonary disease, asthma, and low birth weight are related to some other factor or combination of factors.

In addition to the studies referenced in the 2014 CRVFO Proposed RMP/Final EIS, a 2014 study by McKenzie et al. (2014) addressed the relationship between natural gas developments in Garfield County and birth defects (McKenzie et al. 2014). CDPHE dismissed the study, citing what it called flaws in its design, such as not differentiating between active and inactive wells, not determining how long the mother had lived in the area, not identifying potential exposure pathways, and not accounting for risks from various known contributors to birth defects, such as age and lifestyle. In addition, proximity to oil and gas correlated with lower risks from pre-term birth and low birth weight, seemingly counter to the conclusions about birth defects (Jones 2014).

Water Contamination

As discussed in Section 3.6, Water Resources, sources of potential surface water and groundwater contamination include leaks and spills of fluids such as fuels from storage containers, transportation accidents, leaks from impoundments, and well integrity breaches. In order to minimize the risk of contaminating shallow aquifers due to leaks and spills, transportation, storage and disposal of fuels and chemicals would be done in accordance with regulatory requirements of applicable federal and state programs. In addition, operators would maintain and implement SPCC plans for the potential release of

petroleum and emergency response plans for non-petroleum materials (various ingredients of fracturing fluids and well treatment chemicals).

Hydraulic fracturing has been implicated as a potential source of groundwater contamination and concerns have been raised about potential impacts to human health and safety. However to date, no contamination has been attributed to hydraulic fracturing in the analysis area (USFS 2014a). As noted in the 2014 Final EIS, the COGCC published an analysis in 2011 of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph: "Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing" (USFS 2014a).

Both the CRVFO Proposed RMP/Final EIS (BLM 2015k) and the 2014 Final EIS for Future Leasing on the WRNF (USFS 2014a) conducted a survey of available literature addressing the risk of water contamination. The CRVFO Proposed RMP/Final EIS and the 2014 Final EIS for Future Leasing on the WRNF summarize two reports related to the analysis area (see BLM 2015k Chapter 3.0, pages 219-221 and USFS 2014a, pages 149-150):

- Witter et al. 2008 (also discussed above): Identified two situations in Garfield County relative to environmental exposures. One was the reported occurrence of detectable levels of Ch_4 in 135 of 184 water wells, springs, seeps, ponds, and rivers sampled during a groundwater investigation conducted for Garfield County in 2006 (Papadopoulos 2007a). That study noted that Ch_4 may have been present due to natural levels in some of the bedrock formations penetrated by the water wells or recharging the seeps, springs, and surface water, and that Ch_4 also may be generated by a natural (bacterial) process within the water wells. Because the study could not identify the sources of Ch_4, Witter et al. (2008) were unable to conclude whether any of the Ch_4 in wells and natural waterbodies sampled by Papadopoulos resulted from oil-and-gas related activities or from secondary generation of Ch_4 by natural bacterial processes unrelated to oil and gas. The second situation was a documented occurrence of benzene and other organic compounds in surface water at seeps along West Divide Creek within the CRVFO (URS 2006). That occurrence, related to insufficient use of surface casing and cement to isolate shallow groundwater from the bore of a private (non-BLM-administered) well, led to the enactment of more stringent requirements by COGCC, also adopted by BLM. The COGCC also determined that migration of the Ch_4 to the seeps was not the result of hydraulic fracturing of the problematic oil and gas well.
- McMahon et al. 2011. A 2011 USGS report assessing Ch_4 in water wells in the Silt-Rifle area of the CRVFO, noted that trace concentrations are common in waters derived from the Wasatch formation, the surficial and shallow bedrock formation within which most of the non-alluvial water wells in the CRVFO are completed but documented Ch_4 higher than trace concentrations in four of 27 wells tested. One sample collected in the USGS study did contain Ch_4 of a type that indicated a thermogenic (deep) origin and was similar in geochemistry to Ch_4 contained in produced water from the Mesaverde formation, the primary hydrocarbon-producing formation in the CRVFO. However, the sample also contained biogenic Ch_4, indicating that it moved through the Wasatch formation while migrating toward the water well. The USGS report concluded that one of the 27 sampled water wells had been affected by Ch_4 from the Mesaverde formation; however, they did not conclude that the single water well with Ch_4 of deep origin had migrated to the water well as a result of oil and gas activities.

As discussed in Section 4.5, Water Resources, well integrity problems rather than hydraulic fracturing are the primary risks for groundwater contamination (COGCC 2011). The COGCC recently strengthened rules to increase protection of groundwater from oil and gas operations, including stricter casing and

cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

The lack of specific evidence linking oil and gas operations with Ch_4 water wells does not preclude the fact oil and gas operations use and produce toxic contaminants that can adversely affect human health. As with spills and other accidental releases on pads or during fluids transport, potential risks from groundwater-borne chemicals would be statistically related to the amount of oil and gas activity as well as proximity to public water supplies. Because the exact locations or amounts of chemicals are not known, the relative amount of proposed development and level of protection provided by stipulations by alternative are used as an indicator of the risk to human health and safety in Section 4.2.1.4, Impacts by Alternative.

Air Emissions

Chemicals produced during oil and gas operations consist mostly of natural gas (Ch_4) and produced water, with a small amount of associated liquid constituents that are separated from the gas and produced water at the surface. Among the constituents of natural gas condensate are VOCs such as benzene, toluene, ethylbenzene, and xylenes. Active oil and gas wells can release atmospheric pollutants due to uncaptured gases produced from the wellbore; emissions from condensate tanks, separators, vehicle exhausts, pipeline compressor engines, and open pits containing hydrocarbon fluids; and fugitive dust from access roads and other disturbed surfaces. Abandoned wells may continue to be a source of pollutant emissions if not properly plugged and capped (BLM 2015k). As discussed in Section 4.2, Air Quality, the CARMMS high development modeling scenario shows that the predicted air quality impacts associated with the oil and gas development scenario for the CRVFO outside of the Roan Planning Area are not significant, and it is reasonable to conclude that any individual project-level oil and gas development would have an even lower contribution to the overall impacts.

Impacts to human health and safety from air emissions are therefore expected to be minimal but statistically the alternative with the greatest amount of development would have higher air emissions and a higher statistical risk to human health and safety in terms of air emissions. Because the exact level of emissions are not known, the relative amount of proposed development by alternative is used as an indicator of the risk to human health and safety in Section 4.2.1.4, Impacts by Alternative.

The 2014 CRVFO Proposed RMP/Final EIS summarizes a study of potential health risks of atmospheric emissions within the analysis area (see Chapter 3.0 of the Proposed RMP/Final EIS, page 224). The study (Colborn et al. 2012) reported on potential health risks of atmospheric emissions from a well pad across a period of 15 months before, during, and following drilling of 16 oil and gas wells, including hydraulic fracturing. The sampling site was described as a rural residence located 0.7 mile from the well pad near Battlement Mesa. The authors reported “no correlation between detected emissions…and wind direction” and inferred that atmospheric inversions may explain why concentrations were higher during winter and with calm winds. The authors did not assert that measured concentrations represented an acute or chronic health risk, but they did express concern about the concentrations of polycyclic aromatic hydrocarbons in relation to mental development of children exposed prenatally (before birth). That concern was based on studies in New York City and Poland in which pregnant women carried personal air monitors. The authors noted the difficulty in comparing results of studies using personal monitors to those with stationary samplers.

As noted in this study as well as the studies discussed in *Health Impacts from Oil and Gas Development,* some chemicals emitted to the atmosphere during oil and gas development have the potential for health effects with certain types, levels, and durations of exposure. However, emitted concentrations diffuse rapidly with increasing distance from the pad, and exposures to members of the public are of much short duration than those associated with chronic health effects. Consequently, no actual, existing health effects of oil and gas activities have been documented for the analysis area.

Transportation Safety

Human health and safety may be impacted by increased vehicle collision rates and or an increased risk of collision with wildlife. As discussed in Section 4.10, Transportation, depending on the development phase, oil and gas-related traffic would vary from several vehicles a week to approximately 50 round-trips per day for short periods. The development phases would include drilling, completion, operations/maintenance, and reclamation and may include the use of overweight, over-width, or over-length vehicles to serve oil and gas locations, in addition to other types of vehicles. The drilling and well completion phases would generate the most traffic and could be encountered throughout a 24-hour period. Long-term operations would consist of the daily travel of employees involved in the operation and maintenance of production wells and ancillary facilities such as compressors and pipelines and would mostly consist of pickup trucks, although heavy truck traffic could be encountered. Maintenance activities generally occur daily over the life of the anticipated oil and gas production (estimated to be up to 20 years).

On the basis of statistical probability, increased transportation would increase the potential for vehicle collisions and/or an increased risk of collision with wildlife. The State of Colorado reported a fatality rate of 1.03 deaths per 100 million miles traveled in 2013 (Insurance Institute for Highway Safety, Highway Loss Data Institute 2015). Actual mileages per well are not known, but the alternative with the greatest amount of transportation would have a higher statistical risk of fatalities. **Table 4.16-1** includes data from Section 4.10, Transportation regarding average of number daily round-trips from drilling/completion and operations / maintenance phases by alternative. It should be noted that the average daily vehicle round-trips by lease zone portrayed in **Table 4.16-1** would be spread over the potential development period of 20 years and would not be expected to occur within a 1-year timeframe. However, the totals do allow for a comparison between alternatives.

Worker Health and Safety

As discussed in the 2014 CRVFO Proposed RMP/Final EIS (BLM 2015k), Witter et al. 2008 presented data indicating that the rate of illness, injury, and fatality among oil and gas workers in Garfield County is higher than in most job sectors; however, the analysis in the CRVFO Proposed RMP/Final EIS concluded that fatality rates among oil and gas workers were approximately the same as agricultural workers, and that illness and injury rates are lower than for both agricultural and construction workers.

Table 4.16-1 Average Daily Vehicle Round-trips for All Well Pads by Alternative

Zone	Average Daily Vehicle Round-trips for All Well Pads	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	Drilling and Completion	673	673	673	673
	Operations and Maintenance	51	51	51	51
2	Drilling and Completion	6,019	6,019	6,019	6,019
	Operations and Maintenance	456	456	456	456
3	Drilling and Completion	977	977	911	343
	Operations and Maintenance	74	74	69	26
4	Drilling and Completion	185	185	185	185
	Operations and Maintenance	14	14	14	14
Total		**8,449**	**8,449**	**8,378**	**7,767**

In 2013, the oil and gas industry experienced a nationwide rate of 1.3 nonfatal accidents per 100 full-time workers and 12 fatalities per 100,000 workers (Bureau of Labor Statistics [BLS] 2013a,b). Potential for occupational accidents and mortality would be highest during peak drilling periods and would likely drop

in proportion to the decline in drilling and development activities. This rate is lower than the nationwide rate for agricultural workers (5.4 nonfatal accidents per 100 full-time workers and 23.2 fatalities per 100,000 workers; BLS 2013a,b) but higher in terms of fatalities than construction workers (3.8 nonfatal accidents per 100 full-time workers and 9.7 fatalities per 100,000 workers BLS 2013a,b).

The 2014 CRVFO Proposed RMP/Final EIS also noted that Witter et al. 2008 also reported that "rapid industrial change" may have deleterious impacts on the psychosocial welfare of the local population in terms of increased crime and drug use, but concluded that further study would be needed to determine if oil and gas drilling is contributing [to an increase in these rates] in Garfield County. To date, no further study has been conducted (BLM 2015k).

Hydrogen Sulfide Wells

At this time, the only hydrogen sulfide within the analysis area is associated with produced water, most likely due to the introduction of bacteria during work over or completion activities and is resolved by injecting of biocides to reduce the bacterial action producing the hydrogen sulfide (BLM 2015k).

Oil and gas wells within the leases are not expected to qualify under federal regulations as hydrogen sulfide wells. If the criteria levels as stated in the "Onshore Oil and Gas Order #6, Hydrogen Sulfide Operation" (43 CFR 3160) are reached, then the Public Protection and Safety Requirements would be instituted and the requirements of the Onshore Oil and Gas Order regarding Public Protection Plans, Training Regimens, Equipment Requirements, Warning Signs/Wind Socks, and Protective Fencing would be instituted and vigorously enforced.

Fire

Construction and operation activities associated with lease development that could be sources of ignition include welding, blasting, blading, small-engine use, off-highway vehicle, and vehicle traffic over vegetated areas, and parking vehicles in areas of tall, dry grass. Mitigation measures to reduce the risk of fire are typically proposed at the site-specific level. These may include the requirement for work vehicles to carry shovels, water, and fire extinguishers; restrictions against open trash burning; restrictions limiting vehicular use or spark-generating activities such as refueling, smoking, and welding to cleared areas; and requirements for approved spark arrestors in all engines.

The development of oil and gas includes the potential for well fires or explosions. Well blowouts are rare but can be extremely dangerous. They usually occur during drilling but also can occur during production (especially during well workover operations). If natural gas is in the blowout materials, the fluid may ignite from an engine spark or other sources of flame. Blowouts may take days to months to cap and control (Tribal Energy and Environmental Information 2015). Because of their intensity and the very particular circumstances that set blowouts and oil well fires apart from regular conflagrations, specially trained firefighters must be employed for fire response (Rigzone 2015). Blowout preventors are required on wells to minimize this risk; well design would be reviewed and approved by the BLM during the APD phase.

Fire risk would be proportional to the increased surface disturbance and increases in the sources of ignition and are assumed to increase with the alternative with the greatest amount of development. Local fire responders by zone are outlined in Section 3.16; however, response time is not considered in the analysis as well locations are not known, and depending on fire type, response crews may not be coming from local fire protection districts.

Noise

Development of the leases would result in noise impacts from construction and operation of producing wells, presence of work crews, vehicular travel and other elements of oil and gas development. Average noise levels for typical construction equipment range from 74 decibels on the A-weighted scale (dBA) for

a roller to 88 dBA for a crane (Harris, Miller, Miller, and Hanson, Inc. 2006). In general, the dominant construction noise sources are diesel engines, particularly if the engines are poorly muffled. Other sources of continuous noise include field compressors, bulldozers, and backhoes. For a general assessment of construction impacts, assuming a geometric spreading only (i.e., a decrease of about 6 dBA per doubling of distance from a point source; Truax 1999), it is estimated that the loudest piece of equipment operating at peak load would produce noise levels that would exceed the USEPA guideline for residential noise (55 dBA) at a distance of about 1,600 feet (USEPA 1974). Construction noise levels would be short-term and spatially limited and would be most noticeable during the development phase when construction, drilling, and completion activities would occur. Elevated noise levels also would occur along access roads as vehicles and heavy equipment traveled to each site. Impacts to human health and safety from noise would be dependent upon proximity to the area of development and may need to be analyzed at the site-specific APD level.

Emergency Services

As noted in Section 4.17, Socioeconomics, development of the leases would result in limited employment increases and are not expected to affect service demand under any alternative. In previous years, natural gas revenues have provided funding for new infrastructure improvements such as new hospital facilities that in turn result in emergency service benefits. The relative amount of proposed development by alternative is used as an indicator of risk to emergency services in Section 4.2.1.4, Impacts by Alternative.

4.16.2.4 Impacts by Alternative

Alternative 1 (No Action Alternative)

Under Alternative 1, the BLM would take no action by continuing to administer the leases with their current stipulations. The potential exists for development of approximately 416 wells to be drilled from 60 well pads.

Health Impacts from Oil and Gas Development

Alternative 1 proposes development of 416 well on 60 well pads. There are no surface water or groundwater resources-specific stipulations under this alternative. The general NSO stipulations related to other resources would overlay up to 23 percent of CSWAP areas and 9 percent of SWPPs. None of the Rule 317B areas would be covered. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Well development would result in increased vehicle trips during construction and operations. With consideration of the entire 20-year development period, Alternative 1 would have an average of 8,449 daily vehicle round-trips (see **Table 4.16-1**). The majority of this activity would occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development.

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 416 wells would result in approximately 892 acres of initial disturbance and 387 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2 (76 percent), followed by Zone 3 (12 percent). Development in Lease Zones 1 and 4 would be less than 10 percent of the total disturbance.

Emergency Services

Development of 413 wells would result in revenues impacts that would be distributed across multiple different governmental sectors including but not limited to: Public Safety, Public Health, Parks and Recreation, and Transportation.

Alternative 2

Under Alternative 2, eight leases would be affected by minor changes to stipulations.

Health Impacts from Oil and Gas Development

Alternative 2 would result in the same level of development as Alternative 1 (416 wells to be drilled from 60 well pads). There would be no water resources-specific stipulations under this alternative; but general NSO stipulations related to other resources would overlay up to 23 percent of CSWAP areas and 11 percent of SWPPs. None of the Rule 317B areas would be covered. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All.

Transportation Safety

Stipulation changes would not affect the transportation scenario outlined under Alternative 1 and the risk would remain the same (see **Table 4.16-1**).

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Oil and gas development under Alternative 2 would result in the same amount of initial and long term disturbance as Alternative 1. The distribution of disturbance between zones also would be the same as Alternative 1.

Emergency Services

Impacts to emergency Services would be the same as Alternative 1.

Alternative 3

Under Alternative 3, the BLM would modify the existing leases to apply stipulations that match those identified by the Forest Service for future leasing in its Proposed Action (USFS 2014a). Under Alternative 3, approximately 413 wells would potentially be developed 59 well pads. The reduction in well numbers would be in Zone 3.

Health Impacts from Oil and Gas Development

This alternative would apply more NSO stipulations as compared to Alternatives 1 and 2, which would affect where wells and roads could be developed, particularly in related to water sources. The NSO stipulation to limit surface disturbance in Public Water Supply Source Areas would overlay up to 9 percent of CSWAP areas, 89 percent of the Rule 317B areas and 89 percent of SWPP areas. General NSO stipulations and CTL areas (outside of existing leases) would cover 88 percent of both CSWAP and SWPPs, and 92 percent of the Rule 317B areas. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Alternative 3 would result in a slight decrease in transportation needs relative to Alternatives 1 and 2 (due to decreases in Zone 3). As with Alternatives 1 and 2, the majority of transportation activity would occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development. With consideration of the entire 20-year development period, Alternative 3 would have an average of 8,378 daily vehicle

round-trips, resulting in a slight increase in transportation safety relative to Alternatives 1 and 2 (see **Table 4.16-1**).

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 413 wells under Alternative 3 would result in approximately 886 acres of initial disturbance and 384 acres of long-term disturbance. The distribution of disturbance between zones would be the same as Alternative 1.

Emergency Services

Revenues impacts benefitting Public Safety and Public Health would be based on development of 413 wells, a reduction in 3 wells as compared to Alternatives 1 and 2.

Alternative 4 (Proposed Action)

Under Alternative 4, the BLM would modify or cancel existing lease stipulations and availability decisions identified for future leasing in the 2014 Draft ROD. Under Alternative 4, approximately 383 wells would potentially be developed on 55 well pads. Lease modification and cancellations would occur in Zone 3. NSO, CSU, and TL stipulations would be the same as under Alternative 3.

Health Impacts from Oil and Gas Development:

With the combination of NSO lease stipulations and areas closed to leasing, 45 percent of CSWAP areas, 89 percent of the Rule 317B areas, and 98 percent of the SWPP areas would be precluded from surface disturbance. General NSO and CTL would cover 93, 92, and 99 percent of CSWAP, Rule 317B, and SWPPs, respectively. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Alternative 4 would result in a substantial decrease in transportation needs in Zone 3 as a result of lease cancellations. The majority of transportation activity would occur in Zone 2, followed by Zones 1, 3, and 4, in order of level of development. With consideration of the entire 20-year development period, Alternative 3 would have an average of 7,767 daily vehicle round-trips (see **Table 4.16-1**). This would result in increase in transportation safety due to the decrease in traffic levels relative to Alternatives 1, 2, and 3.

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 383 wells under Alternative 3 would result in approximately 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2 followed by Zones 1, 3, and 4.

Emergency Services

Revenues impacts benefitting Public Safety and Public Health would be based on development of 383 wells, a reduction in 33 wells as compared to Alternatives 1 and 2.

Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled. For producing leases, this action is not within the BLM's authority to implement so it would be necessary to pursue judicial action. For the purposes of analysis, it is assumed that this judicial action would result in the cancellation of all leases. There would be no potential for future development within the 65 leases because all leases

would be cancelled. Leases currently in production would be plugged and abandoned and well pads and roads would be decommissioned and reclaimed.

Health Impacts from Oil and Gas Development

There would be no future development, because this alternative would cancel all the leases. However, there would be potential for short-term impacts to surface water or air quality to occur when the existing wells are plugged and abandoned, and existing facilities reclaimed. However, this disturbance would be temporary and limited to areas already disturbed by oil and gas development. Upon successful reclamation of disturbed areas, the impact to water resources would be expected to be minimal, approaching a condition better than the baseline that already had the disturbed areas. There would be no further impact to air quality.

Transportation Safety

Traffic associated with these plugging and abandonment of wells would result in approximately 54 total vehicle round-trips, stretched over a 25-day period, resulting in minor impacts similar to transportation safety.

Fire

Risk from oil and gas development discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Risk of fire from general construction would be present when existing wells are plugged and abandoned, and existing facilities reclaimed, but all risk of well blowout would be eliminated.

Emergency Services

Alternative 5 would cancel all well production, thereby eliminating all lease-related revenue that might fund emergency services.

Summary of Impacts

Health Impacts from Oil and Gas Development

Compared to the No Action Alternative, Alternatives 2 through 5 would progressively minimize the potential for impacts to water and air resources inside the lease boundaries through lower levels of development and stipulations that would limit development near Public Water Supply Source Areas. Note that the increased leasing stipulations within the lease areas under Alternatives 3 and 4 may cause some disturbance to occur off-lease as compared to the No Action Alternative. The cancellation of 25 leases under Alternative 4 would minimize the risk to human health and safety relative to Alternatives 1, 2, and 3; Alternative 5 would minimize the risk to human health and safety to the greatest degree by cancelling all leases.

Transportation Safety

Alternative 1 (the No Action Alternative) and Alternative 2 would have equal average daily vehicle round-trips and total trips and would result in the highest potential for vehicle collisions. Alternatives 3 and 4 would produce slightly less impacts to transportation resources as a result of the potential development of fewer wells pads and associated wells. Alternative 5 would produce fewer impacts than Alternative 1 and the least of any alternative as all leases would be cancelled and lease-related oil and gas transportation would cease after reclamation.

Fire

Compared to the No Action Alternative, Alternatives 2 through 5 would progressively reduce the potential for human-caused fires, well fires, or explosions within the lease area due to reduced well development, lower levels of surface disturbance, and reduced vehicle and equipment use.

Emergency Services

In comparison to the No Action Alternative (and Alternative 2, which proposed the same level of well development), Alternatives 3, 4, and 5 would progressively reduce oil and gas development revenues that would benefit emergency services. Alternative 5 would eliminate all lease-related revenue that might fund emergency services.

4.16.3 Cumulative Impacts

4.16.3.1 Cumulative Impacts Analysis Area

The CIAA for human health and safety is the four lease zones as well as the regional road network (see **Figures 3.10-1** and **3.10-2**). This area includes multiple county roads currently serving existing oil and gas operations, as well as state and U.S. highways.

4.16.3.2 Past and Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and present actions are broken into three surface disturbing activities: mineral development, transportation corridors, and other development, such as ROWs for pipelines and telephone lines as well as other developments (see **Appendix B**). Oil and gas development may pose impacts to human health and safety as described in Section 4.16.2.3, Impacts Common to All. Past and present actions have associated transportation that has affected and continues to affect transportation safety on the local and regional road network, as represented in current collision and fatality rates.

Reasonably Foreseeable Future Actions

There are no additional oil and gas developments or other surface disturbing RFFAs proposed within the leases; however oil and gas development outside the leases would increase traffic along the regional road network (which is included in the CIAA). It is projected that 50,166 wells will be drilled within the BLM CRVFO, GJFO, and WRFO, producing approximately 4,681,210 round-trips during construction. Rio Blanco County has identified several proposed road improvements and mitigations to improve transportation issues related to continued oil and gas development.

There are approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments within the CIAA (see Section 4.1 and **Appendix B** for more details on RFFAs).

4.16.3.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Health Impacts from Oil and Gas Development: Cumulative impacts within the CIAA would be the same as described for the alternatives.

Transportation Safety: RFFAs would produce approximately 4,681,210 round-trips during construction Development of the WRNF leases would contribute less than 1 percent to the cumulative transportation needs associated with oil and gas development in the region. Road projects, such as slated improvements to CR-5 in Rio Blanco County, would enhance travel safety.

Fire: Within the CIAA, 6,000 acres of proposed vegetation and hazardous fuels reduction treatments would provide countervailing impacts to human health and safety by addressing vegetative conditions that may lead to the uncontrolled spread of fires.

Emergency Services: There are no additional RFFAs proposed within the cumulative impacts CIAA. Cumulative impacts to emergency services would be the same as described for the alternatives.

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4.17 Socioeconomics

4.17.1 Analysis Assumptions and Approach to Analysis

4.17.1.1 Analysis Area

The affected region for the socioeconomic analysis consists of Garfield, Mesa, Pitkin, and Rio Blanco counties. The analysis focuses on the four counties as important governing jurisdictions and primary representative units of sub-regional economies. The counties also are important governmental entities responsible for planning and providing many public facilities and services.

The analysis evaluates the socioeconomic impacts for the communities surrounding the leases that would be expected to have the strongest socioeconomic relationships with projected future development activities and area resources. The local communities addressed for impacts to socioeconomics focuses on Parachute, Rifle, Silt, New Castle, Glenwood Springs, and Carbondale located in Garfield County, as well as the small community of De Beque in Mesa County. While other cities also could be affected by the leasing and future mineral development, they either have only a very limited potential relationship with natural gas activities (e.g., Meeker in Rio Blanco County) or are larger and more economically diversified cities (e.g., Grand Junction and Aspen) whose economic impacts are considered within the county level analysis. Due to the nature of some impacts and data limitations, not all socioeconomic impacts are evaluated at the local level.

4.17.1.2 Scoping Issues

The following socioeconomic issues and perspectives were raised during public scoping:

- Lease cancellation may negatively impact local economies by loss of jobs, tax revenues or affordable health care and emergency facilities supported by natural gas companies.
- Lease cancellation would result in a loss of extraction industry jobs and also related natural gas support service jobs.
- Cancellation of leases will have negative impacts on lessees and mineral owners, as well as any lessees and mineral owners on adjoining private lands.
- Compensation for cancelled leases should not only consider the lease value, but also include other factors such as compliance with NEPA and permitting, rental and royalty payments, expended capital and operational costs, and other investment losses.
- Concerns were raised on leases' long-term profitability and the financial impact to local government services (e.g., law enforcement, social and health services).
- The region may not be able to support transient workers housing and local services' needs and may experience adverse impacts to its social fabric from traffic, industrialization, air, water, and noise pollution.
- Natural gas employment gains may be temporary and less than job losses in the region's tourism, grazing, and other natural resources dependent industries.
- Local communities rely on outdoor recreational resources that could be negatively impacted by natural gas lease activities' impacts (e.g., traffic impacts, environmental degradation, and reduced access). Many commenters are concerned that jobs and businesses in the recreation industry and related businesses that depend on the region's natural resources could be jeopardized by oil and gas development.

- Communities such as Carbondale, Rifle, Silt, and New Castle have long marketed the abundance of WRNF's outdoor recreation opportunities to attract visitors and new residents. Many commenters are concerned that increased traffic volumes, noise, and pollution would change the character of the tourism destinations, deter visitors from coming to the area, decrease property values and diminish of the area's rural character.

4.17.1.3 Assumptions

The cost and revenue values of specific monetary transactions generally depend on a variety of considerations and factors. In addition to the effects of overall supply and demand conditions, the location, timing and quantities of the goods or services being exchanged can affect the actual expense paid or sales price obtained. As a result there is uncertainty inherent in the projections of future socioeconomic conditions and outcomes. Therefore, the socioeconomic impact analysis evaluates the potential leasing and development impacts on the region's economy by using average values, prices and quantities for the key factors being analyzed. The indirect and induced economic effects of future spending changes (e.g., from construction spending for the region or added government revenues) are estimated by input-output analysis using static prices and other model assumptions. These modeling assumptions will inevitably differ from the future economic reality as prices (e.g., oil and gas) are volatile which influences demand, substitution, regional economic structure, technological change, etc. The analysis is not forecasting outcomes (i.e., prices, production, or consumption) as such, but instead modeling regional economic impacts between the alternatives given on the noted and common assumptions. Consequently, this analysis is not a prediction of the future but rather an evaluation and, where possible, an estimation of how the alternatives will each impact the regional economy given the specific and commonly applied assumptions.

Additional analysis and discussion on the socioeconomic analysis's approach and assumptions is provided in **Appendix C**.

<u>General Assumptions</u>

The following general assumptions and approaches are used for the socioeconomic analysis:

- The type and magnitude of potential socioeconomic impacts on the region's other economic sectors from leasing and development depends primarily on the nature and extent of the interrelationships between the other economic sectors and the natural gas production activity within the leases under consideration.
- Published data, analysis, and lessees' past and projected future natural gas activities, employment, and development costs are used to assess the economic, demographic, community service, fiscal, and social consequences under each alternative.
- When necessary, available published data or professional judgment is used to determine the major subcategories of well development costs (e.g., labor, materials, equipment, and construction management) and local supply availability necessary for IMPLAN analysis.
- The IMPLAN modeling assumes that current relationships between sectors and county economies will remain constant in the future.
- Work force access and deliveries of materials and equipment to well sites will use the identified routes described in Section 4.10 and otherwise generally conform to the transportation impact analysis findings.
- Key indirect resource effects (e.g., annual recreation use levels and patterns; average rangeland carrying capacity changes) are characterized based on the findings of their corresponding impact analysis sections in this EIS. If the resource impacts have only been qualitatively

analyzed, then analysis of their socioeconomic values or effects can only qualitatively analyzed by the socioeconomic impact analysis.

- This analysis only considers construction and production that might occur during the 20-year time period of 2017 to 2036.
- If a lease is cancelled, the underlying mineral resources would nonetheless remain and would be available for potential future extraction.
- All values are in 2014 dollars.

Well and natural gas production assumptions are based on Chapter 2.0, Section 2.7.

Specific Assumptions

Analysis assumptions generally tend to be simplified so that the future socioeconomic impacts can be more readily identified without being overestimated and overstated. Consequently, many production assumptions will be based on straightforward geographic relationships and typically not factor in potential "economies of scale" or other site-specific considerations.

Natural Gas Development/Production Activity

- Exact well locations are unknown. This analysis attributes future well locations corresponding with each lease's acreage within the different counties. As such, lease stipulations might impact the number of potential wells that could be drilled but are assumed to have no impact on expense of drilling or operations.
- Almost all projected horizontal wells are projected to occur in Mesa County. Therefore, for purposes of the socioeconomic analysis, it is assumed that all of the horizontal wells would occur in Mesa with no horizontal drilling projected to occur in Garfield, Pitkin, or Rio Blanco counties.
- While 116 acres of the lease area are located in Gunnison County, no lease has greater than 7 percent in Gunnison County. Therefore, for purposes of the socioeconomic analysis, it is assumed that no drilling would occur in Gunnison County.
- This analysis assumes that all drilled wells will be viable for development as long-term production wells.
- New well construction would begin in 2017 and would continue at a constant annual rate over the 20-year period.
- Directional wells and horizontal wells are expected to produce a total of 1.2 Bcf and 6.4 Bcf, respectively. This production is expected to be constant over the expected 20-year operating lifespan, and each directional well is expected to produce 60 MMscf/yr and each horizontal well is expected to produce 320 MMscf/yr.
- The number of wells will not impact the amount of natural gas each well produces.
- The existing 75 wells currently in production would continue to operate until 2026 under Alternatives 1 through 4. These wells began producing between 2002 and 2012 and are conservatively assumed to have the weighted average start date of 2007. As each well is assumed to produce 1.2 Bcf over the course of its lifetime and is assumed to have produced 0.6 Bcf by 2017, the combined future production of the 75 wells is assumed to be 4.5 Bcf/yr for the remaining 10 years of their operating life. However, since the existing well production is part of the existing conditions for the Alternative 1 (No Action Alternative), only new well production is analyzed in the socioeconomic impact analysis for Alternatives1 through 4. Consequently, existing well production is only recognized as an economic loss under Alternative 5, which would cancel all well leases and close all 75 existing wells.

Natural Gas Development/Production Costs

- Average employment for construction of each well is 3.5 man-years and 10.5 man-years for directional and horizontal wells, respectively (BBC Research and Consulting [BBC] 2014).
- One well pad would include seven wells of any type and require an average of one mile of road (2010 WRNF RFD). Each mile of new road construction is expected to generate 3.1 job-years (SGM 2012; American Recovery and Reinvestment Act 2009).
- An estimated 200 and 800 full time equivalents (FTEs) are created respectively for every 1,000 producing directional and horizontal wells (BBC 2014).
- As a result of the region's past history of natural gas development and its current labor supply conditions, future labor sourcing is assumed to be 80 percent local resident and 20 percent non-local employment. Non-local workers would likely consist of both specialized skill employees and less skilled general laborers that would be needed for specific tasks or on a short-notice/ short-term basis (BLM 2015e).
- Some of these workers (especially the more skilled workers) may be interested and willing to relocate to the area. However, for the purposes of the socioeconomic analysis, it is assumed that all non-local workers might represent the development-related transient labor attracted to the region.
- Conversely, only a minor proportion (10 percent) of the development-related equipment or material spending is expected to originate within the region. Consequently, a 10/90 local/ non-local purchasing ratio for both equipment and materials is expected. The majority of the local economic benefit will likely result from in region value added from assembly or final manufacturing of equipment and materials. On-site consumption of natural gas also would account for a major proportion of development-related construction spending in the region (BLM 2015e).
- The 75 currently producing wells would either be abandoned after the decision is made in the ROD (assumed 2016) or once production has stopped (estimated 2026). As the action would be required in all alternatives at a similar future expense, these costs are not included in the analysis.

Future Natural Gas Revenues

- Natural gas production increases from the 65 leases under consideration would not influence future regional natural gas prices.

Government Revenues

- Direct county and local government agency revenues resulting from the future natural gas production in the lease area (i.e., federal mineral lease, severance and property taxes) are assumed to be comparable to the revenue generation rates from past regional natural gas production.
- The Office of Natural Resource Revenue collects 12.5 percent royalties from mineral extraction on federal land, of which almost 20 percent (2.45 percent gross) is assumed to be paid to the county where the well is located.
- Counties and local communities tax natural gas production at different mill levies. The socioeconomic analysis compares natural gas sales to the estimated property tax collected from natural gas revenues to project the future property tax revenues for every new dollar of natural gas sales (**Table 4.17-1**).

Table 4.17-1 Estimated Property Taxes and Severance Tax Rates (2012)

Area	Property Tax on County Production	Severance Tax Direct Distribution on Total Colorado Production
Four-county Region [1]	1.84%	0.11%
Garfield County	1.74%	0.05%
Mesa County	4.89%	0.04%
Pitkin County [2]	1.10%	0.01%
Rio Blanco County	1.10%	0.01%
Local Communities [3]	0.93%	0.04%

[1] Regional total only includes county governments.

[2] Pitkin County currently has no natural gas production. Pitkin's future property tax and severance tax rates are assumed to be the same as Rio Blanco County.

[3] Includes nearby school and special districts as well as the communities of Parachute, Rifle, Silt, New Castle, Glenwood Springs, Carbondale, and De Beque.

Source: Leeds 2014a.

- County severance revenues are indirectly tied to natural gas production in the county and severance is only paid for a particular well if the local property tax levies are less than 58 mills (Leeds 2014b). As a result, since Mesa County has an average levy greater than 58 mills it generates little to no severance taxes for Colorado, but does receive severance tax revenues from the state. **Table 4.17-1** shows the estimated direct distribution of severance tax percentage expected to be paid to the counties.
- The federal government pays "Payments in Lieu of Taxes" to local governments to help offset losses in property taxes from non-taxable federal lands. Payments in Lieu of Taxes are not expected to change as a result of the EIS alternatives and outside the scope of this document.
- Some or all of the leases may be canceled due to the new stipulations by BLM request or election by the lessee. Cancellation would occur through a BLM administrative process and would require that the BLM refund any bonus bids and lease payments. Should the lessee not accept the new lease stipulations on a producing lease, it may be necessary for the BLM to request judicial action to cancel the lease and determine any compensation due to the lessee. Any repayment expense is expected to be paid by the BLM and State of Colorado but is not expected to be passed on to the counties.
- If an Alternative (e.g., Alternative 4) cancels part of a lease, the BLM would refund any bonus bids and lease payments of this specific acreage. While a lease pad requires about 10 acres of initial surface disturbance, the locations may still not allow a lease pad. It is assumed that all leases with less than 100 acres remaining will be completely cancelled. In these cases, it is assumed that 100 percent of the parcel's bonus bids and lease payments will be refunded.
- Refunds are only based on the reduction in total acreage, While Alternatives 2 to 4 are expected to reduce production of certain parcels compared to Alternative 1, only under Alternative 4 limited refunds are expected to occur.

- County revenue generated from natural gas is expected to support current jobs and potentially generate new jobs. Based on the Garfield County 2012 Financial Report, the analysis assumes that 50 percent of the revenue will be retained as "Reserve Funds." The remainder is expected to be used for capital projects or services: road construction (7.5 percent); public building maintenance and repair (12.5 percent); other local government services (e.g., community development, airports and water) (15 percent); and county or program staff salaries (15 percent).

4.17.1.4 Impact Indicators Used for Analysis

Impact indicators for socioeconomic impacts are based on the key economic variables including total employment, income/spending changes, royalties, and taxes associated with mineral extraction. Changes in the key economic variables are used to determine the following impacts in the region.

- Socioeconomic impacts in the context of the region's past, current, and projected future natural gas development, construction, and operations.
- Potential effects on other users of the analysis area (e.g., grazing permittees and recreationists) from future natural gas development.
- Effects of temporary work forces on:
  - Local housing and labor market conditions;
  - State and local government revenues and demand for public infrastructure and services; and
  - Social conditions in the study area, particularly in and near the neighboring communities of De Beque, Parachute, Rifle, Silt, New Castle, Glenwood Springs, and Carbondale.
- Other potential development-related effects on local attitudes, opinions, and lifestyles (e.g., sense of place).

4.17.1.5 Methods of Analysis

The socioeconomic impact analysis quantifies the spending and employment associated with the projected future natural gas activity in the lease area under each alternative. Alternative 1 (No Action Alternative) would allow the leases to continue to be developed with the minimum number stipulations and consequently would result in the highest level of natural gas production activity in the region.

The socioeconomic impact analysis also estimates future annual natural gas production quantities, their expected sales value and net revenue effects on county and local government budgets from changes in royalties, fees and taxes. These projections are primarily intended to be descriptive of the various alternatives and to facilitate comparisons between their effects. The projections are not meant to be predictive of future socioeconomic conditions as there are numerous other important factors that also will affect the type and extent of future natural gas industry conditions.

Most of the other socioeconomic impacts are analyzed qualitatively or unassessed if there is insufficient information or unknown causal relationships to attribute future outcomes to the Alternatives. For example, many local residents have expressed concerns that future project-related natural gas production would decrease the attractiveness of the region's wilderness and natural resources to tourists or potential new residents which in turn could adversely affect the region's economy and property values. However, in the absence of demonstrable links between the development-related activities, regional wilderness resources, local tourism industry and real estate demand it would be speculative to attribute future property price effects to the Alternatives' varying expected future natural gas production levels.

The methods of analysis for socioeconomics include the following steps.

- Determine the proposed magnitude and timing of project construction, employment (construction and operations) and expenditure estimates of the lessees' future natural gas activity (as determined through the RFDS) for economic impact modeling.
- Compare the fiscal implications of the lease changes under different alternatives quantitatively, if possible, using the projected economic impacts to the government from continuing, cancelling, or modifying the leases that would be developed.
- Estimate the short- and long-term economic effects (jobs and income) using IMPLAN economic modeling to assess indirect and induced employment and income effects of development, with emphasis on the construction period activities and potential compensation transfers from federal, state, and local agencies.
- Apply IMPLAN modeling to estimate indirect and induced economic effects of expected future regional spending changes (e.g., from new well construction and increased government revenues).
- Assess the implications of oil and gas development on community, population, housing, public facilities and services, public education, and social conditions in the region using cost and IMPLAN modeling results.
- Model major state and local revenues (e.g., federal mineral lease payments and ad valorem taxes during operations) from with the capital investment and labor force income under each of the alternatives.
- Complete a qualitative assessment of the effects of the alternatives on county, municipal, and school district fiscal conditions based on the projected incremental changes in demands on public services, staffing requirements, facilities and other key governmental expenditure functions.
- Qualitatively discuss local social conditions focusing on the nearby communities and other users of public lands near the analysis area.
- Assess the development-related effects in the context of the cumulative long-term effects of other reasonably foreseeable development in the region. Detailed quantitative analysis of the cumulative scenario may be limited due to the expected lack of detailed data or speculative nature of other energy, mineral and community development projects.
- Analyze job impacts in terms of FTE. Consequently, a part-time job or seasonal employment would be represented as a fractional FTE value.

4.17.2 Impacts Common to Alternatives 1 through 4

Identifying lands as open to natural gas leasing would have no direct impacts on socioeconomic resources. Any effects of potential future development would be indirect and only measureable at the time of lease sale and once lease development subsequently occurs. Indirect impacts could occur from reasonably foreseeable development that could impact natural gas revenues, local government revenues, recreation, grazing, commute patterns and social conditions (e.g., local resident's quality of life and sense of place).

Stipulation Protections

NSO stipulations would prohibit site development on certain areas, minimizing impacts to both big game production areas used for hunting and livestock grazing allotments. By avoiding development to these lands, future usage of these lands for both recreation and grazing would continue unchanged. The extent

to which protected grazing and recreation use contribute to the regional economy would determine the extent to which the stipulations protect the region's socioeconomic resources.

NSO stipulations would prohibit specific areas from future drilling activities and therefore reduce the area available for future well site development. This could have adverse impacts on the future natural gas revenues due to higher costs of development compared to vertical wells and may have negative economic impacts for the region.

CSU and TL also would provide some protection to recreation, grazing and transportation, and socioeconomic resources, but not to the same extent as NSO stipulations.

Impacts from Projected Future Natural Gas Development

Natural Gas Production

Currently, there are nearly 15,000 operating natural gas wells within the four-county region (COGCC 2015g). In 2014 these wells produced more than 700 Bcf of natural gas (**Table 4.17-2**). Under the No Action Alternative 1, an average of over 200 new wells are expected to operate for the entire time between 2017 and 2036, which are anticipated to produce on average slightly more than 15 Bcf of natural gas annually. Although this additional natural gas would be equivalent to only 2 percent of the region's current (2014) production, Alternative 1's projected new natural gas production would result in approximately a 31 percent increase to Mesa County's current natural gas production levels.

Table 4.17-2 Current and Projected Future Regional Natural Gas Production - Alternative 1

Area	Current Natural Gas Production (2014)		Future Average Annual Natural Gas Production (2017-2036)	
	Wells [1]	Bcf [1]	Wells	Bcf
Colorado	53,400	1,572.4	218.6	15.6
Four-county Region	14,961	709.4	218.6	15.6
Garfield County	10,975	596.1	70.9	4.3
Mesa County	1,065	33.5	129.0	10.2
Pitkin County	0	0.0	13.5	0.8
Rio Blanco County	2,921	79.9	5.3	0.3

[1] This includes all natural gas wells that were productive as of March 2015.

Source: COGCC 2015g; USFS 2010a.

Natural gas production for Alternatives 2 through 4 would be similar to Alternative 1. Alternative 2's future production would be effectively the same as would occur under Alternative 1 (No Action Alternative). Alternatives 3 and 4 are projected to result in future total natural gas production that would be 1 and 7 percent, respectively less than that which would occur under Alternative 1. See Section 4.17.4 for more information.

Recreation Impacts

Recreation within the region and more specifically WRNF is an important component of the regional economy. Non-local recreation visitors contribute to the region's economy by their spending at local hotels, restaurants and other tourism related businesses (e.g., outfitters and guides). For every 1,000 non-local hunting and fishing visits, an estimated 1.4 jobs and $51,000 in labor income is generated in the region's economy. Similarly, for every loss of a 1,000 non-local hunting and fishing

visits, a loss to the region's economy of 1.4 jobs and $51,000 of labor income also would be expected (USFS 2014a).

Recreation use by local residents also can directly benefit the regional economy. However the economic impacts of local hunting and fishing use are more limited since local users will generally spend less on food and lodging within the region. If 1,000 local hunters and fishermen chose to hunt or fish outside the analysis area, 0.2 jobs and $8,000 would be lost within the region's economy (USFS 2014a).

Due to the lease areas more remote locations within WRNF and the mostly undeveloped character of the locations, the area's recreation consists of dispersed recreation activities (hiking, hunting and fishing). The current recreation use levels within the lease areas cannot be quantified. However, the majority of WRNF's recreational opportunities and use occur in WRNF's more eastern or northern areas. As a result, the majority of economic activity from WRNF-related recreation use also is associated with the recreation use in those other areas of the WRNF.

As discussed in Section 4.13, Recreation, the future oil and gas development activities would result in an initial surface disturbance of up to 892 acres and long-term surface disturbances of 387 acres within WRNF. As a result, future well development would directly affect only a very small portion of the assigned lease areas and an even lesser proportion of the WRNF.

The areas disturbed by the future well development activities would likely be incompatible and inaccessible for recreation use. While the lost acreage will reduce the total area available for recreational use, for WRNF visitors it will represent a negligible decrease in recreation access and opportunities. Beyond those areas little if any direct adverse effect on recreation use or the quality of the recreational experience can be attributed or expected. Few of the area's recreational users may be expected to physically interact with the future well development sites and those that do would likely be able to relocate and distance themselves from the well sites with little effort and limited inconvenience. As a result, in the absence of any expected negative effects within the area resulting in reduced use or degraded recreation experience, WRNF's future recreation use and its contribution to the region's tourism economy would be expected to remain unchanged.

Although it may be considered highly unlikely (especially due to the proposed stipulations), the area's hiking, hunting and fishing use could be altered if physical changes from the future well development noticeably change the area's landscape and habitat conditions. If the well development decreases hunting and fishing use and associated spending, outfitters, guides and area businesses dependent on hunting and fishing could be affected. The resulting income loss to these businesses could be expected to result in lower employment and income for the region's economy.

However, it is important to note that recreation user displacement from the lease area will not necessarily result in lost recreational use and spending if there are available substitute locations and opportunity for them. Although no carrying capacity analysis is available for the area and licensed guides have limited and designated use areas, even if some recreational use is displaced by the future well development activities, most of that use could likely be readily accommodated nearby within WRNF or elsewhere in the region.

Due to the lack of recreational use information for the lease areas, it is not possible to estimate the potential number and type of recreational use days that could be at risk of displacement and therefore estimate the magnitude of any related potential economic impacts to the outdoor tourism businesses. Nonetheless, while the job and income increases with the alternatives' natural gas development activities can be estimated, these should not necessarily overshadow the value of user experience provided by recreation on National Forest and Public Land Systems' lands and its contribution to the region's economy. With more wells and an absence of actions that support recreation opportunities a decrease in the value of experience for some users relative to the other alternatives could occur.

Grazing Impacts

As discussed in Section 4.12, Livestock Grazing, the future oil and gas development activities would result in an initial surface disturbance of up to 892 acres and long-term surface disturbances of 387 acres within WRNF. The total amount of surface disturbance would equate to a loss of 74 AUMs for short-term disturbance and 34 AUMs for long-term disturbance. While Alternative 2 would have similar impacts, impacts to Alternatives 3 and 4 would be slightly less than those described above. In comparison to the overall size of the region's grazing resources the small loss of AUMs could potentially be absorbed by other grazing lands that are currently underutilized.

In the unlikely event that other underutilized substitute grazing lands are unavailable, conservatively assuming a typical 4-month grazing season, the short–term loss of 74 AUMs would represent at most a carrying capacity reduction of 18.5 beef cattle. The corresponding potential long-term loss of 34 AUMS would represent at most a carrying capacity reduction of 8.5 beef cattle. In both cases, the AUM loss would likely be shared between several ranchers.

The economic cost to those ranchers is best represented by their net cost for an alternate substitute grazing lease (or feed) or possibly their net revenue (profit) loss for their reduced cattle. While the grazing loss would have a negative cost impact to the affected ranchers, the limited size of the reduction would not be expected to reduce the overall viability of their livestock operations. Consequently, the economic impact would be limited to the direct net cost/revenue effect on their livestock operations which in turn would have a negligible effect on the regional economy.

Transportation Impacts

As discussed in Section 4.10, the increase in average daily trips along the area's roads will be highest during well construction. The majority of added vehicles will be light trucks (for workers) followed by heavy truck traffic and to a much lesser degree, over-sized vehicles. Alternatives 1 and 2 are expected to result in the greatest traffic volume increases. Since the most development is projected for Zone 2, it also is expected to have the highest increase in traffic.

Along the analysis area's likely affected highways, its future traffic volumes would not be substantially higher than current levels as a result of the anticipated additional traffic generated from well development. Lease-related oil and gas development traffic is expected to increase by an average of 72 daily vehicle trips per well. The traffic growth may be expected to add vehicle use along sections of SH-13, SH-133, and SH-82 as well as US-6 and possibly I-70. Based on these roadways' current traffic levels, the increased traffic from the oil and gas development would have a negligible effect on travel conditions. Given the absence of any change in these roadways travel conditions, no effects on visitor or local residents use would be expected and consequently, no changes to these individuals' behavior or spending would occur. Therefore, given the negligible traffic increases on these roadways, no traffic related economic effects on the local communities or the regional economy would be expected.

While this traffic volume may not cause traffic congestion by itself, the additional truck traffic, noise, and dust may be easily noticed in rural areas. Although the roads in Zones 3 and 4 are projected to be only lightly used by heavy truck traffic for oil and gas development and production, these roads serve mostly recreation users and homeowners. As a result, traffic impacts from additional oil and gas development along potential haul routes (such as Four-Mile Road [CR-117] and Thompson Creek Road [CR-108] would be more noticeable. Impacts to these rural roads could include temporary conflicts with normal traffic, causing travel delays, decreased travel speeds, and increased vehicle collision rates with other vehicles and/or with wildlife.

The increase in vehicle traffic also could negatively impact the quality of life for those living in the vicinity of the development and particularly those that live along more frequently use travel routes. It is possible that in some cases, increased oil and gas traffic could potentially result in noise, dust and/or degraded

travel conditions that could reduce for some residents or individuals the area's attractiveness and desirability. In such cases this also could possibly result in some negative impacts to specific property's real estate values - at least during the period that elevated traffic levels from new well construction occur.

Social Impacts

None of the alternatives would be expected to reduce economic diversity (the number of economic sectors) or increase economic dependency, which occurs when the local economy is dominated by a limited number of industries. Shifts in emphasis could occur, but these would not be the result of any of the alternatives.

While the alternatives have the potential to affect local businesses and individuals, the relative contribution and the relative differences between the alternatives would not be large enough to have any measurable effect on economic diversity or dependency.

Estimates of the levels of employment and labor income that would be supported by the alternatives are based on projected new wells construction and subsequent natural gas production. Estimated average annual employment and labor income changes from natural gas development activities are summarized below for each alternative in the discussion of natural gas development impacts. The employment growth from the future oil and gas development is expected to be relatively limited with at most a minimal influx of temporary workers or new migrants. Given the very small number of the new job opportunities, the new employment and residents would not be expected to change the character or composition of the local county or surrounding local communities.

The components of quality of life can differ amongst individuals, however generally many components relate to income, employment and job satisfaction, affordable housing, health, food, culture, surrounding land uses, and amenities such as recreation and views. Impacts to quality of life can be perceived differently by individuals in part due to what they value and prioritize. Consequently, federal resource management decisions, such as this project can be perceived to impact quality of life differently.

Besides the quality of life effects related to changes associated with employment, population, and housing, there are perceptions of change to quality of life that may occur from growth and change, in general, of the kind that would occur under all of the development alternatives. These effects may be perceived as occurring because of attitudes toward oil and gas development held by particular communities and groups; they may be felt independent of the level of change to the economy and other factors.

In Garfield County, the commonly held perception that the county is split between the economic and social values of the western part of the county (where the energy industry is prominent) and the eastern part of the county (which has a greater focus on resort and nature tourism) would likely be reinforced by any of the development alternatives.

Across the region, a period of noticeable oil and gas development may be associated with the perception of a decline in public safety, which might occur independent of crime statistics. Similarly there may be a perception of decline in air and water quality. Each of these concerns would have an adverse effect on assessments of quality of life. Concerns such as these tend to be associated with the prominence of individual incidents and not necessarily correlated to an underlying growth or environmental trend.

The increased oil and gas development will likely be viewed unfavorably by many residents while others may appreciate its job creation and increased local spending. For residents concerned about the potential adverse impacts to regional and local air quality, water and other natural resources, less new oil and gas development will be preferred.

While most of the region's residents may have limited (if any) direct experiential interaction with the increased oil and gas development or its effects, they may nonetheless feel a related decrease to their quality of life and/or sense of place. These residents will likely perceive that any increase in oil and gas development will result in a corresponding decrease to the region's environmental/ecosystem integrity and natural wilderness and rural character. Accordingly, these individuals will prefer less new oil and gas development.

For groups having a strong identification with the historical character of northwestern Colorado, whether based on deep local roots or as part of an adopted value structure, the presence alone of the natural gas industry raises concerns about loss of traditional characteristics and access to traditional resources. Either actual change from the development alternatives or just a feeling that change may affect traditional values is a negative influence on such a group's perception of the quality of life. Some of the cultural attributes of this traditional value structure are the open space and low land cost for with traditional ranch agriculture and rural living, undeveloped, accessible land for hunting and fishing, and traditional rural and public lands landscape.

4.17.3 Impacts by Alternative

Each alternative's different stipulation requirements would result in changes in the future natural gas production activity and additional production costs; however, this socioeconomic analysis does not try to individually evaluate or determine the feasibility of future lease development. Instead, the analysis uses the development assumptions presented in Section 2.6.4. For the purpose of the EIS analysis, it is assumed that all the initial exploratory wells will be adequately productive to be developed as a production well as a conservative assumption to represent the maximum extent of future lease development and production. However, if an exploratory well proves to have limited production potential so that it is not economically feasible for future development, that lease's future natural gas production (and correspondingly any related lease development benefits or impacts) would be expected to be similarly reduced.

Any additional stipulation-related construction or production costs are generally expected to be absorbed by the operators (which may result in slightly reduced government revenue payments). The analysis also does not analyze the leases individually but focuses instead on average expected costs and government revenues. The analysis does not expect there would be any major overall increase in leaseholders' development or production costs. If there were overall increase in production costs, this would reduce the amount of pre-tax revenue, leading to reduction in government tax revenues.

Table 4.17-3 below provides a summary of the average annual production values over the 20-year study period between 2017 and 2036. Consequently, the average annual values shown in the table correspond approximately to the expected 2027 production conditions for the number of operating wells, gas production, revenue, employment, and county revenue. Production levels would be higher during the period from 2028 to 2036. Currently, there also are 75 existing wells in operation that would continue to produce under all Alternatives except for Alternative 5 through 2026.

Table 4.17-3 Annual Average Values by Alternatives (2017-2036)

Factor	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5[1]
New Well Construction (wells/yr)	20.8	20.8	20.7	19.2	0.0
Natural Gas Production (Bcf/yr)	15.6	15.6	15.5	14.4	-4.5
Sales Revenue ($ Million/yr)	$79.0	$79.0	$78.5	$73.3	-$18.8
Direct Employment (FTE/yr)	137.6	137.6	136.7	127.0	-15.0
Revenue to Counties ($ Million/yr)	$5.7	$5.7	$5.6	$5.4	-$1.4

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown for Alternative 5 are solely for the 2017-26 loss in natural gas production.

Table 4.17-4 provides the total natural gas produced for the region and each county individually for each Alternative. **Table 4.17-5** shows the percentage change for each Alternative compared to the Alternative 1 (No Action Alternative) baseline. There is no change between Alternatives 1 and 2 and only a very minor overall decrease in future production under Alternative 3 of less than 1 percent. Future natural gas production under Alternative 4 is projected decrease by only 7 percent when compared to Alternatives 1 and 2 future production levels. Alternative 5 would result in a comparative production loss not only due to abandoning 75 wells that are currently producing, but also from not developing the new wells that would be constructed under the No Action Alternative.

Table 4.17-4 Total Future Natural Gas Production by County (2017-2036)

Location	Total Gas Production (Bcf) (2017-2036)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5[1]
Four-county Region	311.5	311.5	309.6	288.9	-45.0
Garfield	85.1	85.1	87.8	81.8	-9.6
Mesa	203.9	203.9	199.6	199.7	-35.4
Pitkin	16.2	16.2	15.9	0.7	0.0
Rio Blanco	6.3	6.3	6.3	6.3	0.0

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown for Alternative are solely for the 2017-26 loss in natural gas production.

Source: USFS 2010a.

Table 4.17-5 shows the percentage change for each Alternative compared to the Alternative 1 (No Action Alternative) baseline. There is no change between Alternatives 1 and 2 and only a very minor overall decrease in future production under Alternative 3 of less than 1 percent. Future natural gas production under Alternative 4 is projected decrease by only 7 percent when compared to Alternatives' 1 and 2 future production levels. Alternative 5 would result in a comparative production loss not only due to abandoning 75 wells that are currently producing, but also from not developing the new wells that would be constructed under the No Action Alternative.

Table 4.17-5 Percent Change in Total Future Natural Gas Production Compared to Alternative 1

Area	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Four-county Region	0.0	-0.6	-7.4	-114.4
Garfield	0.1	3.2	-3.8	-111.3
Mesa	0.0	-2.1	-2.1	-117.4
Pitkin	0.0	-1.7	-95.7	-100.0
Rio Blanco	0.0	0.0	0.0	-100.0

4.17.3.1 Alternative 1 (No Action Alternative)

Alternative 1 is the No Action Alternative, which would reaffirm leases with current stipulations. Under Alternative 1, the BLM would take no action by continuing to administer the leases with their current stipulations. Those leases that are currently under suspension would be reaffirmed and could be developed at the discretion of the lessee.

Impacts from Future Natural Gas Development

Based on the Reasonable Foreseeable Development Scenario, Alternative 1 is projected to add a total of 416 new wells across the four counties over the next 20 years. The majority of the new wells, and most of the new surface disturbance, would occur in Mesa County (246 wells).

Impacts from New Well Construction and Production Operations

Over the 20-year analysis period, future lease development within the four-county region is expected to produce a total of 312 Bcf in natural gas with estimated revenues of approximately $1.6 Billion (**Table 4.17-6**). On average 20 directional wells and one horizontal well are expected to be constructed each year. Future new natural gas production from the leases would initially begin at 1.5 Bcf per year in 2017 and increase to 29.7 Bcf annually in 2036.

Table 4.17-6 Natural Gas Production in the Four-county Region - Alternative 1

Time Period	New Well Construction			Operating Wells	Natural Gas	
	Directional	Horizontal	Total		Production (Bcf)	Revenues ($ Million)
2017	19.9	0.9	20.8	20.8	1.5	$4.3
2036	19.9	0.9	20.8	416.4	29.7	$172.9
Total (2017-2036)	398.4	18.0	416.4	416.4	311.5	$1,580.4
Annual Average	**19.9**	**0.9**	**20.8**	**218.6**	**15.6**	**$79.0**

As seen in **Table 4.17-7**, nearly two thirds (65 percent) of this future natural gas production is expected to occur in Mesa County. The future value of natural gas produced from Mesa County is expected to be approximately $1.0 billion dollars. Garfield County would be the other primary production location with more than a quarter (27 percent) of the total future production coming from wells within its jurisdiction. Together Pitkin and Rio Blanco counties would produce a total of 22 Bcf that would account for the remaining 7 percent of the total natural gas production.

Table 4.17-7 Natural Gas Production by County - Alternative 1

Area	Total New Wells	Production (Bcf)	Sales Revenues ($ Million)
Garfield	135.0	85.1	$431.6
Mesa	245.7	203.9	$1,034.8
Pitkin	25.7	16.2	$82.2
Rio Blanco	10.0	6.3	$32.0
Four-county Region	**416.4**	**311.5**	**$1,580.4**

Figure 4.17-1 shows the number of wells constructed and the total number of producing wells on an annual basis between 2017 and 2036.

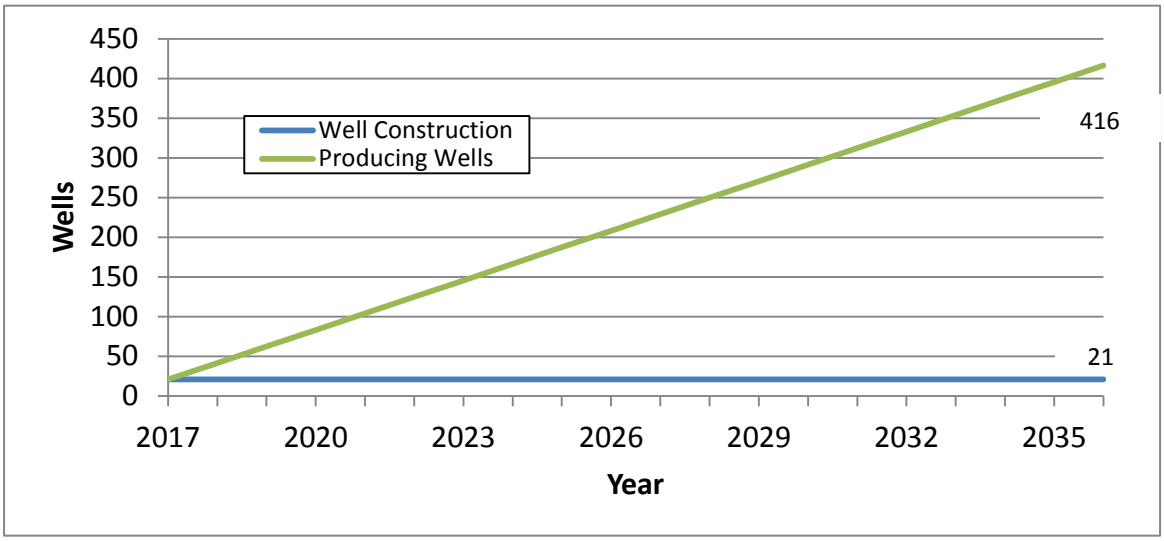


Figure 4.17-1 Projected New Well Construction and Operating Wells (2017-2036)

Under Alternative 1, future well drilling and natural gas production is expected to create an average annual direct employment of approximately 138 FTEs in the four-county region. Over the entire 20-year analysis period, the oil and natural gas development is projected to generate a total of 2,751 job-years of direct employment.

Table 4.17-8 shows the estimated future direct, indirect and induced impact to the regional economy from the future well construction and subsequent natural gas production activities. The related indirect and induced effects of the natural gas production activities were analyzed using IMPLAN input-output modeling of the counties and regional economies. Over the full 20-year time period, Alternative 1 would add a total of 592 jobs-years of indirect and 1,240 jobs-years of induced employment for the region. This future employment growth would correspond to an annual average increase of 29 new indirect and 62 induced FTEs.

Table 4.17-8 Total Employment and Revenue Impacts from Natural Gas Development and Operation (2017-2036) - Alternative 1

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (job-years)					
Direct	814.0	1,721.0	155.0	60.0	2,751.0
Indirect	118.8	345.1	9.3	9.6	592.8
Induced	260.0	884.0	29.6	9.6	1,240.2
Total	1,192.8	2,950.1	193.9	79.2	4,584.0
Income ($ Million)					
Labor Income	$83.1	$192.8	$16.4	$5.6	$309.1
Value Added	$49.9	$139.2	$7.4	$3.0	$217.4
Output	$277.8	$642.5	$42.7	$19.6	$1,021.3

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

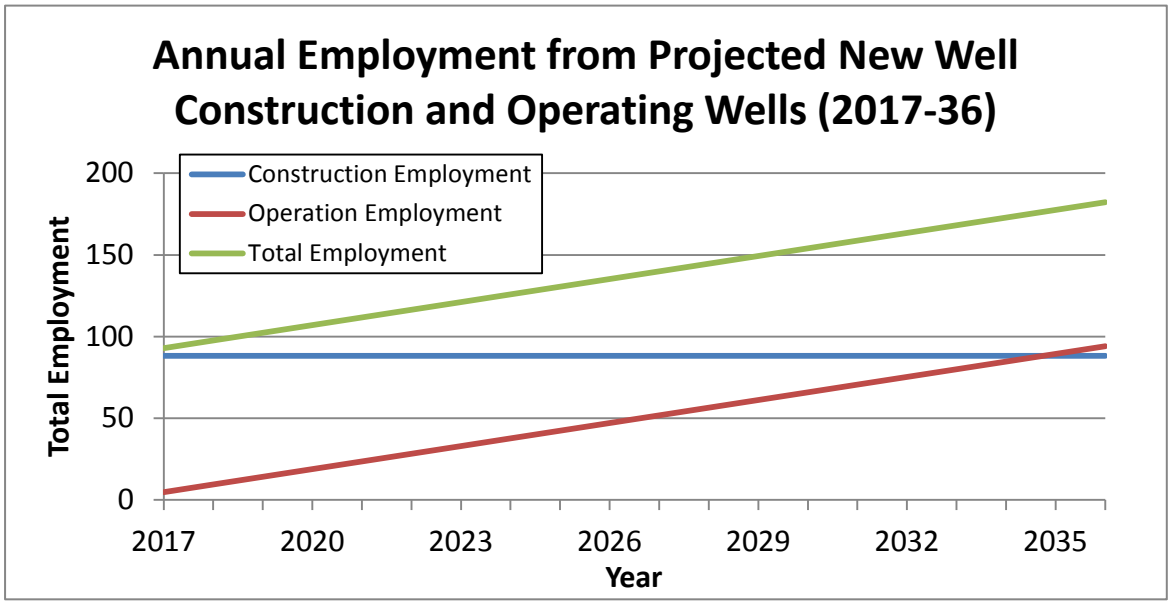
Source: BBC 2014; IMPLAN 2015.

Figure 4.17-2 shows the annual future employment growth that would be expected as additional natural gas wells are brought on-line and begin to operate. Future well construction activities are estimated to regularly employ approximately 88 persons per year between 2017 and 2036. While most (80 percent) of these jobs are expected to be staffed by workers from the region, up to 20 percent would likely be transient or new in-migrants to region. In which case, Alternative 1 would be expected to result in up to 18 new transient or new residents to the region.

As shown in **Figure 4.17-2**, future operational employment would steadily increase as the newly constructed wells start producing. Initially in 2017, the new operating wells would provide employment for approximately 5 FTEs, which would increase steadily to a total of 94 FTEs in 2036. All of these well operating and maintenance jobs can be expected to be staffed by residents of the region. Consequently, no new transient or new residents would be expected to the region as a result of the oil and gas development's future operations.

Overall, in 2036 a total of 182 FTEs would be employed for new well construction as well as operating and maintaining of the projected 416 operating wells. This would represent a total increase in employment of 2,751 job-years over the intervening 20-year period. The related total labor income for the region is estimated at $309.1 million. The natural gas production activity also is expected to result in a total value added of $217.4 million, with the increase of output to the region's economy of $1.0 billion.

Figure 4.17-3 shows total annual well construction and operations spending between 2017 and 2036. The annual total well construction cost is estimated to be $45 million (including road construction). The production cost in 2017 for the first 21 wells is estimated be approximately $0.8 million and expected to increase steadily to a total of $16.5 million in 2036. Over the 20-year period between 2017 and 2036, new well construction spending will total $948.7 million and production cost spending will total $32.9 million. As a result, over the 20-year analysis period, the total well development related spending is estimated to be $1.1 billion.



Note: Totals may not add up exactly due to rounding.

Figure 4.17-2 Annual New Well Construction and Operations Employment (2017-2036) – Alternative 1

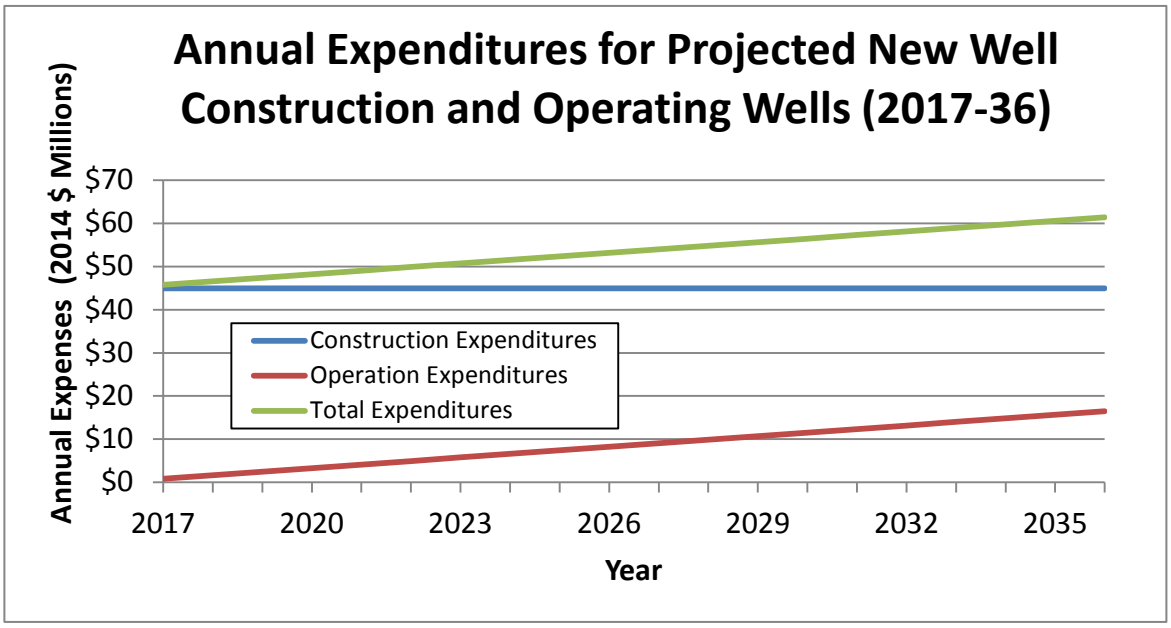


Figure 4.17-3 Annual New Well Construction and Operations Spending (2017-2036) – Alternative 1

As discussed above, future natural gas development related employment is expected to be 182 FTEs in 2036 and the majority of these new jobs (164 jobs or 90 percent of the total) are expected to be filled by workers already living and working in the region. Regardless, these new job estimates represent a maximum possible change to the region's future population and households. Even if all the new jobs were staffed by non-residents the change in population would be less than 1 percent of the region's current population. Within counties likely to experience the largest share of natural gas development (i.e., Mesa and Garfield counties) the total change in population would not exceed 1 percent of their current population. In addition, the region's housing vacancy rate (14 percent) would readily accommodate any increased housing demand from population changes since the required housing for that population would be than 1 percent of current vacancies.

Local Government Revenue Impacts

Natural gas and oil production provides significant local government revenues for the four-county region. As shown in **Table 4.17-9**, in 2012, the four counties' oil and gas revenue receipts (e.g., federal mineral lease (FML) and property tax payments) totaled $66.4 million, which was equivalent to nearly a quarter (24 percent) of their total General Fund Expenses that year.

Table 4.17-9 General Fund Expenses and Oil and Gas Revenues for the Four-county Region (2012) – Alternative 1 ($ Millions)

Area	General Fund Expenses	County Oil & Gas Revenues	Percent of General Fund Expenses
Four-county Region	$272.0	$66.4	24.4
Garfield County	$98.3	$44.7	45.5
Mesa County	$106.4	$10.3	9.7
Pitkin County	$47.2	$0.0	0
Rio Blanco County	$20.1	$11.3	56.2

Source: DOLA 2013; Garfield 2012; Leeds 2014a; Mesa 2012; Pitkin 2012; Rio Blanco 2012.

Table 4.7-10 shows the projected county revenues from the future natural gas development. While the counties typically save a sizeable portion of these revenues as reserve funds, they still represent significant contribution to their annual budgets. Alternative 1 would not alter any of the leases. In 2017, the county revenues from the future oil and gas development are expected to be $0.3 million and will increase steadily to $10.8 million by 2036. As a result, the four-county governments are expected to receive a total of nearly $99 million in oil and natural gas related revenue payments over the future 20-year analysis period.

Table 4.17-10 County Revenue from Natural Gas Development and Operations for the Four-county Region (2017-2036) – Alternative 1 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total Revenues
2017	$0.5	$0.1	$0.2	$0.0	$0.3
2036	$21.6	$4.2	$6.5	$0.1	$10.8
Total (2017-2036)	$197.6	$38.7	$59.4	$0.7	$98.8
Annual Average	$9.9	$1.9	$3.0	$0.0	$4.9

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $14.9 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, state of Colorado and all county and local agencies.

As discussed in **Appendix C**, the majority of future production is expected to occur in Mesa County, and Mesa is expected to receive more than 77 percent of this revenue. In addition, local communities are expected to receive an additional $14.9 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county. **Table 4.17-11** shows the estimated future employment and income impacts from the oil and gas revenues. The impact results include both the induced and indirect effects as estimated by the IMPLAN analysis.

Table 4.17-11 Total County Government Revenue Impacts (2017-2036) – Alternative 1

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Garfield	
Employment (Job-years)					
Direct	63.7	257.0	8.6	3.8	332.3
Indirect	16.2	88.0	2.4	0.3	121.6
Induced	18.7	125.9	2.0	0.5	146.2
Total (2017-2036)	98.6	470.9	13.0	4.6	600.1
Income ($ Million)					
Labor Income	$4.4	$27.4	$1.1	$0.3	$36.9
Value Added	$5.0	$37.4	$1.3	$0.4	$49.6
Output	$9.2	$68.8	$2.3	$0.6	$89.8

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

It is conservatively assumed that half of the county revenues ($49.4 million) would likely be held as reserve funds (and therefore would not result in any spending impacts). As discussed in more detail in the Socioeconomic Technical Appendix (**Appendix C**), the agencies are expected to spend the remaining revenues on capital projects and for agency operations. Based on IMPLAN analysis of the expected future use of these remaining county natural gas revenues, direct employment in the

four-county region is expected to increase by 332 job-years over the 20-year time period. This job growth would be equivalent to an average annual direct employment increase of 17 FTEs.

The related indirect and induced effects of the natural gas revenues would add additional employment of 121 indirect and 146 induced job-years to the region over the 20-year analysis period. The employment growth would correspond to an average of 6 indirect and 7 induced FTEs annually. During the future 20-year time period, the region's total labor income also is estimated to increase by $37 million with an overall economic output increase of approximately $90 million.The natural gas related revenue payments to the county government and other agencies are generally intended to provide compensation to those agencies that might incur increased service or capital costs as a result of the gas development. For example, the County's share of FML revenues may be expected to offset road improvements that might be necessary from the increased use of county roads by well construction traffic.

As discussed above, the annual employment impacts from the future natural gas development are relatively limited with average annual total direct employment growth of 182 FTEs of which all but 18 would be filled by workers from the region's labor force. Only the 18 transient or in-migrant workers (and potentially their families) would represent a net increase in demand for local government services. Given the small magnitude of the increased service demand, the potential impacts to the region's public services and infrastructure will be negligible.

4.17.3.2 Alternative 2

Alternative 2 addresses inconsistences between the 1993 WRNF ROD and the lease stipulations as they were subsequently issued. In some cases, the leases did not include the stipulations as stated in the Forest Service decision document; these leases would be modified to include those stipulations under this alternative. Under Alternative 2, BLM would offer the lessees the option of either accepting the new lease terms or having the lease cancelled. Cancellation would be done through a BLM administrative process and would require that BLM refund all past bonus bids and lease payments.

However, since all the leases appear to have sufficient acreage for well pads, it is expected that there will be no cancelations under Alternative 2 and the same number of wells would be drilled. Consequently, the future socioeconomic impacts for Alternative 2 would be the same as those determined for Alternative 1.

4.17.3.3 Alternative 3

The Forest Service has updated the 1993 WRNF ROD with its 2014 Proposed Action for any future leasing. Under Alternative 3, the BLM would modify the existing leases to match this Proposed Action. Under this alternative, the BLM would offer the lessee the option of either accepting the new lease terms or having the lease cancelled. Any new wells to be developed on a lease with modified stipulations would be required to comply with the modified stipulations. Changes in lease stipulations would not apply to locations with producing wells because the constraints applied through lease stipulations only apply to exploration and development.

Under Alternative 3, the proposed stipulations are expected to have only a very limited impact on future well development within the WRNF. This analysis projects that no leases would be cancelled and consequently no future refund payments are expected to occur. Stipulations are expected to slightly reduce the total number of possible wells; overall, it is projected that a total of 413 future new natural gas well would be constructed, which would result in a net decrease of 3 future wells compared to Alternative 1.

As shown previously in **Table 4.17-4**, future natural gas production under Alternative 3 is projected to be 309.6 Bcf, which would correspond to a reduction of 1.9 Bcf from Alternative 1 (approximately 0.6 percent). Consequently, future natural gas sales, employment and county revenue impacts would be

similar, but slightly reduced from those under Alternative 1. Given the very minor (0.6 percent decrease) difference in their future natural gas production level, it is expected that there would be at most only very minor differences in the socioeconomic outcomes for Alternative 3. Consequently, the future socioeconomic impacts for Alternative 3 would be the same as those determined for Alternative 1.

4.17.3.4 Alternative 4 (Proposed Action)

Under Alternative 4, the BLM would modify existing lease stipulations in areas identified as open to future leasing by the Forest Service and cancel existing leases in areas identified as closed to future leasing. Although the Forest Service's decision on future leasing does not apply to these 65 previously issued leases, this alternative is designed to reflect the Forest Service's future management objectives for these lease areas. The primary difference between Alternatives 3 and 4 is that under Alternative 4, some leases (or parts of leases) would be cancelled to match the Forest Service draft decision for future leasing availability in the WRNF Draft ROD (2014). In the areas identified as open to future leasing in the WRNF Draft ROD (2014), the stipulations would be modified to be the same as those listed for Alternative 3.

Stipulations are geographically based and are not expected to have a significant reduction in total production. A total of 25 leases are projected to be cancelled in whole or in part, resulting in not only the repayment of bonus bids and lease payments, but also reduced future total natural gas production. **Table 4.17-12** shows the projected future well construction and natural gas production under Alternative 4. Over the 20-year analysis period, Alternative 4's total future natural gas production is projected to be 288.5 Bcf. This would result in a 23 Bcf decrease (equivalent to a 7 percent reduction) compared to the No Action Alternative.

Table 4.17-12 Natural Gas Production in the Four-county Area (2017-2036) – Alternative 4

Time Period	New Well Construction			Operating Wells	Natural Gas Production (Bcf)	Revenues ($ Million)
	Directional	Horizontal	Total			
2017	18.3	0.9	19	19.2	1.4	$4.0
2036	18.3	0.9	19	383.1	27.5	$160.3
Total (2017-2036)	365.7	17.4	383	383.1	288.5	$1,465.7
Annual Average	18.3	0.9	19	201.1	14.4	$73.3

Table 4.17-13 shows the expected future total quantity and value of natural gas that would be produced under Alternative 4 over the entire 20-year study period. The majority of this reduction in the region's future natural gas production is expected to occur in Pitkin County where future total natural gas production is anticipated to decrease from 16.2 Bcf (Alternative 1) to 0.7 Bcf (Alternative 4). The Alternative 4 stipulations are expected to result in only relatively small reductions in both Garfield and Mesa Counties' total future natural gas reductions (compared to Alternative 1).

Table 4.17-13 Natural Gas Production by County (2017-2036) – Alternative 4

Area	Total New Wells	Production (Bcf)	Sales Revenues ($ Million)
Garfield	127.3	81.8	$415.3
Mesa	244.6	199.7	$1,013.2
Pitkin	1.1	0.7	$3.5
Rio Blanco	10.0	6.3	$32.0
Four-county Region	383.0	288.5	$1,465.7

Table 4.17-14 shows the estimated future employment and income impacts over the entire 20-year study period from Alternative 4's future oil and gas development. Under Alternative 4, over the 20-year analysis period, well drilling and natural gas production is expected to add 2,540 job-years of new direct employment in the four-county region. This job growth would be equivalent to an annual average of 127 FTEs. The related indirect and inducted effects of the natural gas production activities will add a total of 547and 1,145 jobs-years, respectively to the region which would be equivalent to an annual average of 27 indirect and 57 induced FTEs. Over the 20-year analysis period, Alternative 4 has a lower growth in employment and labor income compared with Alternative 1 from natural gas development and operations, of the magnitude 5 percent for Garfield County, 6 percent for Mesa County, 91 percent for Pitkin County and no change for Rio Blanco County. For the four-county region as a whole, Alternative 4 has 8 percent lower growth in employment and income as compared with the No Action Alternative over the analysis period.

Table 4.17-14 Total Employment and Income Impacts from Natural Gas Development and Operations (2017-2036) – Alternative 4

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (Job-years)					
Direct	776.0	1,698.0	7.0	60.0	2,542.0
Indirect	113.3	362.1	0.4	9.6	547.7
Induced	247.5	716.7	9.3	9.6	1,145.8
Total	1,136.8	2,776.9	16.7	79.2	4,235.5
Income ($ Millions)					
Labor Income	$79.1	$190.2	$1.1	$5.6	$285.6
Value Added	$47.5	$146.0	$1.2	$3.0	$201.6
Output	$264.6	$601.9	$3.2	$19.6	$943.5

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC; IMPLAN 2015.

The annual future employment growth that would be expected as additional natural gas wells are brought on-line and begin to operate. Future operational employment would steadily increase as the newly constructed wells start producing. Initially in 2017, the new operating wells would provide employment for approximate 4 FTEs, increasing to 87 FTEs in 2036. Future well construction activities are estimated to consistently employ approximately 81 persons per year between 2017 and 2036. A total of 168 FTEs would be employed in 2036 for new well construction as well as operating and maintaining

of the projected 383 operating wells. This would represent a total increase in employment of 2,540 job-years over the intervening 20-year period. The related total labor income for the region is estimated at $286 million. The natural gas production activity also is expected to result in a total value added of $202 million, with the increase of output to the region's economy of $944 million.

Local Government Revenue Impacts

As shown in **Table 4.17-15**, Alternative 4's future natural gas production is projected to generate $93.6 million in total revenue payments for the four counties over the 20-year analysis period. This would correspond to an average annual revenue payment of $4.7 million to the region's county governments.

As discussed in **Appendix C**, over the 20-year lease period, Mesa County is expected to receive the greatest proportion of the future natural gas revenue payments ($74.6 million) with Garfield obtaining most of the remainder ($17.6 million). Rio Blanco and Pitkin Counties would each receive $1.2 million and $0.2 million, respectively. In addition, local communities are expected to receive an additional $13.7 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county.

Table 4.17-15 Estimated County Revenues from Natural Gas Development and Operation (2017-2036) – Alternative 4 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total
2017	$0.5	$0.1	$0.2	$0.0	$0.3
2036	$20.0	$3.9	$6.3	$0.1	$10.2
Total (2017-2036)	$183.0	$35.9	$57.2	$0.6	$93.6
Annual Average	$9.1	$1.8	$2.9	$0.0	$4.7

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $13.7 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, State of Colorado and all county and local agencies.

Table 4.17-16 shows the estimated future employment and income impacts from the natural gas revenues. The impact results include both the induced and indirect effects as estimated by the IMPLAN analysis.

Table 4.17-16 Revenue Impacts Generated from Natural Gas Development and Operation (2017-2036) – Alternative 4

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (FTE)					
Direct	62.4	251.6	0.5	3.8	314.9
Indirect	15.8	86.1	0.2	0.3	115.2
Induced	18.3	123.3	0.1	0.4	138.6
Total (2017-2036)	96.6	461.0	0.8	4.6	568.7
Income ($ Million)					
Labor Income	$4.3	$26.8	$0.1	$0.3	$34.9
Value Added	$4.8	$36.6	$0.1	$0.4	$47.0
Output	$9.0	$67.3	$0.1	$0.6	$85.1

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

It is conservatively assumed that half of the County revenues ($46.8 million) would likely be held as reserve funds (and therefore would not result in any spending impacts). Future county natural gas revenues are expected to result in increased direct employment of 314 job-years over the 20-year analysis period. This job growth would be equivalent to an average annual increase of 16 FTEs direct jobs for the region's economy.

The related indirect and induced effects of the natural gas revenues will add an additional 115 and 138 jobs, respectively, over the entire 20-year analysis period. This job growth would be equivalent to an average annual of 6 indirect and 7 induced FTEs. During the future 20-year time period, the region's total labor income also is estimated to increase by $34.9 million with an overall economic output increase of $85.1 million.

It is expected that 25 of the leases would be at least partially canceled and the leaseholders would be paid back for any rental fees and bonus bids. **Table 4.17-17** shows the estimated potential future bonus bids and lease payment refunds. Leaseholders had previously paid $1.0 million for the specific acreage that would be expected to be canceled, of which 49 percent ($0.5 million) was distributed to the state of Colorado. This value was calculated from bonus and rent payments from 1995 through 2014.

Table 4.17-17 Contract Cancellations Refunds to Lessees – Alternative 4 ($ Millions)

Location	Total	Non-federal Payment
Zone 1	$0.0	$0.0
Zone 2	$0.0	$0.0
Zone 3	$1.0	$0.5
Zone 4	$0.0	$0.0
Total	**$1.0**	**$0.5**

Approximately 40 percent of the non-federal revenues were subsequently distributed to the region's county and local governments, it uncertain whether the county and local governments would be required to pay back their share of the revenues received from cancelled leases. Under the similar circumstances of the Roan lease closures, the State of Colorado assumed sole responsibility for repayment of the non-federal share of the bonus bid and lease payment refunds. In which case, there would be no economic impact to the region's economy from the lessee refunds. If the county and local municipalities are require to repay their share of the received revenues they would need to refund an estimated total of $0.2 million.

4.17.3.5 Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled. For producing leases, this action is not within the BLM's authority to implement so it would be necessary to pursue judicial action. For the purposes of the socioeconomic analysis, it is assumed that this judicial action would result in the cancellation of all leases. This alternative is included mainly to facilitate a full range of analysis from continuing the existing leases with their current stipulations to considering a scenario as close to not having issued leases (following the WRNF 1993 ROD) as is feasible today.

Under this alternative, all producing wells would have to be plugged and abandoned, infrastructure would be removed, roads, well pads, and other ancillary facilities would be reclaimed, and all disturbed areas would be re-vegetated. As with other alternatives, a decision to implement this alternative would not authorize any on-the-ground activities, including specific reclamation actions. If this alternative were selected, additional site-specific analysis would be required.

<u>Stipulation Protections</u>

Stipulations would not be necessary as all leases would be cancelled and no development would occur in the foreseeable future.

<u>Impacts from Future Natural Gas Development</u>

Under Alternative 5 no new natural gas wells would be developed within the 65 lease areas. In addition, the 75 currently producing wells would need to be plugged and abandoned, leading to loss of production for their remaining operational lives (10 years). Additionally, any impacts that would occur under Alternative 1 (No Action Alternative) (e.g., future new well construction) would not happen under Alternative 5.

Natural Gas Development Impacts

The four-county region would lose 45 Bcf of production over the 10-year period from the existing wells. As shown in **Table 4.17-18**, the estimated total value of the resulting future production loss is $188.2 million.

Table 4.17-18 Natural Gas Production in the Four-county Area – Alternative 5

Time Period	New Well Construction			Operating Wells	Natural Gas Production (Bcf)	Sales Revenues ($ Million)
	Directional	Horizontal	Total			
2017	0.0	0.0	0.0	-75.0	-4.5	-$13.0
2026	0.0	0.0	0.0	-75.0	-4.5	-$22.7
Total (2017-26)	0.0	0.0	0.0	-75.0	-45.0	-$188.2
Annual Average (2017-26)	0.0	0.0	0.0	-75.0	-4.5	-$18.8

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown are only for the 2017-27 loss in natural gas production by existing wells.

As can be seen in **Table 4.17-19**, the majority of the lost natural gas production would occur in Mesa County with the remainder lost from wells located in Garfield County.

Table 4.17-19 Natural Gas Production by County – Alternative 5

County	Wells	Natural Gas Production (Bcf)	Sales Revenues ($ Million)
Garfield	-15.0	-9.6	-$40.2
Mesa	-60.0	-35.4	-$148.1
Pitkin	0.0	0.0	$0.0
Rio Blanco	0.0	0.0	$0.0
Four-county Region	-75.0	-45.0	-$188.2

Additionally the project would lose future gas production and revenues that would otherwise be obtained under the Alternative 1 - No Action Alternative conditions. This would amount to an additional loss of 312 Bcf in future natural gas production that would have an estimated total future sales value of almost $1.6 billion.

Consequently, over the entire 20-year study period, under Alternative 5, there would be a total loss of 357 Bcf in future natural gas production with an estimated value of almost $1.8 billion.

The loss of natural gas production by the existing 75 operating wells under this alternative is expected to result in a direct employment loss of 150 FTEs in the four-county region between 2017 and 2026 (**Table 4.17-20**). The reduced labor income for the region is estimated to total $21.1 million. In addition, there would be a total value added loss of $12.1 million and $53.6 million decrease in economic output.

Table 4.17-20 Employment and Revenue Impacts Generated from Natural Gas Development and Operation (2017-2026) – Alternative 5

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (Job-years)					
Direct	-29.0	-118.0	0	0	-150.0
Indirect	-4.7	-17.7	0	0	-24.6
Induced	-12.2	-76.6	0	0	-83.4
Total	-45.8	-212.2	0	0	-258.0
Income ($ Million)					
Labor Income	-$3.9	-$16.7	$0.0	$0.0	-$21.1
Value Added	-$2.3	-$9.9	$0.0	$0.0	-$12.2
Output	-$10.8	-$43.1	$0.0	$0.0	-$53.9

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

Since the construction (and subsequent production) of the 416 new wells in No Action Alternative also would not occur, there would be additional losses to the regional economy. Under the alternative, a direct employment loss of 2,751 job-years and a total economic output loss of $1.0 billion are estimated over the 20-year analysis period (**Table 4-17.8**). Over the same time period, Alternative 5 has a loss in employment and labor income compared with Alternative 1 from natural gas development and operations, of the magnitude 104 percent for Garfield County, 107 percent for Mesa County, 100 percent for Pitkin County and 100 percent for Rio Blanco County. For the four-county region as a whole, a 94 percent loss in employment and income is foreseen under Alternative 5 as compared with the No Action Alternative over the analysis period.

Decreases in direct employment in the analysis area would be 15 FTEs annually from 2017 through 2026. With current unemployment rates at 5.8 percent (Colorado Department of Labor and Employment 2015), total employment losses from the closure of the wells would only account for 0.1 percent of unemployed. Regardless, the change in unemployment would represent the maximum increase unemployment with many of the persons being able to find new work in the region.

Local Government Revenue Impacts

As discussed in Section 4.17.4.1 Alternative 1, natural gas operations generate significant revenue payments to counties. Not only would the four-county region no longer receive the projected payments identified in Alternative 1, but both Garfield and Mesa Counties would lose future revenue payments from the existing 75 wells that would be abandoned ten years before their estimated productive life is otherwise expected to end. The loss from current production for these two counties is estimated at $12.6 million over the 10-year period; with initial revenue loss of $0.9 million in 2017 and increasing to $1.5 million in 2026 (**Table 4.17-21**). In addition, local communities are expected to receive an additional $1.8 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county.

Table 4.17-21 Estimated County Revenues from Natural Gas Development and Operations (2017-26) – Alternative 5 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total [3]
2017	-$1.6	-$0.3	-$0.5	$0.0	-$0.9
2026	-$2.8	-$0.6	-$1.0	$0.0	-$1.5
Total (2017-26)	-$23.5	-$4.6	-$7.9	$0.0	-$12.6
Annual Average (2017-26)	-$2.4	-$0.5	-$0.8	$0.0	-$1.3

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $1.8 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, State of Colorado and all county and local agencies.

[3] Due to rounding, values may not add up exactly.

[4] No revenues losses would occur after 2026 when the existing wells' natural gas production would otherwise end.

In addition, under Alternative 5 the counties would lose future gas revenues that would otherwise be obtained under the Alternative 1 conditions that would amount to an additional loss of $98 million. Consequently, under Alternative 5, over the entire 20-year analysis period, there would be a total loss to the counties of over $111 million.

Table 4.17-22 includes the revenue distribution on a county by county government basis. Both Garfield and Mesa counties would lose future revenue payments from the existing 75 wells that would be abandoned ten years before their estimated productive life is otherwise expected to end. The loss of government from current production for these 2 counties is estimated at $12.6 million over the 10-year period.

Table 4.17-22 Total County Revenue Impacts (2017-26) – Alternative 5 ($ Millions)

Time Period	County Oil and Gas Revenues				Total Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
2017	-$0.1	-$0.8	$0.0	$0.0	-$0.9
2026	$0.2	$1.3	$0.0	$0.0	$1.5
Total (2017-26) [2]	-$1.7	-$10.9	$0.0	$0.0	-$12.6
Annual Average (2017-26)	-$0.2	-$1.1	$0.0	$0.0	-$1.3

[1] Due to rounding, values may not add up exactly.

[2] No revenues losses would occur after 2026 when the existing wells' production would otherwise end.

Table 4.17-23 shows the projected future county government revenue impacts on a county-by-county basis. Based on the assumption that 50 percent of the revenues ($6.3 million) would be retained in a reserve fund, the lost natural gas revenues are expected to result in a total decrease of 42 job-years of direct jobs for the region over the 10-year analysis period. This is would be equivalent to an annual average of approximately 4 FTEs over the 10-year period that these wells would otherwise have remained in production. The related losses in indirect and induced effects of the natural gas production activities are 15 and 18 job-years, respectively, over the 10-year analysis period. This is would be equivalent to an average of approximately 1 indirect and 2 induced FTEs of loss employment each year between 2017 and 2026. Over entire the 10-year analysis period, there is expected to be a total of $4.6 million in lost labor income and a total economic output loss of $11.3 million.

Table 4.17-23 Total County Government Revenue Impacts (2017-26) - Alternative 5 ($ Millions)

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment					
Direct	-5.3	-36.7	0	0	-41.7
Indirect	-1.3	-12.6	0	0	-15.3
Induced	-1.5	-18.0	0	0	-18.4
Total (2017-26)	-8.1	-67.3	0	0	-75.3
Income (Millions $)					
Labor Income	-$0.5	-$3.9	$0.0	$0.0	-$4.6
Value Added	-$0.7	-$5.3	$0.0	$0.0	-$6.2
Output	-$1.2	-$9.8	$0.0	$0.0	-$11.3

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

In addition, it is assumed that as all of the leases would be cancelled, and the leaseholders would be refunded all rental fees and bonus bids. Leaseholders had previously paid $5.2 million, of which 49 percent ($2.6 million) was distributed to Colorado. These value were calculated from bonus and rent paid from 1995 through 2014. While a percentage of these funds were subsequently distributed to the counties, in accordance with similar circumstances for the Roan lease closures, it is expected that the counties (and any other local agencies) would not be required to repay any of their past revenues from the cancelled leases. Instead, the state of Colorado is expected to be solely responsible for repayment of the non-federal share of any necessary bonus bid and lease payment refunds. As a result, there would be no economic impact to the region's economy from the lessee refunds (**Table 4.17-24**).

Approximately 40 percent of the non-federal revenues were subsequently distributed to the region's county and local governments, it uncertain whether the county and local governments would be required to pay back their share of the revenues received from cancelled leases. Under the similar circumstances of the Roan lease closures, the State of Colorado assumed sole responsibility for repayment of the non-federal share of the bonus bid and lease payment refunds. In which case, there would be no economic impact to the region's economy from the lessee refunds. If the counties and local municipalities were required to repay their share of the received revenues they would need to refund an estimated total of $1.0 million.

Table 4.17-24 Potential Lessee Refunds – Alternative 5 ($ Millions)

Location	Total	Non-Federal Share
Zone 1	$0.3	$0.2
Zone 2	$3.2	$1.6
Zone 3	$1.7	$0.8
Zone 4	$0.0	$0.0
Total	$5.2	$2.6

Note: Totals may not add up exactly due to rounding.

Recreation Impacts

Alternative 5 would result in the removal of 75 wells, and consequently may have slight positive impact to the future landscape and habitat hunters and fishermen use. However, decommissioning of roads may reduce access to recreational opportunities. As this alternative has fewer wells relative to the other alternatives, this may result in a relative increase in the value of experience for some users.

Grazing Impacts

Surface disturbance for Alternatives 5 would result in a reduction of long-term disturbance related to the operation, and maintenance of well pads, access roads, and pipelines. All disturbed areas would be reclaimed to pre-disturbance conditions. The Forest Service would be responsible for approval of reclamation methods and determining when reclamation is satisfactory. The extent of impacts to grazing would be the least of all alternatives and reclaimed areas within the grazing allotments would be available for grazing once reclamation is determined to be successful.

Transportation Impacts

Alternative 5 is expected to have the least traffic volumes of all the alternatives. As a result, compared to Alternative 1, it could maintain or improve the quality of life for those residents living in the vicinity of the existing natural gas development.

Social Impacts

None of the alternatives would be expected to reduce economic diversity (the number of economic sectors) or increase economic dependency, which occurs when the local economy is dominated by a limited number of industries. Shifts in emphasis could occur, but these would not result in any of the alternatives.

While the alternatives have the potential to affect local businesses and individuals, the relative contribution and the relative differences between the alternatives would not be large enough to have any measurable effect on economic diversity or dependency.

Estimates of the levels of employment and labor income that would be supported by the alternatives are based on projected wells drilled and consequent natural gas production. Estimated average annual employment and labor income from natural gas leasing related outputs and activities are summarized for each alternative in the Natural Gas Development Impacts discussion.

4.17.3.6 Summary of Impacts

Alternatives 1 and 2 would result in the greatest economic impacts to the regional economy. The revenue of the total new natural gas production (i.e., over the entire 2017 to 2036 time period) is estimated to approach $1.6 billion. The value of Alternative 5's projected natural gas production lost from

the 75 existing wells is estimated to be $188 million. Combined with the forgone future natural gas production that would otherwise be obtained from new well development, compared to No Action Alternative conditions, Alternative 5 is expected to result in a total loss of natural gas production worth approximately $1.8 billion.

Only qualitative analysis of the alternatives economic impacts to recreation, grazing and transportation could be performed. The information constraints on both their current activity levels and the specific future natural gas production activities prevent quantitative analysis of the both the resource impacts themselves and consequently their related spending and economic effects. Furthermore, the relatively low use and expected limited interaction between the future natural gas development activities and other resources with potential economic sector impacts (e.g., recreation, grazing and transportation) suggest that no future economic impacts can be attributed to those uses from the future natural gas development.

However, while most of the region's residents may have limited direct experiential interaction with the increased oil and gas development or its effects, they may nonetheless feel a resulting decrease to their quality of life and/or sense of place from any new oil and gas development in the region. These residents will likely perceive that any increase in oil and gas development will result in a corresponding decrease to the region's environmental/ecosystem integrity and natural wilderness and rural character. Accordingly, these individuals will prefer less oil and gas development in the region.

Each alternative's quantifiable economic impacts are directly related to their corresponding projected natural gas production quantities. Future employment in the four-county region would increase from new short-term well construction jobs. There also would be an increase in the region from the more permanent jobs operating and maintaining the producing wells over their full 20-year expected operating lifespan. Under Alternatives 1 and 2, total jobs produced by natural gas development and operations are expected to be 93 FTEs in 2017 and increase to 182 FTEs by 2036; this would represent a total increase in employment of 2,751 job-years over the intervening 20-year period. Alternative 3 would be very similar, with total increase in employment of 2,733 job-years through the same 20-year period. Alternative 4 would generate slightly fewer annual jobs; with projections of 2,542 job years of new direct natural gas development employment which would represent a net decrease of approximately 209 job-years compared to the Alternative 1, No Action Alternative.

Alternative 5's projected annual employment lost from closure of the 75 existing wells is projected to result in total 150 lost job-years over the 10-year period that those wells would otherwise continue to operate. This would be equivalent to an average annual 15 FTE job loss for the region for the 10-year period. Combined with the forgone future employment growth that would otherwise be obtained from new well development, compared to No Action Alternative conditions, Alternative 5 is expected to result in a total future natural gas production employment loss of approximately 2,901 job years. This would be equivalent to an average annual 145 FTE job loss for the region over the 20-year period.

Alternatives 1, 2, and 3 are expected to generate total future county revenue payments of approximately $99 million over the 20-year period. Alternative 4 would result in slightly lower future total county revenue receipts of approximately $94 million – a net decrease of approximately $5 million compared to the Alternative 1 – No Action Alternative. The total county revenue loss from Alternative 5's closure of the 75 existing wells is projected to total approximately $13 million. Combined with the forgone future county revenues that would otherwise be obtained from new well development, Alternative 5 is expected to result in a total future county revenue loss of approximately $111 million compared to No Action Alternative conditions.

4.17.4 Cumulative Impacts

4.17.4.1 Cumulative Impacts Analysis Area

The CIAA would be the same as the analysis area described in Section 4.17.1.1 and will consist of the four-county region of Garfield, Mesa, Pitkin, and Rio Blanco counties.

4.17.4.2 Past and Present Actions

Past and present actions are broken into three surface disturbing activities: mineral development, transportation corridors, and other development. Other socioeconomic resources from past and present surface disturbing activities are similar to those described in Section 4.17.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the total leasing area.

4.17.4.3 Reasonably Foreseeable Future Actions

RFFAs would include oil and gas, as well as road, powerline, pipeline, reservoir, vegetation treatment, habitat improvement, and recreational trails projects. These projects also could contribute to increased levels of traffic, impacts to current recreation access, impacts to access of grazing lands, increased demands for labor, and changes to governmental revenues.

Oil and Gas

BLM manages approximately 6.72 million subsurface acres of federal lands within the four-county region. The majority (95.4 percent) are administered by three BLM FOs: The GJFO which manages 2.39 million acres; the WRFO which manages 2.25 million acres; and the CRVFO that manages 1.77 million acres. The WRNF occupies a large portion of the lands administered by these three BLM FOs. These field offices also manage lands located in other Counties outside the region.

In support of its land management and planning, the BLM periodically develops RFD Scenarios for its planning areas within its jurisdictions. A RFD is a long-term scenario used as a baseline for planning. It is a rational estimate of the possible future development based on potentially available productive areas that are not closed for development. The RFD projections include both fee and federal wells. The RFD estimates the potential oil and gas development activity on all lands including private or state lands. Consequently, the RFDs provide a likely upper limit estimate of its area's future cumulative oil and gas development.

The WRFO's most recent RFD was performed in 2007 and it estimated that up to 17,800 wells could be drilled over the subsequent 20 years (BLM 2007). The GJFO finalized a RFD in June 2012, which estimates that another 9,116 wells to be drilled in the next 20 years (BLM 2012). The RFD for the Roan Plateau projected that 5,470 federal and fee wells could be drilled within the Roan Plateau Planning Area (which is part of the CRVFO) within the next 20 years. The RFD for the Roan Plateau also reported that the CRVFO office wide RFD estimates that 14,792 wells could be drilled during the next 20 years (BLM 2014d). The cumulative analysis for the USFS Final EIS did not consider the cumulative effects of the other reasonably foreseeable oil and gas development in the region (USFS 2014a).

Based on these analyses, it is projected that up to 42,722 wells could be drilled within the BLM CRVFO, GJFO, and WRFO over the next 20 years. While the RFD include some areas outside the region, the oil and gas development nonetheless provide an indication of the potential overall future oil and gas development conditions for the region.

4.17.4.4 Contribution of the Proposed Actions and Alternatives to Cumulative Impacts

Oil and Gas

Development of the WRNF leases would add 416 new wells which would contribute less than 1 percent to the region's cumulative oil and gas development over the next 20 years. The other cumulative well development would increase road construction and further expand the regional road network with the region's rural areas. Well development also would result in increased employment opportunities and generate additional county revenues.

However, if future oil and gas development in region occurs at the level foreseen above there also will be the potential for adverse impacts to the region's economy and social resources. Such a high level of oil and gas development can be expected to attract and require new transient workers to the region, which could reduce the availability of affordable housing in the region and encourage greater residential development. The related population increase also may increase the demand for public services and increase the costs to county and local service agencies.

Reduce unemployment and the availability of better paying energy industry jobs could reduce the available labor force willing to work the lower paying jobs in the region's tourism-related businesses which in turn could threaten their viability.

The oil and gas development foreseen by the cumulative analysis also could have a noticeable impact on the region's wilderness, grazing and recreation resources. As future oil and gas development becomes more prevalent (as well as its related transportation and other impacts), these resources could be reduced in size (or accessibility) and/or degraded in quality. In either case, this could result in decreases in their use by tourists, ranchers and area residents. A substantial decrease in use would be expected to negatively affect any related businesses that are dependent on these users for their livelihood. For example, reduced tourism to the region would likely adversely and directly affect hotels and restaurants in the region.

The possible social impacts from natural gas development activities were described earlier in this section. The potential influx of new temporary or permanent residents drawn by a major increase in future oil and gas development in the region could affect the region's social character as these new individuals may have different values, interests and lifestyles than those of the existing residents. Furthermore, alteration of the region's natural setting, recreational opportunities and rural character by a major increase in oil and gas development also could adversely affect the existing residents' "sense of place" and "quality of life." While affordable housing could become scarcer as better paid energy industry workers relocate to the area, other residents could face reduced property values for some private homes if oil and gas activities (including visual and transportation impacts) reduce the attractiveness of their rural and natural setting.

However, the contribution to any of these possible outcomes by the action alternatives will be small as its oil and gas development growth would a very small portion (1 percent) of the any such cumulative effects. While the various action alternatives would in some way contribute the cumulative impacts, their addition or elimination would not be expected to noticeably change the future outcomes to the region's economy or social resources from the cumulative natural gas development.

Other Surface Disturbance

Other surface disturbing activities such as coal and gravel mining in Garfield County would likely incrementally increase traffic levels, affect recreation access and access to grazing lands, increase demands for labor, and result in changes to county revenues. However, their contribution to the cumulative impacts would be expected to be very small compared to the effects of the expected future new oil and gas development in the region.

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4.18 Environmental Justice

4.18.1 Analysis Assumptions and Approach to Analysis

4.18.1.1 Analysis Area

The analysis area for direct and indirect impacts to environmental justice includes U.S. Census Bureau tracts in Garfield, Mesa, Pitkin, and Rio Blanco counties that contain existing oil and gas leases.

4.18.1.2 Scoping Issues

No scoping issues related to environmental justice were identified by the public.

4.18.1.3 Assumptions

The assumptions used in this analysis of impacts are summarized below.

- Oil and gas leasing decisions in and of themselves have no direct impacts to environmental justice communities, but only indirect resources impacts that might potentially result in environmental justice impacts on communities of concern in the region.
- Any effects of leasing and potential future development would be only measureable at the time of lease sale and once subsequent lease development occurs.
- The natural gas leasing and stipulation decisions could indirectly impact numerous resources and result in future outcomes (e.g., natural gas revenues, local government revenues, recreation, grazing, commute patterns and social conditions) that could affect local populations.

4.18.1.4 Impact Indicators Used for Analysis

The following impact indicators were used in the analysis:

- Total population
- Percentage of the population with minority status (e.g., Hispanic or Latino, Black or African American, Asian American, American Indian or Alaskan Native, Native Hawaiian and other Pacific Islander)
- Percentage of the population with low-income status

4.18.2 Stipulations Providing Protections to Environmental Justice

NSO stipulations would prohibit site development on certain areas including avoiding impacts to culturally significant resources to Native American tribes as well as areas that local populations may use for subsistence or cultural practices.

4.18.3 Impacts Common to All Alternatives

As discussed in Section 3.18, Environmental Justice, there are currently no environmental justice communities located within the analysis area. In the absence of any such communities of concern, no environmental justice impacts would occur. Nonetheless, it should be recognized that there may still be the potential for Environmental Justice communities in the planning area, and additional analysis may be necessary at the project level to determine the potential for disproportionate adverse impacts. Such impacts could include housing, recreation, tourism, transportation and services, as well as air quality and noise. Should disproportionate adverse impacts be identified, then BLM would consider appropriate outreach to affected communities and needed mitigation measures to reduce impacts. Any affected communities may be involved in developing such measures.

Additionally, in accordance with federal environmental justice guidance, public involvement efforts for this project have been inclusive and the BLM has considered input from persons or groups regardless of race, color, national origin, income, or other socioeconomic characteristics (CEQ 1997).

4.18.4 Impacts by Alternative

4.18.4.1 Alternative 1

As discussed in Section 4.17, Socioeconomics, over the next 20 years Alternative 1 is expected to result in future employment and labor income growth (both directly and indirectly) from future natural gas development within WRNF. As the increased employment opportunities would be distributed across the entire population, including minority and low-income residents, the region's minority and low-income residents could experience benefits. In addition, Alternative 1 would continue to ensure access for subsistence uses, traditional materials, and cultural sites which would continue to provide valuable resources to communities in the area. Sustaining lifestyles, traditions, ceremonies, and heritage would remain an important part of the regional community lifestyle, rural character, and quality of life.

However, no environmental justice communities are located within the analysis area and consequently, in the absence of any such communities of concern, no environmental justice impacts would occur.

4.18.4.2 Alternative 2

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.3 Alternative 3

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.4 Alternative 4 (Proposed Action)

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.5 Alternative 5

As discussed in Section 4.17, Socioeconomics, Alternative 5 would result in decreases in future employment and labor income from lease cancellations and discontinuation of 75 currently operating wells. These economic losses would be distributed across the entire population, including minority and low-income residents and could adversely impact some minority and low-income residents in the region. However the total number of person currently employed by the current oil and gas production activities within the WRNF is minor compared to the overall regional economy.

Similar to Alternative 1, Alternative 5 would continue to ensure access for subsistence uses, traditional materials, and cultural sites, thereby sustaining lifestyles, traditions, ceremonies, and the heritage that remain an important part of community lifestyle, rural character, and quality of life.

4.18.5 Summary of Impacts

Overall no disproportionate and adverse effects to environmental justice communities are expected from any of the action alternatives as no environmental justice communities were identified within the study area.

4.18.6 Cumulative Impacts

4.18.6.1 Cumulative Impacts Analysis Area

The CIAA for environmental justice is the population within Census Tracts either totally or partially inside the WRNF analysis area and is the same area as that analyzed for environmental justice impact analysis.

4.18.6.2 Reasonably Foreseeable Future Actions

No minority or low-income communities of concern were identified within the CIAA. Consequently, in the absence of any such communities of concern, there are no RFFAs that cumulatively would be expected to result in disproportionate and adverse environmental justice impacts to any communities of concern within the CIAA.

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4.19 Short-term Uses Versus Long-term Productivity

4.19.1 Introduction

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity is required to be addressed under NEPA. Short-term use considers the effect of occupying the land for production of gas for the period of years until the supply is depleted and reclamation is completed. This section discusses whether the short-term uses of environmental resources would affect the long-term productivity of the environment. Short term refers to the period of gas production, assumed to be 20 years for this analysis although wells may produce longer. Short-term uses of the environment associated with the alternatives are generally the same as the impacts, both temporary and permanent, described for each resource in this EIS. The relationship between short-term uses and long-term productivity would not be appreciably different across the range of alternatives.

4.19.2 Air Quality

There would be short-term impacts on air quality from emissions generated by development, production, and reclamation equipment and dust from vehicle traffic. At the low density of mineral development projected for the analysis area, it is unlikely that these impacts to air quality would affect long-term regional air quality.

4.19.3 Geology, Minerals, Paleontology

Short-term uses and long-term productivity are not relevant to geologic hazards and paleontological resources. Oil and gas infrastructure (roads, pads, pipelines) constitutes a relatively short-term use even though the wells may have productive lives of 20 to 30 years. But as long as the wells are active, the land occupied by the development is precluded from other uses. Once wells are abandoned and the lands reclaimed, those areas can be returned to other uses. Development of oil and gas resources within the leases would permanently remove a large fraction of the technically recoverable resource for short-term use. Short-term uses also would have an adverse impact on long-term productivity for other mineral development in the immediate location of wells. However, because the acres of mineral resources impacted by all alternatives would be low, and better availability of some resources exist outside the lease area, overall long-term impacts to the productivity of salable mineral resources would be minor.

4.19.4 Soils

Overall site productivity is primarily a matter of revegetation success. Productivity varies with vegetation community and soil type, but more importantly, with land management practices as they relate to the establishment of desirable or productive vegetation types. In contrast, soil quality is an inherent soil characteristic involving structure, permeability, texture, acidity, microbial populations, fertility, and other physical and chemical characteristics that are beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to short-term uses while mineral development infrastructure is in place. There may be some impacts to long-term soil productivity after surface disturbance occurs due to reduced microbial activity and modification of the natural soil horizons and compaction, which may extend for many years beyond successful revegetation, is achieved.

4.19.5 Water Resources

4.19.5.1 Surface Water

Regarding Alternatives 1 through 4, until the lessees pursue approval to develop the oil and gas resources, no short-term uses of water resources would occur. At that time, surface water may be affected by increased stormwater runoff and sedimentation, although those impacts would be minimized by compliance with permit requirements.

Alternative 5 would result in impacts to short-term uses of the resource during well plugging and abandonment and reclamation of disturbed areas. However, because existing facilities would be decommissioned and disturbed areas reclaimed, the short-term disturbance would be expected to increase long-term productivity once reclamation is achieved.

4.19.5.2 Groundwater

Assuming additional approvals to develop the leases under Alternatives 1 through 4, oil and gas development would consume water resources in the short-term, potentially affect the chemistry of groundwater resources, and alter the hydrogeology. In the long term, water resources may be slightly reduced due to increased consumption. Groundwater resources could be locally contaminated due to spills, leaks, and well failures, although this would be minimized by compliance with state and federal laws and permit requirements. Based on current knowledge of the hydrogeologic settings in the WRNF, oil and gas resources are often developed from geological reservoirs that do not contain significant amounts of freshwater.

Under standard procedures the USFS and BLM follow when considering specific post-leasing drilling proposals, the agencies have the ability to move a proposed oil and gas well location up to 200 meters to minimize potential environmental effects. This would include the ability to move a location to protect or minimize effects to groundwater resources and would serve to further reduce potential effects to groundwater resources. Further, during subsequent NEPA analyses that would consider effects of post-leasing project level proposals, site-specific circumstances and effects may indicate that water resource monitoring is required. Compliance with existing rules and regulations, stipulations, other COAs, modern practices, and BMPs would combine to reduce the likelihood of adverse impacts to long-term productivity.

4.19.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

Impacts from localized short-term uses on long-term vegetative resource productivity would vary slightly by alternative with greater impacts from alternatives with more development and fewer restrictions. A loss of native vegetation productivity from oil and gas development would most likely occur in areas of concentrated oil and gas development. The extent of impacts to long-term productivity would vary depending on the intensity of the local short-term use.

After disturbance, most native vegetation communities would not recover to pre-disturbance levels until decades after implementation of reclamation. Habitat and populations of federally listed plant species would be protected under all alternatives, while habitat and populations of other special status plant species would receive lesser protections, varying by alternative. Relaxed reclamation standards could promote the spread of noxious weeds and other invasive plant species. This could reduce the suitability of special status plant habitats, and habitats of their pollinators. Herbicide drift from chemical treatment of invasive species also could impact special status plants and their pollinators.

4.19.7 Terrestrial Wildlife Including Special Status Species

Under all alternatives, construction, drilling, and completion activities would result in some short-term impacts to terrestrial wildlife and special status species habitat as well as individuals. This short-term use may affect long-term productivity of terrestrial species should there be alteration or loss, modification or fragmentation of habitat, direct mortality of individuals, and increased disturbance from human activity. Wildlife habitat would be reduced due to local short-term uses until reclaimed areas return to mature vegetation communities that provide suitable habitat. Oil and gas development activities would have localized impacts on wildlife populations during development particularly during the construction drilling and completion phases, although stipulations and regulatory requirements would reduce the level of adverse impacts to terrestrial wildlife species.

4.19.8 Aquatic Resources

Construction under all alternatives would result in some short-term impacts to aquatic habitat and fish species that may affect long-term productivity due to surface disturbance and water use if sources are derived from or linked to surface water. Specific short-term impacts to aquatic habitat and species would include alteration or loss of habitat, water quality effects from sedimentation and possible contaminant spills, and potential habitat reductions due to water use. Oil and gas development activities may have localized short-term impacts on fish populations particularly during the drilling and completion phases. Stipulations and compliance with regulatory requirements would minimize the level of adverse impacts to fish species over the long-term.

4.19.9 Cultural Resources

Short-term uses that involve surface disturbance have the potential to adversely affect eligible cultural resources if they are not mitigated or avoided. Compliance with federal and state laws and regulations would minimize the potential for adverse impacts to eligible sites. Cultural resources surveys and data recovery and analyses would contribute to the long-term knowledge of cultural resources in the region.

4.19.10 Transportation

Over the 20-year development period, a more extensive road network would be in place for enhanced access and other uses, where permitted. Over the long-term, roads accessing well pads would be reclaimed, resulting in a return to the previous transportation network in the area unless the Forest Service decides to keep and maintain some of the roads.

4.19.11 Lands and Special Uses

Under Alternatives 1 through 4, lease development may preclude authorization of other potential uses in the locations of oil and gas infrastructure until those facilities are plugged, abandoned, and reclaimed. Under Alternative 5, other uses of the land would be facilitated after the 75 producing wells and associated infrastructure are reclaimed.

4.19.12 Special Designations

Naturalness and the roadless aspects of special designations could be disrupted during lease development as roads and facilities are constructed and used for the producing life of each well. However, in the long-term as areas are reclaimed, the naturalness and solitude of special designations would be restored. Restoration of naturalness and solitude would depend, in part, on successful reclamation as well as the timing of other potential projected oil and gas activities in the area.

4.19.13 Recreation

Recreational access could be disrupted during lease development as roads are constructed and used to facilitate mineral development and extraction. Hunting and dispersed recreational opportunities may be impaired in the short-term in areas with active drilling and production. In the long-term as areas are reclaimed, visual aesthetics and dispersed recreational opportunities would be restored to original conditions.

4.19.14 Livestock Grazing

Short-term impacts from the removal of forage for construction of oil and gas facilities would be returned to pre-disturbance conditions and restore long-term productivity following depletion of the mineral resource and successful reclamation. Short-term uses would apply to areas where initial surface disturbance would occur during construction. Permanent structures required for operations would have a longer term impact but these areas would eventually be returned to productive forage through

reclamation activities that may achieve better than pre-disturbance conditions within the grazing allotments.

4.19.15 Scenic Resources

Short-term impacts to scenic resources would result from the disturbance associated with the construction and development of oil and gas infrastructure. Impacts could be seen in the form of changes in the existence of wells infrastructure and roads that would exist over the producing life of each well. Long-term impacts would be visible until production of oil and gas well is complete and the area has been reclaimed. These impacts to scenic resources could include changes in landscape scenery, light pollution during nighttime hours, and the construction of buildings, well pads, and other associated infrastructure.

4.19.16 Hazardous Materials and Human Health and Safety

The maintenance and enhancement of long-term productivity of resources linked to human health and safety is not expected to be affected by short-term uses due to compliance with regulations and BMPs for protections of the transportation and use of hazardous materials and disposal of solid waste. Long-term productivity could be affected by short-term uses if spills or improper waste disposal were to impact water, soils, vegetation, or other resources.

4.19.17 Socioeconomics

Natural gas development would result in short-term use, the duration of which will be determined by rate of the extraction and quantity of the developable natural gas reserves. After surface reclamation is completed, the full productivity of the surface lands would be expected to be fully restored. Consequently, in the long-term, surface lands would continue to provide the current levels of economic activity and the future productivity would not be permanently impaired or reduced.

4.19.18 Environmental Justice

Because no minority or low-income communities of concern occur in the analysis area, there would be no impacts would result in changes to short-term uses or long-term productivity.

4.20 Irreversible or Irretrievable Impacts

4.20.1 Introduction

NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided, should the alternatives be implemented. A commitment of a resource is considered irreversible when the primary or secondary impacts from its use limit the future options for its use. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations.

Selection and approval of any of the alternatives could result in the irreversible commitment of specific resources (e.g., the loss of future options for resource development or management), especially for nonrenewable resources such as minerals or cultural resources. It also may result in the irretrievable commitment of resources due to lost production or use of resources.

4.20.2 Air Quality

There would be no irreversible or irretrievable impacts to air quality.

4.20.3 Geology, Minerals, and Paleontology

4.20.3.1 Mineral Resources

The development and production of natural gas from the resource base would be an irreversible impact. When the natural gas is consumed, that would constitute an irreversible impact because it cannot be replaced.

4.20.3.2 Paleontological Resources

Damage to paleontological resources would be irreversible and irretrievable. An irreversible impact would occur if even if valuable fossils are documented, salvaged, and curated, because once disturbed they cannot be returned to their previous in-place conditions. The impacts to paleontological resources also would be irretrievable if fossils are destroyed and not scientifically documented. If documented and preserved, they would be preserved for future study.

4.20.4 Soils

Disturbance activities associated with oil and gas development could result in the loss of soil through erosion or physical disruption of natural soil horizons during construction and reduced soil productivity. This reduction of soil productivity could extend over many years, depending on interim reclamation methods and success, as well as site-specific conditions and mitigation measures, until reclamation success is achieved and soil quality and productivity improve. With successful reclamation, adverse impacts to soils would not be irreversible.

4.20.5 Water Resources

4.20.5.1 Surface Water

Irreversible impacts to surface water would not be anticipated because the permitting agency would require practices that minimize sedimentation and disturbance to surface water. Reclamation would be performed at the end of the development, which would minimize long-term effects on water quantity and quality over time. Temporary reductions in water quality from erosion and sedimentation, should they occur, would be irretrievable, as would water used during lease development. However, consumptive use of water is not likely to be irreversible because the water uses would end after development is completed.

4.20.5.2 Groundwater

The anticipated irreversible impacts to groundwater would be removal of produced water from oil and gas development and disposal possibly into a different formation, and hydrogeologic alterations from well drilling, completion, operation, and plugging, withdrawal of oil, gas, and produced water. In addition, oil and gas development would create a slightly increased risk of potentially irreversible events due to contamination from accidental spills of hydrocarbons, fuels, or chemical additives, and from improperly cased and sealed wells.

4.20.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

If features associated with oil and gas facilities, such as roads, become permanent, then there would be localized irreversible or irretrievable loss of vegetation resources. These may include loss of riparian/wetland (including fen) habitat and loss of sensitive plant species habitat. The actions to protect or reclaim habitat from surface disturbance and protect from the spread of noxious weeds should adequately prevent irreversible or irretrievable impacts to special status plant species and significant plant communities.

4.20.7 Terrestrial Wildlife Including Special Status Species

Depending on the selection of alternative, 821 to 893 acres of terrestrial wildlife habitat would be incrementally lost during construction, drilling, completions, production, and maintenance of the leases. This would be considered an irretrievable commitment of the resource because it is anticipated that upon completion of mineral production or cancellation of the leases, reclamation would return affected areas to native habitats. Some vegetation communities are expected to return to a native state within in a relatively short period of time (i.e., 5 years). Other more sensitive habitats, such as sagebrush shrublands, may require up to 50 years or longer to return to native conditions. Regardless of timeframes, it is possible that wildlife habitat impacted during construction could return to pre-development conditions, thus avoiding any irreversible commitments of wildlife habitat.

4.20.8 Aquatic Resources

No irretrievable or irreversible impacts to aquatic resources are anticipated. Most of the impacts to aquatic resources would cease to be adverse after the disturbed stream or riparian areas are reclaimed or oil and gas infrastructure is stabilized.

4.20.9 Cultural Resources

There would be an irretrievable and irreversible impact on cultural resources should archaeological sites be disturbed without being identified, recorded, and a determination of eligibility to the NRHP. Compliance with federal laws and permit requirements would minimize these impacts.

4.20.10 Transportation

Oil and gas development-related road construction and traffic increases would exist over the 20-year development period, but would be reversible and would cease at the end of well production. Although development-related traffic increases would be reversible after the development period, the potential exists for these impacts to extend beyond 20 years, depending on what ultimately would be the development timeframe. Development related impacts due to development of new roads would be reversible, as roads would be reclaimed at the end of well production life; however, the timeframe for production life could be many years, resulting in an extended long-term impact, depending on the life of the field. It is anticipated that there would be no irretrievable impacts to transportation associated with lease development, assuming that road construction and maintenance follow federal and state guidelines.

4.20.11 Lands and Special Uses

There would be no irreversible or irretrievable impacts for lands and special use authorizations. Any surface disturbance and related infrastructure that might be authorized under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.12 Special Designations

There are no anticipated irreversible or irretrievable impacts to areas with special designations. Any surface disturbance and related infrastructure that might occur under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.13 Recreation

There are no anticipated irreversible or irretrievable impacts to recreation. Any surface disturbance and related infrastructure that might occur under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.14 Livestock Grazing

Assuming successful reclamation would occur following completion of oil and gas operations, there would be no irreversible or irretrievable impacts to livestock or livestock grazing operations. The disturbed areas within the affected allotments would return to prior conditions (or better) with successful reclamation, and would provide desirable forage for livestock grazing.

4.20.15 Scenic Resources

Future oil and gas development would result in an increase in the appearance of man-made structures and equipment associated with oil and gas exploration activities. The impacts to scenic resources would be greatest in localized areas of concentrated oil and gas operations. Although the location and concentration of facilities would vary by alternative, the characteristic landscape would appear more developed and lose much of its natural scenic quality in some areas. The appearance of the equipment and operations associated with oil and gas development would be an irretrievable impact on scenic resources until production ceases and final reclamation of the site is complete.

4.20.16 Hazardous Materials and Human Health and Safety

Assuming additional approvals to develop the leases would be required, irreversible and irretrievable impacts to resources linked to human health and safety would not be anticipated because the permitting agency would require adherence to regulations and BMPs that would minimize adverse impacts to air quality, noise, fire, water resources, transportation, and other human health and safety issues. If a spill affecting public water supplies, atmospheric contamination, or fire were to occur, the affected resources would experience irretrievable impacts until cleanup or remediation is complete. There would be no irreversible or irretrievable impacts from traffic or noise.

4.20.17 Socioeconomics

As with any consumptive use of a nonrenewable resource, natural gas extraction would have an irretrievable and irreversible impact on the mineral reserves. Consequently, there would be a permanent loss of the mineral resource. While this may represent an irretrievable socioeconomic impact related to the extraction of mineral resources, future surface reclamation can be expected to allow future resumption of any permitted surface uses (such as recreational activities and livestock grazing) that could have positive socioeconomic outcomes.

4.20.18 Environmental Justice

No minority or low income communities of concern were identified within the analysis area. Consequently, no irreversible or irretrievable impacts would result in disproportionate and adverse environmental justice impacts to any communities of concern in the region.

4.0 Environmental Consequences

4.1 Introduction

This chapter presents the analysis of impacts for each resource that may be affected by reaffirming, modifying, or canceling the 65 leases under consideration.

4.1.1 Direct and Indirect Effects

Leasing, by itself, would not directly impact most resources with the possible exception of some aspects of socioeconomics but, given that the development of the leases is a reasonably foreseeable result of the granted lease right, the impact analysis considers the potential impacts of reasonably foreseeable future development. The basis for the analysis of future oil and gas development is the Reasonably Foreseeable Development Scenario (RFDS) for Oil and Gas Activities on the White River National Forest (WRNF) (U.S. Forest Service [Forest Service or USFS] 2010a), which has been scaled to the amount of development feasible under each alternative (see Chapter 2.0, **Table 2-7** for details by lease zone). To scale the development for each alternative, the RFDS was adjusted to reflect each alternative using the assumptions presented in Chapter 2.0, Section 2.7.3 derived from the RFDS, the WRNF Mineral Specialist Report (Mattson 2010) prepared in support of the WRNF Oil and Gas Leasing Draft Environmental Impact Statement (EIS) (USFS 2012), as well as knowledge of the historical development in the area. The adjustments to the RFDS were made using data on the extent of No Surface Occupancy (NSO) stipulations in and around each of the 65 leases, in conjunction with an assumed maximum lateral offset for directional (i.e., “s-curve”) and horizontal wells that could be used to access the target gas formations. It should be noted that many of the reasonably foreseeable wells may extract minerals from each lease using directional or horizontal well bores so that well pads may be located either on-lease or off-lease. Assumed development (for analysis of each alternative) using the constraints resulting from NSO limitations are somewhat less than the full development potential documented in the RFDS. Additional details are included in **Appendix D**, Methodology for Scaling RFDS for EIS Alternatives.

Using the assumptions for average initial and long-term surface disturbance for well pads, roads, and pipelines and the estimated number of wells per pad, acres of surface disturbance were calculated for each lease and totaled for each lease zone (see Chapter 2.0, **Table 2-8** for details by lease zone). Surface disturbance is an important factor in predicting the potential impacts for most of the resources that are analyzed. Until the actual locations and number of proposed wells are known, the analysis of impacts from fluid mineral development cannot be site-specific. For this reason, the impacts analyses focuses on the extent of protection of surface resources that would result from implementation of the stipulations proposed under each alternative and the potential risk to the resources where no protection through stipulations would occur. The extent to which different types of stipulations vary across the alternatives is analyzed in detail in this chapter.

Each section provides an overview of the issues identified during public scoping. The impacts presented in each section address the scoping issues to the degree possible. However, because this is a leasing analysis with general projections of the amount of development likely to occur within each lease, those scoping issues that call for analysis of site-specific conditions or potential impacts in precise locations cannot be addressed until the Application for Permit to Drill (APD) stage of permitting, when onsite surveys and site-specific National Environmental Policy Act (NEPA) analysis is completed and mitigation measures or management practices are prescribed.

Each resource section summarizes the methods of analysis, including the type of information and assumptions used in the analysis, and the indicators (quantitative or qualitative metrics) used to identify impacts, and then presents a description of the types of impacts likely to result from reasonably

foreseeable development under these alternative leasing decisions, followed by details of the anticipated impacts under each of the five alternatives. Resources were evaluated according to the available data, so some discussions are based on qualitative information and others on more detailed quantitative data when available and feasible within the scope of this EIS.

The impact analyses assume that the environmental protection measures required by Forest Service and Bureau of Land Management (BLM) policies and guidelines would be successfully implemented. It also assumes that operators and lessees would comply with applicable state and federal regulations and conditions of required permits. As noted in Chapter 2.0, Section 2.6, specific environmental protection measures, such as project design features, best management practices (BMPs), and conditions of approval (COAs), would be evaluated during the onsite review at the APD stage of oil and gas development. These measures would become part of the Forest Service Surface Use Plan of Operations and the permit to drill issued by the BLM. Because site-specific locations and conditions are unknown at this time, recommended mitigation measures have not been incorporated into the resource sections in Chapter 4.0 and are deferred to future NEPA analyses.

4.1.2 Cumulative Impact Analysis

Toward the end of each resource section is a discussion of cumulative impacts. In its Regulations for Implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), the Council on Environmental Quality (CEQ) defines a cumulative impact as follows in Section 1508.7:

> *"Cumulative impact" 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 impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Cumulative impacts are the combination of the individual effects of multiple actions over time in the context of other development in the analysis area or the region. The individual effects may be minor when considered separately, but may be major when considered in combination with all others in the region. A CEQ memorandum issued in 2005 (CEQ 2005) provides additional guidance on the consideration of past actions in cumulative effects analysis. Per 43 CFR 46.115, the Responsible Official must analyze the effects of past action in accordance with this or other superseding guidance CEQ guidance. The 2005 memorandum stresses the "forward-looking" nature of NEPA analysis. It states that the effects of past actions are only required to be analyzed if they are relevant and useful to determine whether the proposed project "may have a continuing, additive and significant relationship" to projected future impacts in the region.

Cumulative impacts are those that would result if lease development (as outlined in Chapter 2.0) is combined with disturbances of past and present actions and other reasonably foreseeable future actions (RFFAs), regardless of what agency or private entity undertakes such actions. Per 43 CFR 46.30, *reasonably foreseeable future actions* include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a Responsible Official of ordinary prudence would take such activities into account in reaching a decision. These federal and non-federal activities that must be taken into account in the analysis of cumulative impact include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by the bureau. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

The following sections summarize the past and present actions and RFFAs that are likely to have similar impacts to those analyzed in this chapter for each resource. The focus is on surface disturbing actions that are quantified to the degree possible with available information. **Appendix B** contains a more

detailed description of past and present actions and RFFAs; and the assumptions used to calculate long-term surface disturbing actions.

The geographic extent of cumulative impacts varies by resource. Impacts to some resources, such as cultural resources or soils, are restricted to the area within the leases. Other resources, such as wildlife and water resources, may be affected over a larger area; therefore, cumulative impacts are assessed beyond the leases. Twelve spatially distinct CIAAs are identified in **Table 4.1-1**. The CIAAs primarily comprise National Forest System (NFS) lands (WRNF and Grand Mesa, Uncompahgre, and Gunnison National Forest [GMUGNF]) but also include BLM lands within the Colorado River Valley Field Office (CRVFO), Grand Junction Field Office (GJFO), and White River Field Office (WRFO), as well as non-federal lands, particularly in situations where cumulative effects extend beyond the leases.

4.1.2.1 Past and Present Actions

Surface-disturbing Actions

The primary past and present actions with surface disturbance affecting the resources analyzed in this EIS include mineral development; road development and other land development such as rights-of-way (ROWs) for pipelines, telephone lines or other developments. **Table 4.1-2** presents total quantifiable past and present surface disturbance by CIAA. **Appendix B** discusses each of these actions in more detail in Section B.2.1. Water use associated with oil and gas development also is quantified in Section B.2.1.

Other Forest Service District or BLM Field Office Actions

Other past and present actions, such as farming, timber harvests, livestock grazing, vegetation treatments, and land management decisions, may not have adverse impacts on all resources; and in some cases may have a countervailing effect on cumulative impacts. These include livestock grazing, agriculture, vegetation treatments and timber sales. These are discussed qualitatively in **Appendix B**, Section B.2.2 as well as in applicable Affected Environment sections.

4.1.2.2 Reasonably Foreseeable Future Actions

RFFAs are those actions for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. RFFAs within each CIAA that have potential for similar impacts to those analyzed in this chapter for each resource are summarized briefly below and are described in detail in **Appendix B**.

Surface-disturbing Actions

The WRNF, GMUGNF, CRVFO, GJFO, and the WRFO have identified lands available for oil and gas leasing that fall within some or all of the CIAAs. Each agency has developed an RFDS for future oil and gas development within its administrative boundaries. Each RFDS is discussed in detail in **Appendix B**, Section B.3.1.1, along with the projections and assumptions used to estimate long term surface disturbance within each CIAA, which is presented in **Table B-3**, Long-term Surface Disturbance from Oil and Gas Development by CIAA. Other RFFAs with surface disturbing actions identified in **Appendix B** include ROW development projects within the WRNF and CRVFO; road improvements within the WRNF and GMUGNF; trail developments within the CRVFO and GMUGNF; and a reservoir enlargement project within the GMUGNF (see **Table B-7**, Long-term Surface Disturbance from Non-oil and Gas Development by CIAA). **Table 4.1-3** summarizes the total quantifiable RFFA surface disturbances contained in **Tables B-5** and **B-6**.

Table 4.1-1 Cumulative Impact Analysis Areas by Resource[1]

Resource	Cumulative Impact Analysis Area (CIAA) Description	Spatial Extent (acres)	Rationale for Use
Geology/Minerals/Paleontology, Soils, General Vegetation, Nongame and Small Game Terrestrial Wildlife, Special Status Species Terrestrial Wildlife, Land Use, Recreation, Visual Resources	65 existing leases (identified as (Lease Area in subsequent tables)	80,380	Primary impact from reasonably foreseeable future development would be due to surface disturbance on the leases.
Special Status Plants[1]	Lease area plus a 300-foot buffer around known populations within 65 existing leases	Varies depending on species	Buffer considers impacts to known plant species and surrounding area that may be disturbed.
Cultural Resources/Native American Traditional Values, Groundwater	Lease area plus a 2-mile buffer around 65 existing leases (identified as “Lease+2 miles” in subsequent tables)	332,040	Buffer considers impacts to the context of cultural resources and extent groundwater sources that may encountered within the leases.
Transportation, Hazardous Materials/ Human Health and Safety	Lease area plus the regional road network used to access leases	N/A	Addresses impacts to new and existing local access roads from project-related transportation.
Surface Water Quality and Quantity, Aquatics [4]	Hydrologic Unit Code (HUC)12 watersheds crossed by leases (identified as “HUC-12” in subsequent tables)	606,006	Takes into account effects of activity on-lease and downstream.
Big Game	Big Game Management Units (GMUs) crossed by lease.	2,121,890	Puts habitat disturbance from future development into context of entire area used by big game.
Greater Sage-grouse	Priority Habitat Management Area and General Habitat Management Area (GHMA) polygons crossed by leases	14,155	Puts habitat disturbance from future development into context of entire sage-grouse habitat areas in vicinity.
Lynx	Lynx Analysis Units (LAUs) polygons crossed by leases	510,805	Puts habitat disturbance from future development into context of entire area used by lynx.
Livestock Grazing	Grazing allotments crossed by lease.	308,666	Puts disturbance from future development into context of entire allotment.

Table 4.1-1 Cumulative Impact Analysis Areas by Resource[1]

Resource	Cumulative Impact Analysis Area (CIAA) Description	Spatial Extent (acres)	Rationale for Use
Special Designations	Special Designations within leases (1 Research Natural Area [RNA] and portions of roadless areas)	64,864	Future development outside existing leases would be limited by special designation management requirements. Impacts from future development therefore limited to special designations within existing leases.
Socioeconomics and Environmental Justice[2]	Mesa, Garfield, Pitkin, and Rio Blanco counties	N/A	Economics and populations of four-county area could be affected by future development.
Air Quality; Climate[3]	Northwest region of Colorado	N/A	Incorporates the analysis contained in the Colorado Air Resource Management Modeling Study (CARMMS).

[1] Acreage for Special Status Plant CIAA is not included in subsequent tables because the scale at which projects are identified is too coarse to differentiate between this CIAA and the lease CIAA.

[2] Acreage for Social and Economic Values/Environmental Justice CIAA, which comprises Garfield, Mesa, Pitkin, and Rio Blanco counties, are not included in this or subsequent tables because surface disturbance is not an impact indictor used for cumulative analysis of this resource.

[3] Acreages for an Air Resources CIAA are not included because the cumulative impact analysis for air resources considers the entire northwest region of Colorado and relates to the analysis contained in the CARMMS.

[4] The aquatics CIAA also extends downstream into Designated Critical Habitat for Colorado pikeminnow, razorback sucker, bonytail and humpback chub in the Colorado River.

Table 4.1-2 Past and Present Surface Disturbing Actions by CIAA

Past/Present Actions	Long-term Disturbance by CIAA (acres/percent)							
	Lease Area	**Lease+2 miles**	**HUC-12**	**Big Game**	**Sage-grouse**	**Lynx**	**Range**	**Special Desig.**
Mineral Development[1]	38 / <1	590 / <1	2,658 /<1	4,262 /<1	22 / <1	693 / <1	92 / <1	3 / <1
Transportation Corridors[2]	91 / <1	249 / <1	1,460 /<1	3,282 /<1	28 / <1	669 / <1	390 / <1	1 / <1
Other Land Development	325 / <1	304 / <1	1108 /<1	1153 /<1	0 / <1	695 / <1	627 / <1	0 / <1
TOTAL	**454 / <1**	**612 / <1**	**5,226** /<1	**8,697** /<1	**50** /<1	**2,057** / <1	**1,109** / <1	**4** / <1

[1] Number of wells by CIAA: Lease Area-75; Lease+2 miles -1,180; HUC-12-5,315; Big Game-8,523; Sage-grouse-43; Lynx-1,385; Range-183; Special Designations-5. Well count incudes all Colorado Oil and Gas Conservation Commission (COGCC) well categories except “permitted locations”. Long-term surface disturbance assumptions: Wellpad size- 0.5 acre per well (see Chapter 2.0).

[2] Disturbance acreages for roads assume the following widths: Interstate: 72 feet (4 lanes); principal arterial: 60 feet (4 lanes); minor arterial: 60 feet (2 lanes); major collector: 30 feet (2 lanes); minor collector: 15 feet (2 lanes); local road: 22 feet (1 lane).

Source: BLM 2015g; COGCC 2015b; Colorado Department of Transportation 2015; U.S. Department of Transportation (USDOT) 2013.

Table 4.1-3 RFFA Long-term Surface Disturbance by CIAA

Management Area	Estimated Future Disturbance by CIAA (acres/percent)[1, 2]					
	Lease+2 Miles	**HUC-12**	**Big Game**	**Range**	**Lynx**	**Sage-grouse**
In and around Zones 1, 2, and 3						
USFS WRNF Reasonably Foreseeable Development (RFD) Glenwood Springs FO	496 / <1	496 / <1	496 / <1	496 / <1	496 / <1	0
USFS WRNF RFD-GJFO	94 / <1	94 / <1	94 / <1	94 / <1	94 / <1	0
USFS GMUGNF RFD	23 / <1	23 / <1	23 / <1	0	0	0
BLM CRVFO RFD-excluding Roan Plateau Planning Area (RPPA)	6,893 / 2	13,256 / 2.2	13,256 / <1	0	0	0
BLM RPPA	0	382 / <1	0 / 0	0	0	0
BLM GJFO RFD	71 / <1	560 / <1	1,897 / <1	0	0	71 / <1
Hunter Reservoir Enlargement			61 / <1			
Colorado Department of Transportation Highway 133 Debris Dump Site and Placita Roadside Landscaping			9 / <1			
Rio Grande Connection Trail Reroute			<0.5 / <1			
Trickel Park Road Improvement Project			9 / <1			
In and around Zone 4						
BLM WRFO RFD	9 / <1	43 / <1	625 / <1	9 / <1	97 / <1	0
TOTAL	**7,586 / 2**	**14,854 / 2.5**	**16,490 / <1**	**599/ <1**	**687 / <1**	**71 / <1**

[1] Disturbance acreages do not include projects for which no acreage of surface disturbance has been defined.

[2] The Special Designations and Lease Area CIAAs are not included in this table because those CIAAs comprise only lands within the existing leases, and future oil and gas development on the existing leases is already considered in Chapter 2.0 of this EIS as part of the alternatives.

Source: BLM 2015b, 2014d, 2012, 2008a, 2007; USFS 2015c, 2015d, 2014d, 2010a, 2007b.

As noted in **Appendix B**, Section B.3.1.2, not all development forecasted in the RFDS would occur immediately or at the same time. The COGCC database was used to identify recently approved and pending APDs in order to understand what portion of the disturbance identified in the RFDSs for each area might be developed within the next few years. This disturbance is presented in **Table 4.1-4**.

Table 4.1-4 Long-term Surface Disturbance from Recently Approved or Pending APDs by CIAA

Management Area	Estimated Future Disturbance by CIAA (acres / percent)[1,2]					
	Lease+2 Miles	HUC-12	Big Game	Range	Lynx	Sage-Grouse
In and around Zones 1, 2, and 3	242 / <1	704 / <1	2,300 / <1	14 / <1	105 / <1	7 / <1
In and around Zone 4	0	0 / 0	10 / <1	0 / 0	0 / 0	0 / 0
TOTAL	**242 / <1**	**704 / <1**	**2,310 / <1**	**14 / <1**	**105 / <1**	**7 / <1**

[1] The Special Designations and Lease Area CIAAs are not included in this table because those CIAAs comprise only lands within the existing leases, the development of which is already considered in this EIS in the alternatives.

[2] As of May 2015, recently approved and pending APDs by CIAA were as follows: Lease+2 miles-1 recently approved APD and 68 pending APDs; Big Game CIAA- 591 recently approved APDs and 69 pending APDs; HUC-12 CIAA- 197 recently approved APDs and 4 pending APDs; Range- 2 recently approved APDs and 2 pending APDs; Lynx- 26 recently approved APDs and 4 pending APDs; and Sage-grouse- 2 recently approved APDs. Long-term surface disturbance assumptions: Wellpad - 0.5 acre per well, road -3 acres per well (see Chapter 2.0).

Source: COGCC 2015h.

As discussed in Section B.3.1.2, and disclosed in **Table B-4**, based on the well projection included in each RFDS and using the water demand assumptions as discussed in **Appendix B**, there would be 22,304 acre-feet of freshwater required for drilling and 431,291 acre-feet of recycled water for well completions. Full RFDS development would require 2,061,180 truck trips for drilling activities, 2,620,030 truck trips for completion activities and 368,820 truck trips for reclamation. Water use and transportation requirements would change over time. As of May 2015, there were 1,529 recently approved and pending APDs within Garfield, Mesa, and Pitkin counties. Development of these wells would require 1,177 acre-feet of freshwater for drilling and 9,847 acre-feet of recycled water for completion. Assuming 7 wells per well pad, there would be 26,752 truck trips for drilling, 37,915 trips for completion and 5,431 trips for reclamation.

Other Forest Service District or BLM Field Office Actions

The following sections describe other types of RFFAs within the CIAAs. These actions are not included in **Table 4.1-3** because they do not necessarily result in surface disturbance; may not have adverse impacts on all resources; and in some cases may have a countervailing effect on cumulative impacts. Identified RFFAs include vegetation treatments and hazardous fuel reduction projects, the Battlement Reservoir Reconstruction Project; and continued livestock grazing and agriculture. These projects are discussed in more detail in **Appendix B**, Section B.3.2. **Table 4.1-5** provides a summary by CIAA of vegetation treatment and hazardous fuels reduction RFFAs within the WRNF, GMUGNF, and CRVFO. There are no identified vegetation treatments in any of the CIAAs within the GJFO or WRFO.

Table 4.1-5 Vegetation Treatments and Hazardous Fuels Reduction RFFAs by CIAA

Treatment Project	Disturbance Acreages by CIAA (acres/percent)[1, 2]							
	Lease	**Lease +2 mi.**	**HUC-12**	**Big Game**	**Lynx**	**Sage-grouse**	**Range**	**Special Desig.**
South Rifle Habitat Enhancement Project	6,000 / 7	6,000 / 2	6,000 / 1	6,000 / <1	6,000 / 1	0 / 0	6,000 / 2	3,000 / 9
Aspen/Sopris Wildlife Habitat Improvement Project	0	0	2,100 /<1	11,500 / 1	6,370 / 1	0 / 0	0 / 0	0 / 0
Lookout Mountain Communications Site Hazardous Fuels Reduction Project	0	0	25 / <1	25 / <1	0 / 0	0 / 0	0 / 0	0 / 0
Spruce Creek Oakbrush Thinning Project	0	0	100 / <1	100 / <1	100 / <1	0 / 0	0 / 0	0 / 0
Uncle Bob Oakbrush Thinning Project	0	0	200 / <1	200 / <1	200 / <1	0 / 0	0 / 0	0 / 0
Uncle Bob Mountain Road Hazardous Fuels Treatment Project	0	0	2,100 / <1	2,100 / <1	2,100 / <1	0 / 0	0 / 0	0 / 0
Cedar Springs II Vegetation Treatment Project	0	0	800 / <1	800 / <1	0 / 0	0 / 0	0 / 0	0 / 0
Cedar Mountain Fuels Reduction Project	0	0	667 /<1	667 / <1	0 / 0	0 / 0	0 / 0	0 / 0
TOTAL	**6,000 / 7**	**6,000 / 2**	**11,992 / 2%**	**21,392 / 1**	**14,770 / 3**	0 / 0	**6,000 / 2**	**3,000 / 9**

[1] Disturbance acreages do not include projects for which no acreage of surface disturbance has been defined.

[2] For each project, the total projected treatment acreages have been included within each CIAA because there is significant overlap between the CIAAs and because treatments areas and treatment locations have not been finalized and therefore have potential to occur within any of the CIAAs.

Source: BLM 2015a-c; Larson 2015a,b; Ringer 2015; USFS 2014d, 2010c.

County Actions

Appendix B, Section B.3.3, describes the future goals and plans for each of the four counties in which the CIAAs are located. In general, all four counties all strive to retain the rural character of the area. Mesa and Garfield county plans anticipate transportation issues due to the continued need to commute from affordable housing to places of employment and continued oil and gas development. Both counties have identified areas where road improvements are planned or may be required. Rio Blanco County also identified several proposed road improvements and mitigations to improve transportation issues related to continued oil and gas development. Within Pitkin County, the Snowmass-Capitol Creek Valleys Master Plan (which guides land use in a portion of the Big Game CIAA) actively discourages oil and gas development.

4.2 Air Quality

The burning of fossil fuels (natural gas, crude oil, coal, etc.) produces various emissions, including greenhouse gases (GHGs). These GHGs (primarily carbon dioxide [CO_2]) are widely believed to cause contribute to climate change. The continued or increased production and combustion of natural gas from resources in the 65 federal fluid minerals leases underlying White River National Forest (WRNF) considered under the alternatives would produce GHGs. However, the amount of GHGs produced from potential development of future WRNF resources would be an extremely small fraction of global emissions and lower than it would be if other fuels (coal, oil, etc.) were to be used for the same energy demand. Standardized protocols designed to measure factors that may contribute to climate change and to quantify climatic impacts are presently unavailable. However, no significant adverse impacts on climate are anticipated from implementation of any of the alternatives because it is reasonable to assume that they would not add to the demand or consumption of fossil fuels. In other words, global and U.S. energy supply and demand would not be affected by whether or not WRNF resources are developed.

Air pollution impacts are limited by state and federal regulations, standards, and implementation plans established under the Clean Air Act (CAA) and administered by the Colorado Department of Public Health and Environment – Air Pollution Control Division (CDPHE-APCD). Colorado regulations require that proposed air pollutant emission sources—including dehydrators, separators, and natural gas compressors—undergo a permitting review. Therefore, CDPHE-APCD has the authority to review emission permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. In addition, Section 116 of the CAA authorizes tribal, state, and local air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Additional site-specific air quality analysis would be performed during permitting, and additional emission control measures, including best available control technology, may be required to protect air quality resources.

Under the Federal Land Policy and Management Act (FLPMA) and the CAA, the BLM provides for compliance with all applicable federal, tribal, state, and local air quality laws, statutes, regulations, standards, and implementation plans. For this environmental impact statement (SEIS), potential air quality impacts for specific development projects were not analyzed in detail; rather, rates of oil and gas related emissions in a low, medium and high range were used to bound anticipated future oil and gas development in the WRNF lease area. The BLM has developed various emission and air quality impact analysis tools under the CARPP that will be used for authorizing future WRNF oil and gas development on the 65 lease area. When future projects are proposed by an applicant, the BLM will use these tools to prepare a project-specific assessment of impacts of the maximum “near-field” (local) ambient air pollutant concentrations and hazardous air pollutant impacts. Future project-specific air quality analyses also will include an evaluation of the Colorado Air Resources Modeling Management Study (CARMMS) for specific and cumulative regional impacts to determine its usefulness and applicability for assessing regional ambient air pollutant concentrations and air quality related values impacts for a proposed project in the WRNF area.

Computational models that estimate the dispersion and formation of atmospheric pollutants are mathematical approximations regardless of their level of complexity, based on fluid dynamics and atmospheric chemistry. Thus, given the uncertain nature of the number and placement of future emissions sources under the alternatives in this analysis, the results should be viewed as the best possible estimates of future concentrations based in known or available information at this time and not as exact predictions in time and space. Because of this, modeling air pollution is generally conducted using assumptions that ensure that the modeled results do not underestimate actual future impacts so that appropriate planning decisions can be made. For example, sources may be assumed to operate for longer periods or emit more pollutants than actual conditions to ensure that health-based standards are protected. At the same time, analyses are not conducted assuming “worst-case” conditions over the

entire analysis area because this could lead to results that are unreasonable and unrealistic. Hence, air pollution modeling uses the best available information and methods (USEPA-approved models, emission factors, previous or current/ongoing studies, etc.) when possible, and the best scientific and professional judgment in attempting to ensure that projections of future air quality are neither under-predicted nor unrealistically over-predicted.

The remainder of this section describes the methodologies used to assess air quality impacts for low, medium, and high oil and gas development scenarios. No results for modeling specific development sites' near-field air quality impacts in the RNF are presented; however, this chapter will present the procedure that BLM field offices will use to evaluate individual development projects under NEPA.

4.2.1 Colorado Air Resources Protection Protocol

The following section provides a brief overview of the CARPP and describes the process and strategies the BLM will use when authorizing activities that have the potential to adversely impact air quality within the state of Colorado (BLM, 2014). The process described includes those activities that could come as a result of the previously issued 65 oil and gas leases in the WRNF. The CARPP is not a decision document, but rather a strategy to address air quality concerns throughout BLM-managed lands and resources in Colorado. Because the CARPP is not a field office specific management tool, it may be modified as necessary to comply with changing laws, regulations, BLM policy, or to address new information and changing circumstances without maintaining or amending any specific field office Resource Management Plan (RMP). Through CARPP the BLM cooperates with other federal, state, tribal and local air resource management partners. In particular when making oil and gas implementation decisions, the BLM will consider or apply, as appropriate, the provisions of the Memorandum of Understanding (USEPA 2011).

Appropriate air resources protection requires the BLM to manage its authorized activities and actions at broad spatial and temporal scales that are dynamic and thus subject to change. The BLM would accomplish this through an adaptive management approach, which includes establishing baseline conditions, monitoring, reevaluation, and adjustment as necessary. Adaptive management therefore incorporates regular review and adjustment of management approaches during the authorization of emissions generating activities commensurate with changing circumstances. The BLM will take the any of the following actions to ensure an adequate analysis and guide subsequent protection of air quality resources within Colorado.

- Monitoring: Ambient air monitoring provides valuable data for determining current and background concentrations of air pollutants. The BLM participates in a cooperative effort with industry, and other entities to establish, operate, and maintain a comprehensive air monitoring network. The BLM may request proponents of projects with the potential to generate substantial air emissions, to submit pre-construction air monitoring data from a site within the proposed development area. BLM also could to request that air monitoring for the life of the project to be conducted based on the availability of representative air monitoring data. Finally, project-specific monitoring data may be used by the BLM in subsequent NEPA analysis required for project approvals.
- Emissions Inventories: The BLM will request the proponent of an oil and gas development activity to submit a comprehensive inventory of anticipated direct and indirect emissions associated with a proposed project. The BLM will review the emissions inventory to determine its completeness and accuracy.
- Modeling: The BLM will use regional air modeling and project-specific modeling, in conjunction with other air analysis tools, to develop air resource protection strategies. Further, the BLM will provide appropriate disclosure for any modeling of direct, indirect, and cumulative impacts of proposed actions during required NEPA analysis. Currently, the BLM is facilitating the Colorado

Air Resources Management Modeling Study (CARMMS 2015). CARMMS is a BLM funded regional air quality modeling study of expected impacts on air quality from projected increases in oil and gas development across Colorado. CARMMS results include the predicted impacts from all projected federal and non-federal oil and gas development within the region and will be presented in more detail in the following section.

- Permitting: The BLM would consider or apply, as appropriate, any state or federal permit requirements. As part of the NEPA process and prior to the authorization of any federal mineral development activity, the BLM would conduct an air analysis to determine the potential impacts on air quality based on the estimated emissions from the activity being authorized.
- Mitigation: Many activities that the BLM authorizes, permits, or allows generate air pollutant emissions that have the potential to adversely impact air quality. The primary mechanism to reduce air quality impacts is to reduce emissions via project design features and mitigation. The BLM will ensure implementation of reasonable mitigation, control measures, and design features through appropriate mechanisms, including lease stipulations, notices to lessees, and conditions of approval (permit terms and conditions) as provided for by law and consistent with lease rights and obligations.

One important aspect of the CARPP is the concept of adaptive management, which incorporates the principles of monitoring current conditions, predicting future impacts, and adapting strategies to account for changing conditions. An adaptive management strategy for air quality resources allows the BLM to comply with NEPA and complete an appropriate analysis to ensure that activities approved by the BLM minimize adverse impacts to air quality. The strategy includes evaluating air quality on an ongoing basis, and if necessary, implementing appropriate mitigation measures to meet the identified objectives and targets for any applicable Colorado land use plan.

4.2.2 Regional Air Quality Impacts Analysis

In order to disclose cumulative and regional air quality impacts, the BLM has initiated the Colorado Air Resources Management Modeling Study (CARMMS). CARMMS was developed to provide an analysis of regional and cumulative air quality and air quality related values (AQRV) impacts for future projected oil and gas and mining development throughout Colorado. Several Colorado-based RMPs are currently being prepared or are in a pre-planning phase. For these RMPs and the White River National Forest EIS, air quality and AQRV impacts are being analyzed for BLM-authorized mineral development activities. A goal of CARMMS is to avoid potential inconsistencies in how future year impacts are evaluated and the inefficiency of having individual projects conduct regional and cumulative analysis.

The CARMMS modeling study consist of a photochemical grid model (PGM) and far-field dispersion modeling protocol. The protocol describes modeling procedures for addressing potential air quality and AQRV impacts due to BLM-authorized mineral development and other BLM-authorized activities in Colorado. CARMMS leveraged the West-Wide Jump-Start Air Quality Modeling Study (WestJumpAQMS) 2008 modeling platform. The modeling protocol was developed by BLM and reviewed by an Interagency Air Quality Review Team (IAQRT). The IAQRT consists of federal (USEPA Region 8 and Region 6, National Park Service [NPS], U.S. Fish and Wildlife Service (USFWS) and the U.S. Forest Service (USFS) and state air quality agencies (Colorado and New Mexico). The protocol lists the components of the CARMMS modeling system which include:

- The Weather Research Forecasting Model (WRF) was used to develop meteorological data for year 2008.
- The Sparse Matrix Operator Kernel Emissions (SMOKE) model was used for emissions processing and to produce CAMx-ready emissions

- The USEPA Motor Vehicle Emissions Simulator (MOVES) model was used to prepare on-road mobile source emissions.
- Biogenic emissions in the western United States were developed using the Model for Emissions of Gases and Aerosols in Nature (MEGAN).
- Photochemical grid modeling simulations were performed with the Comprehensive Air-Quality Model with extensions (CAMx). The ability of the model to provide source apportionment information was critical to the CARMMS study.

All models used the most recent versions available and provide the most advanced analysis techniques.

In order to estimate future air quality and AQRV impacts, two sets of emission and modeling impacts data were developed: 1) a 2008 base- case emissions that serve as baseline emissions and 2) a future-year 2021 emissions that consider emission changes including growth from Colorado-based oil and gas sources along with mining sources.

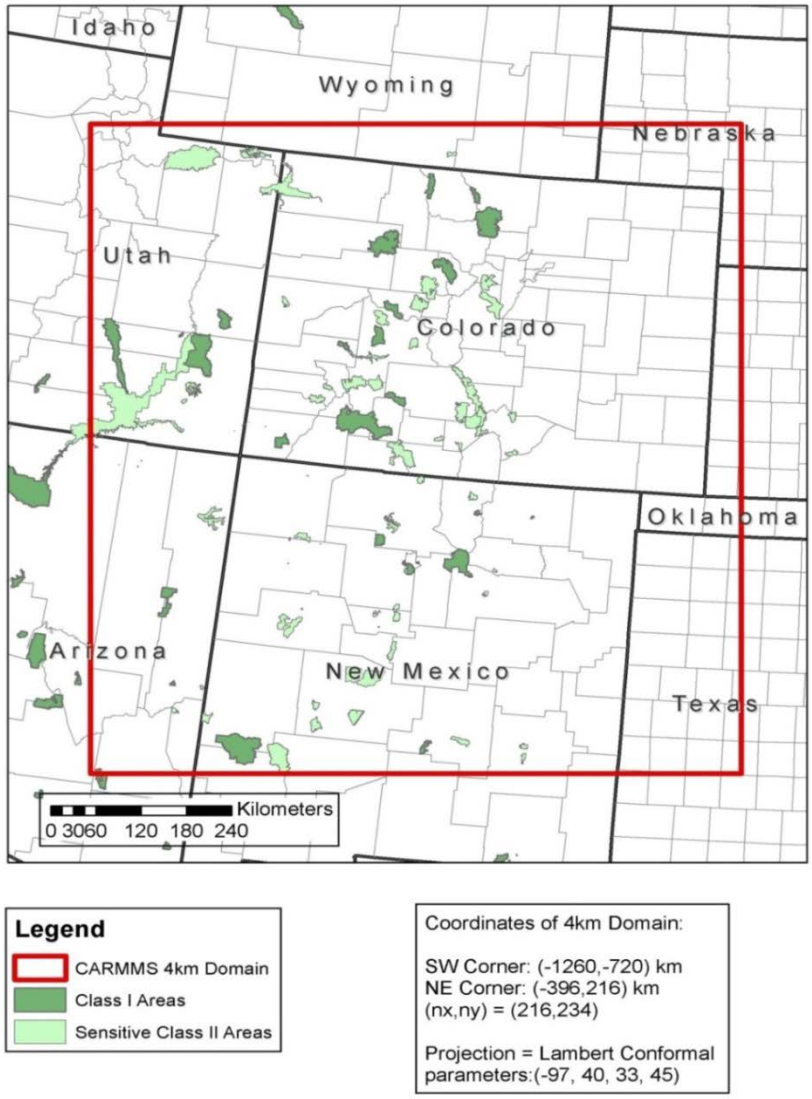
The CARMMS 2008 Base Case emissions and modeling platform were developed by WestJumpAQMS and the primary source for the 2008 Base Case emissions was Version 2.0 of the National Emissions Inventory. The comprehensive and detailed documentation for the WestJumpAQMS 2008 Base Case emissions inventory and modeling platform is available on the WestJumpAQMS website (http://www.wrapair2.org/WestJumpAQMS.aspx) and includes a final report and 16 Emissions Technical Memorandums that provide details on the 2008 emissions for each source category (WestJumpAQMS 2008).

Future-year oil and gas emissions databases were developed for a range of potential outcomes with the intent to bound the actual future-year oil and gas development in Colorado. These potential outcomes are defined in CARMMS as low, medium, and high development scenarios. The CARMMS cumulative emissions inventory also includes non-oil and gas emission inventories encompassing biogenic (natural) emissions, electric generating units (EGUs), fires and mobile sources. The non-oil and gas emissions estimates for CARMMS were developed by USEPA and updated for the Three-State Air Quality Study (3SAQS) projected year 2020 emissions inventory. Oil and gas future year emissions estimates for nearby states were obtained from the latest studies for future oil and gas development in the region. Future year 2021 emissions inventories for Colorado based mining were developed specifically for CARMMS and were based on the latest foreseeable mining projections.

The CARMMS modeling area covers all of Colorado and portions of adjacent states for a short-term period of approximately 10 years (up to year 2021). **Figure 4.2-1** shows the extent of CARMMS modeling domain which has a horizontal grid spacing of 4 kilometers. Results from CARMMS include prediction of future potential O_3 and other criteria pollutant (i.e., NO_2, CO, PM_{10}, $PM_{2.5}$, and SO_2) concentrations. AQRVs impact evaluation includes nitrogen and sulfur deposition rates, visibility impairment, and lake acid neutralizing capacity (ANC).

The prediction of ozone formation is a complex process that requires adequate input data requirements and could consume significant modeling time. Ozone is formed in the atmosphere from a combination of VOCs and NO_X precursors from various sources within a region and has the potential to be transported across long distances. CARMMS was used to model potential ozone impacts for the low, medium, and high oil and gas development scenarios in order to provide ozone impact analyses for the White River National Forest and other BLM Colorado regions. In doing so, the potential impacts of an individual project on regional ozone formation and transport, including the White River National Forest EIS Alternatives, were considered by the CARMMS analysis. For more detailed information regarding

CARMMS, the full CARMMS Report (based on 2008 modeling platform) and Excel Workbooks with CARMMS results can be found online[1] (CARMMS 2015).



Source: CARMMS 2015.

Figure 4.2-1 CARMMS 4-kilometer Modeling Domain

The study assesses impacts from projected oil and gas development through 2021 for both federal and fee (private) lands for three development scenarios: low, medium, and high. The low development scenario is based on historical average oil and gas development over the 5-year period from 2008 through 2012 for most BLM Colorado planning areas, but not all including the Roan Plateau Planning

[1] CARMMS webpage: http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carmms.html.

Area and the Uncompahgre Field Office. The historical average is then used to estimate potential oil and gas emissions for each year between 2011 and 2021. Applicable state and federal controls are applied to the oil and gas emissions starting in the year that they are required. The medium development scenario is based on the most recent field office (FO) Reasonably Foreseeable Development (RFD). The RFD is based on 20-year projections estimated by the oil and gas industry and BLM resource specialists. For the medium development scenario, additional controls beyond the application of existing state and federal requirements were applied. The high development scenario considers the same level of development assumed by the medium development scenario; however, only applicable federal and state controls were applied.

The following subsection summarizes CARMMS results for new CRVFO federal oil and gas development (from year 2012 through year 2021) outside the Roan Planning Area. The analysis of the CRVFO outside the Roan Planning Area is most relevant to this EIS because the previously issued oil and gas leases on the WRNF are not located within the Roan Planning Area boundary and the CRVFO includes most of the WRNF.

4.2.2.1 CARMMS Oil and Gas Development and Emissions

A full description of the alternatives analyzed in detail and the projected oil and gas development activity under each alternative can be found in Sections 2.2 and 2.6 of this EIS. In general, the highest air quality impacts would be associated with those alternatives that have more potential for oil and gas development activity. The concentrations of directly emitted pollutants such as CO, SO_2, and greenhouse gases (GHG) are expected to increase as a result of increased oil and gas development. However, the concentrations of pollutants formed in the atmosphere as a result of multiple physical and chemical processes (secondary pollutants including ozone and $PM_{2.5}$) do not always increase near the emissions source. For instance, ozone formation is a complex process in which ozone concentrations do not always increase when the emissions of precursors increase. The impact assessment of these secondary pollutants usually requires modeling that includes project specific emission inventories.

Emission estimates for each alternative were not developed for this analysis because the scope of analysis is regional and cumulative. Instead, emission scenarios developed for the CARMMS have been used in the analysis. In the CARMMS, the BLM developed three future emission scenarios (low, medium and high) for a range of potential outcomes that will bound all alternatives for regional analysis. Because emissions created by oil and gas wells are proportional to the number of wells and development rate, the CARMMS emission scenarios are discussed in terms of total well development. For projected Colorado oil and gas development, the high oil and gas development scenario is based on the reasonably foreseeable development (RFD). The medium development scenario's development rates are identical to the high scenario in terms of location and wells drilled per year; however, the medium development scenario assumes additional mitigation measures summarized below, to reduce potential air pollutant emissions. The low CARMMS scenario annual emissions rates were developed by projecting current 5-year average oil and gas development paces forward to year 2021. Potential emissions for the high, medium and low scenarios were calculated for each new well assuming the minimum and basic legally required emissions control measures, and the medium scenario accounted for additional mitigation measures to reduce air pollutant emissions, as follows:

- All development (drilling/completion/hydraulic fracturing) engines will be Tier 4. Tier 4 gen-set standards will be applied for all engines with a nameplate horsepower (hp) greater than 750 hp.
- All condensate tank, oil tank, and dehydrator emissions are captured and controlled by vapor recovery units (VRUs) with an assumed control efficiency of 95 percent.
- All pneumatic devices are low-bleed or no-bleed. It was assumed that 50 percent of devices are low bleed with a bleed rate of less than 6 cubic feet per hour (cfh) and that 50 percent of the devices are no-bleed.

- 30 percent of the production engines are powered by electricity.
- Dust control for unpaved road traffic is controlled with an assumed control efficiency of 80 percent.
- Truck loading emissions are captured and controlled by VRUs.

For each CARMMS scenario, air pollutant emissions were calculated from the following emissions source equipment and activities:

- Emissions from well pad construction and development:
  - Well pad, access road, and pipeline construction equipment and traffic
  - Drilling, completion and hydraulic fracturing equipment
  - Drilling and well completion traffic
  - Fugitive dust emissions from construction equipment, drilling, and completion support vehicles
  - Construction wind erosion
  - Well completion venting and flaring
- Emissions from the production phase:
  - Well workovers equipment
  - Production traffic (well workovers, road maintenance, well pad reclamation, and production)
  - Fugitive dust emissions from production traffic (well workovers, road maintenance, well pad reclamation, and other production)
  - Blowdown and well recompletion venting
  - Wellhead fugitives
  - Pneumatic devices and pumps
  - Water injection pumps
  - Miscellaneous engines
  - Compressor station maintenance traffic exhaust
  - Fugitive dust emissions from compressor station maintenance traffic
  - Condensate tank flashing
  - Loading emissions from condensate tanks
  - Condensate, crude oil and produced water hauling traffic exhaust
  - Heaters
  - Dehydrator emissions
- Midstream sources:
  - Glycol dehydrators
  - Natural gas processing facilities, gas sweetening: amine process
  - Condensate tanks
  - Natural gas processing facilities, flanges and connections

- Compressor engines
- Process heaters
- Flares

Detailed emission estimation procedures can be found in the CARMMS Report Appendix C, CARMMS Oil and Gas Emission Calculator.

Emissions from the high, medium, and low CARMMS scenarios are expected to be representative, but not equal to, emissions that could occur from future oil and gas developed under all the alternatives. In general, new oil and gas development / emissions from Alternatives 1 to 4 are expected to be above the low development scenario and below high scenario rates. Emissions from Alternative 4 are expected to be the closest to the low development scenario because of the reduced level of oil and gas development as a result of leases that would be cancelled to match the Forest Service draft decision. New projected oil and gas development /emissions from Alternatives 1, 2, and 3 are expected to be above the low scenario but below the high scenario as the process for management of exploration, development, and reclamation would continue under those leases. As noted above, the potential emissions associated with new oil and gas development for Alternatives1, 2, 3, and 4 would be bound by the development rates represented in the CARMMS high and low scenarios. New oil and gas development under Alternative 5 would be expected to see the lowest level of emissions as all previously leases would be cancelled and all producing wells would have to be plugged and abandoned under this alternative. **Table 4.2-1** provides the CRVFO outside the Roan Planning Area oil and gas development and projected production rates modeled with the CARMMS' high, medium and low development scenarios. Development and projected production rates for the medium scenario are identical to the high scenario.

Table 4.2-1 CARMMS-Predicted Future Oil and Gas Development for CRVFO (Outside Roan Planning Area)

Parameter	High and Medium Development Scenario (RFD)[1]	Low Development Scenario (5-year Average)[2]
Federal Wells Per Year	166 (1,661 in 10 years)	107 (1,069 in 10 years)
Cumulative (Federal and non-Federal) Wells Per Year	584	359
Wells Per Pad (assumed for analysis)	12	8
2021 Cumulative Active Well Counts	11,811	9,561
% 2021 Cumulative Wells that Are Federal	28%	24%
Cumulative Average Annual No. Drill Rigs Operating	12	10
Cumulative 2021 Gas Production (MMscf/yr)	427,908	282,155
Cumulative 2021 Oil / Condensate Production (Mbbl/yr)	1,985	1,252

[1] RFD based on Oil and Gas Industry and BLM Resource Specialists 20-year projections for the CRVFO.

[2] Future oil and gas development projections based on recent 5 years (2008-2012) of oil and gas development data for the CRVFO.

Source: CARMMS 2015.

Emission estimates for oil and gas activities were calculated using oil and gas emissions calculators developed specifically for CARMMS and are shown in the CARMMS report (http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carmms.html). The CARMMS western Colorado oil and gas emissions calculators were based directly on survey responses from oil and gas operators in the CRVFO and WRFO (Piceance Basin) area. **Table 4.2-2** provides a summary of the annual oil and gas emissions for the CRVFO outside the Roan Planning Area in tons per year (tpy) for selected pollutants. The table shows the emissions from the baseline year (2011) and the high, medium and low development scenarios (2021). In addition to the emission totals, the table also shows the emissions changes from the baseline year 2011 to year 2021. The year 2011 baseline annual emissions were calculated using CDPHE permitted APEN data / information and historical oil and gas development information (i.e., oil and gas well drilling and completion information for calendar year 2011). These year 2011 emissions for "existing" conditions were adjusted for projected year 2021 inventory accounting for oil and gas production decline for current / existing year 2011 oil and gas wells. The emissions inventories were developed for the high, medium, and low oil and gas development scenarios and include emissions from construction, development (upstream) and production (upstream and "midstream") operations. The following pollutants were inventoried when an appropriate methodology, and sufficient data existed: carbon monoxide (CO), oxides of nitrogen (NO_X), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), volatile organic compounds (VOCs), hazardous air pollutants (HAPs), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The emissions inventory was developed using reasonable but conservative scenarios for each construction and production activity. Production emissions were calculated for an entire year and included activities that are not likely to occur every year (i.e., well workovers and recompletions); thus, the project inventory is conservative on an annualized basis. Potential emissions for the CARMMS high, medium and low scenarios were calculated for each new well post year 2011, assuming the minimum and basic legally required emissions control measures; the medium scenario accounted additional emissions controls previously described.

Table 4.2-2 CARMMS CRVFO Federal Oil and Gas (outside Roan Planning Area) Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
High Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
High Development (2021)	328	96	1,679	5,070	1,279	2	773,232	23,898	13
Difference[1] (2021 – 2011)	128	43	643	2,474	545	-5	440,770	13,984	8
Percent Change	64%	81%	62%	95%	74%	-71%	133%	141%	160%
Medium Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
Medium Development (2021)	202	76	1,428	3,174	1,257	2	771,396	19,946	13
Difference[1] (2021 – 2011)	2	23	392	578	523	-5	438,934	10,032	8
Percent Change	1%	43%	38%	22%	71%	-71%	132%	101%	160%

Table 4.2-2 CARMMS CRVFO Federal Oil and Gas (outside Roan Planning Area) Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
Low Development Scenario									
Baseline (2011)	200	53	1,036	2,596	734	7	332,462	9,914	5
Low Development (2021)	239	71	1,212	3,701	949	2	604,270	18,767	10
Difference[1] (2021 – 2011)	39	18	176	1,105	215	-5	271,808	8,853	5
Percent Change	20%	34%	17%	43%	29%	-71%	82%	89%	100%

[1] Reduction of SO_2 emissions in the future year for both scenarios (High and Low) are due to Federal regulations on diesel fuel sulfur content.

Source: CARMMS 2015.

Table 4.2-3 provides a summary of the annual oil and gas emissions for the fraction of the CRVFO outside the Roan Planning Area that are colocated with the WRNF surface. The fraction of the emissions modeled for the source group that encompasses the CRVFO outside the Roan Planning Area that are co-located with WRNF surface is approximately 11.35 percent, and the CARMMS emissions that were modeled and "associated" with new (after year 2011 through year 2021) WRNF (in CRVFO) oil and gas emissions presented in **Table 4.2-3** take into account this factor. This percentage of new projected CRVFO outside Roan Planning Area oil and gas development was estimated using ArcMap with USFS and CARMMS oil and gas RFD Shapefiles. The table shows the emissions from the baseline year (2011) and the high, medium and low development scenarios (year 2021) as well as their differences relative to the baseline year 2011.

Table 4.2-3 CARMMS WRNF Federal Oil and Gas Annual Emissions

Emissions Scenario	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)
High Development Scenario									
Baseline (2011)	23	6	118	295	83	1	37,734	1,125	1
High Development (2021)	37	11	191	575	145	0	87,762	2,712	1
Difference[1] (2021 – 2011)	14	5	73	280	62	-1	50,028	1,587	0
Medium Development Scenario									
Baseline (2011)	23	6	8	295	83	1	37,734	1,125	1
Medium Development (2021)	23	9	162	360	143	0	87,553	2,264	
Difference[1] (2021 – 2011)	0	3	44	65	60	-1	49,819	1,139	
Low Development Scenario									
Baseline (2011)	23	6	118	295	83	1	37,734	1,125	
Low Development (2021)	27	8	138	420	108	0	68,585	2,130	
Difference[1] (2021 – 2011)	4	2	20	125	25	-1	30,851	1,005	0

[1] Reduction of SO_2 emissions in the future year for both scenarios (High and Low) are due to Federal regulations on diesel fuel sulfur content.

Source: CARMMS 2015.

Table 4.2-4 provides year 2021 federal oil and gas emissions that were explicitly modeled for the CRVFO outside the Roan Planning Area estimated for the emissions source group specific / source apportionment air quality impacts analysis in CARMMS. For comparison with the CRVFO outside the Roan Planning Area, **Table 4.2-4** also shows the sum of the 13 BLM Colorado planning areas (including all of the CRVFO [inside and outside the Roan Planning Area]), total oil and gas emissions (which include the 13 BLM Colorado planning areas, one BLM New Mexico planning area and oil and gas emissions outside of the BLM planning areas all within the CARMMS 4-kilometer modeling domain [see **Figure 4.2.1**]) and total CARMMS 4-kilometer domain emissions (includes man-made and natural [biogenic and fires]) modeled. For the CRVFO outside the Roan Planning Area and the sum of 13 LM Colorado planning areas, these emission rates represent emissions only from new federal oil and gas development post year 2011 through year 2021.

Table 4.2-4 CARMMS Projected Year 2021 Annual Emissions Rates Modeled

Group	CARMMS 2021 Emissions (tpy)[1]				
	NOx	VOC	SO_2	$PM_{2.5}$	PM_{10}
High Development Scenario					
CRVFO (outside Roan Planning Area)	1,311	6,076	2	71	250
Colorado Groups 1-13 [2] (“Colorado Federal”)	29,246	67,930	943	1,429	5,586
Total Oil and Gas	240,667	835,785	6,071	10,530	43,859
Total Emissions Modeled	814,245	2,140,889	102,931	339,768	2,025,594
Medium Development Scenario					
CRVFO (outside Roan Planning Area)	1,060	3,253	2	51	123
Colorado Groups 1-13 [2] (“Colorado Federal”)	24,519	43,039	943	996	2,494
Total Oil and Gas	234,309	808,100	6,068	9,935	39,621
Total Emissions Modeled	808,067	2,113,203	102,928	339,173	2,021,356
Low Development Scenario					
CRVFO (outside Roan Planning Area)	844	3,916	1	46	161
Colorado Groups 1-13 [2] (“Colorado Federal”)	5,066	13,547	155	256	899
Total Oil and Gas	182,021	656,912	5,099	6,865	22,152
Total Emissions Modeled	755,779	1,962,016	101,958	336,104	2,003,888

1 Total emissions for source group and combination of source categories from the CAMx source apportionment diagnostic output files after process by SMOKE.

2 Colorado groups include Little Snake Field Office, White River Field Office, Colorado River Valley Field Office, Roan Plateau, Grand Junction Field Office, Uncompahgre Field Office, Tres Rios Field Office, Kremmling Field Office, Royal Gorge Field Office, Areas 1 through 4, and Pawnee Grasslands portion of Royal Gorge Area #1.

Source: CARMMS 2015

As part of a strategy for the CARPP, annual oil and gas completions/development inventories (post-year 2011) are routinely compiled by the BLM to verify whether actual current and future oil and gas development and cumulative emissions rates are consistent with the annual emissions rates modeled in

CARMMS. Since year 2011, there have been approximately 363 new Federal wells completed in the CRVFO at a maximum rate of 153 new Federal oil and gas wells completed per year for year 2012 (recent years 2013 and 2014 have averaged just above 100 new Federal wells completed per year). For this comparison, it is assumed that most wells developed since the year 2011 were developed outside of the Roan Plateau Planning Area. This development rate for the CRVFO outside the Roan Planning Area is lower than the 166 new Federal wells per year for the High Development Scenario, but is slightly higher than the approximately 107 new Federal wells per year for the Low Development Scenario.

In addition, the BLM tracks emissions changes and air quality conditions to determine which of the CARMMS' scenarios (low, medium, high) is most representative of current trends. Emissions data from recently approved Applications for Permit to Drill (APDs) are added to the total regional emissions estimates to derive an annual estimate of regional emissions levels. These regional emissions are compared to the CARMMS scenarios. Based on the oil and gas development level analysis conducted regularly by the BLM as described above and the information provided in **Table 4.2-2** and **4.2-3**, it is observed that current levels of CRVFO Federal oil and gas development outside the Roan Planning Area are tracking below the CARMMS high development scenario and slightly above the low oil and gas development scenario. Therefore, it is expected that the CARMMS modeling results for the low development scenario are adequate for assessing future potential regional and cumulative air quality impacts assuming that Colorado based oil and gas development continues at current annual development rates. The results and summaries of BLM's annual analyses (data / information tracking and comparisons to modeled rates) will be included in the BLM Colorado Air Resources annual reports beginning in year 2015 based on data from calendar year 2014.

4.2.2.2 CRVFO Outside the Roan Planning Area specific New Oil and Gas End-Use and Energy Consumption CO_2 Emissions

The year 2021 GHG CO_2 emissions shown in the previous tables correspond to upstream (wellhead) and "midstream" (gas processing, consolidated storage, etc.) federal oil and gas development and operations in WRNF. For disclosure purposes only, downstream / end-use GHG CO_2 emissions have been estimated for projected year 2021 CRVFO outside the Roan Planning Area federal oil and gas production. Downstream GHG emissions are directly related to the end-use energy consumption. The U.S. Energy Information Administration (USEIA) releases an Annual Energy Outlook each year that provides projected U.S. energy consumption and corresponding GHG CO_2 emissions for future years (USEIA 2014b). The 2014 Annual Energy Outlook predicts that the total year 2021 U.S. energy consumption for natural gas will be approximately 27.9 (quadrillion BTU) and 36.8 (quadrillion BTU) for petroleum and other liquids, which corresponds to GHG emissions of approximately 1,460 million metric tons of CO_2 for natural gas approximately 2,240 million metric tons of CO_2 for petroleum and other liquids.

Using standard conversion factors, CARMMS projected year 2021 CRVFO outside the Roan Planning Area federal oil and gas production was converted to annual energy units, and the following shows projected year 2021 energy production:

- High Scenario: approximately 124.1 (trillion BTU) for natural gas and approximately 3.3 (trillion BTU) for oil and other petroleum liquids production.
- Medium Scenario: it would be the same as for CARMMS high scenario.
- Low Scenario: approximately 83.8 (trillion BTU) for natural gas and approximately 2.1 (trillion BTU) for oil and other petroleum liquids production.

End-use GHG CO_2 emissions for future year 2021 CRVFO outside the Roan Planning Area federal oil and gas can be estimated by simply assuming that all CRVFO outside the Roan Planning Area federal oil and gas is part of the total year 2021 U.S. energy consumption and calculating the ratio to determine the fraction of total year 2021 U.S. energy consumption that would be associated with 2021 CRVFO

outside the Roan Planning Area federal oil and gas, and then apply this year 2021 CRVFO outside the Roan Planning Area federal oil and gas fraction to the total U.S. energy consumption GHG CO_2 emissions that have been estimated for AEO. The following presents the results of using this methodology for projected end-use energy consumption year 2021 GHG CO_2 emissions for CRVFO outside the Roan Planning Area federal oil and gas:

- High Scenario: approximately 6.5 (million metric tons) for natural gas and approximately 0.2 (million metric tons) for oil / petroleum liquids consumption.
- Medium Scenario: it would be the same as for CARMMS high scenario.
- Low Scenario: approximately 4.4 (million metric tons) for natural gas and approximately 0.1 (million metric tons) for oil / petroleum liquids consumption.

4.2.2.3 CRVFO Federal oil and gas Outside the Roan Planning Area CARMMS Modeling Results

In order to estimate the impact associated with new projected oil and gas development in various BLM Colorado planning areas / FOs, the new Federal oil and gas emissions from each planning area / FO were modeled using a source apportionment technique. By using source apportionment tools, the incremental impacts to regional ozone and AQRVs from Federal oil and gas development in each of the BLM Planning Areas are tracked and accounted to better understand the significance of such development on impacted resources and populations.

Table 4.2-5 provides a summary of O_3 and $PM_{2.5}$ impacts for the projected new CRVFO outside the Roan Planning Area federal oil and gas emissions associated with the three modeling scenarios (high, medium and low). **Table 4.2-6** shows the visibility and nitrogen deposition impacts for the projected CRVFO outside the Roan Planning Area federal oil and gas emissions associated with the three CARMMS modeling scenarios. These impacts show the relative contribution to full cumulative impacts (impacts due to all "world-wide" emissions sources) for new (i.e., post-year 2011) projected year 2021 CRVFO outside the Roan Planning Area oil and gas emissions associated with each modeling scenario.

Table 4.2-5 CARMMS – 2021 Maximum CRVFO (Outside Roan) New Federal Oil and Gas Contributions to Modeled Ozone and $PM_{2.5}$ Impacts at any Class I or Sensitive Class II Area

Source Group[1] - Modeling Scenario	Maximum Contribution to 4th High Daily 8-hour Ozone (ppb)[2]	Maximum Contribution to 4th High Daily 8-hour Ozone Modeled Exceedance (ppb)[2]	Maximum Contribution to 8th High 24-hour Average $PM_{2.5}$ ($\mu g/m^3$)	Maximum Contribution to Annual Average $PM_{2.5}$ ($\mu g/m^3$)
CRVFO (Outside Roan) High Scenario	2.6	0.18	0.4	0.3
CRVFO (Outside Roan) Medium Scenario -	2.3	0.15	0.3	0.2
CRVFO (Outside Roan) Low Scenario	1.5	0.14	0.2	0.2

[1] Maximum modeled concentrations corresponding to any Class I or sensitive Class II area when referring to AQRV impacts or the concentrations within any grid cell (Class I or Class II) when referring to ozone impacts.

[2] Overall maximum ozone contributions (first column of numeric values) are determined for all levels of cumulative modeled ozone values; while the maximum contributions to modeled ozone Standard exceedances (second column of numeric values) only considers contributions for cumulative ozone concentrations above the former 75 ppb 8-hour ozone standard (subset of all cumulative modeled ozone values).

Source: CARMMS 2015.

Table 4.2-5 CARMMS – 2021 Maximum CRVFO (Outside Roan) New Federal Oil and Gas Contributions to Modeled Visibility and Nitrogen Deposition Impacts

Source Group - Modeling Scenario	Number of Annual Days Above 0.5 dv Change	Class I Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr)	Class II Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr)
CRVFO (Outside Roan) – High Scenario -	0	0.0198 (Flat Tops)	0.0118 (Holy Cross)
CRVFO (Outside Roan) – Medium Scenario -	0	0.0156 (Flat Tops)	0.0097 (Holy Cross
CRVFO (Outside Roan) – Low Scenario -	0	0.0122 (Flat Tops)	0.0072 (Holy Cross)

Source: CARMMS 2015.

Overall, **Table 4.2-5** shows that the maximum contributions to the fourth highest daily maximum 8-hour ozone concentrations are minimal with respect to the 70 ppb eight-hour ozone standard, and that the maximum contributions to the eighth highest maximum 24-hour $PM_{2.5}$ concentration also are minimal with respect to the 35 µg/m^3 24-hour $PM_{2.5}$ standard. For all the CARMMS scenarios, **Table 4.2-6** shows there are no days with a significant (approximately 0.5 dv) visibility change impact at any Class I or sensitive Class II area from the projected new CRVFO outside the Roan Planning Area year 2021 federal oil and gas emissions for any scenario. The maximum modeled annual nitrogen deposition contributions for each scenario is minimal with respect to the cumulative critical nitrogen deposition load of 2.3 kg/ha-yr value. CRVFO source apportionment impacts for sulfur deposition are not shown because of minimal sulfur emissions associated with projected CRVFO federal oil and gas development.

Table 4.2-7 lists selected sensitive areas (areas with highest modeled impacts) where the CRVFO high, medium, and low development scenarios contribute to nitrogen deposition. **Table 4.2-8** lists the change in the acid neutralizing capacity (ANC) in sensitive lakes due to the CRVFO outside the Roan Planning Area high, medium and low development scenarios, respectively. The changes in ANC specific to the CRVFO outside the Roan Planning Area for all scenarios are below the U.S. Forest Service ANC Level of Acceptable Change (LAC) thresholds.

Table 4.2-6 CARMMS – 2021 CRVFO (Outside Roan) New Federal Oil and Gas Nitrogen Deposition Contributions to Class I and Sensitive Class II Areas

Class I / Sensitive Class II Area	Total Nitrogen Deposition Contribution[1] (kg-N/ha-yr)		
	High Scenario	Medium Scenario	Low Scenario
Black Canyon of the Gunnison	0.0038	0.0032	0.0023
Colorado National Monument	0.0050	0.0042	0.0032
Eagles Nest Wilderness	0.0121	0.0100	0.0073
Flat Tops Wilderness	0.0198	0.0156	0.0122
Maroon Bells – Snowmass Wilderness	0.0126	0.0105	0.0077

[1] Maximum nitrogen deposition for all Class I / Class II area grid cells.

Source: CARMMS 2015.

Table 4.2-7 CARMMS – 2021 CRVFO (Outside Roan) New Federal Oil and Gas Lake Impacts

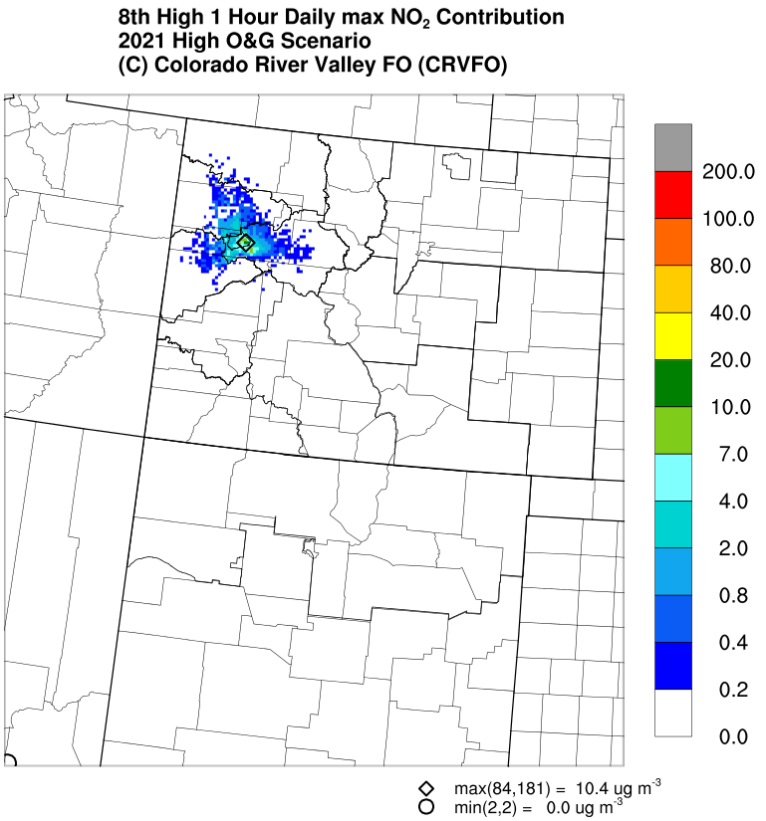
Sensitive Lake / Wilderness Area	Delta ANC (μeq/L) or Delta ANC Percent Change (%) [1]	USFS LAC Threshold
High Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.1169 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0742 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0684 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.39 %	<10%
White Dome Lake / Weminuche	0.0087 μeq/L	<1 (μeq/L)
Medium Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.0921 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0607 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0562 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.31 %	<10%
White Dome Lake / Weminuche	0.0071 μeq/L	<1 (μeq/L)
Low Development Scenario		
Upper Ned Wilson Lake / Flat Tops	0.0716 μeq/L	<1 (μeq/L)
Deep Creek Lake / Raggeds	0.0448 μeq/L	<1 (μeq/L)
Blue Lake / Indian Peaks	0.0409 μeq/L	<1 (μeq/L)
Lower Pack Trail Pothole / Flat Tops	0.24 %	<10%
White Dome Lake / Weminuche	0.0052 μeq/L	<1 (μeq/L)

[1] USDA Forest Service methodology reports Delta ANC calculation as positive quantities; however they reflect a decrease in lake ANC

Source: CARMMS 2015

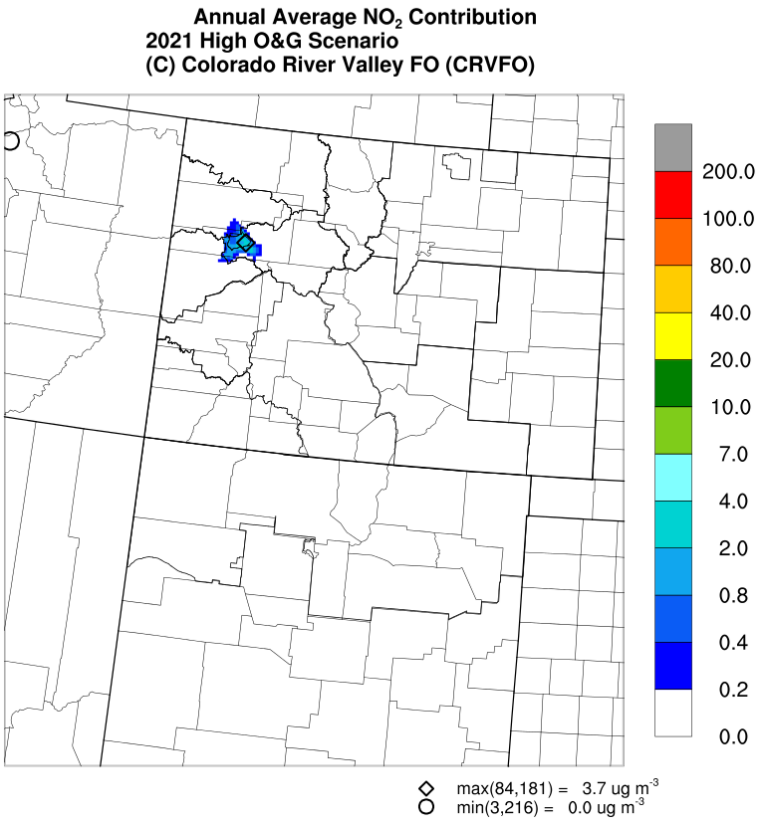
The information above shows that the predicted air quality impacts associated with the CARMMS future oil and gas development scenarios that bound the anticipated development for the CRVFO outside the Roan Planning Area are minimal, and it is reasonable to conclude that any future oil and gas development projects in the Planning Area would have lower contributions to the overall cumulative air quality since these projects would be a subset of entire CRVFO (outside RPPA) projected oil and gas development.

Figures 4.2-2 through **4.2-7** show the CRVFO outside the Roan Planning Area contribution to ambient NO_2 for the eighth highest 1-hour daily maximum period and annual average period for the high, medium, and low development scenarios. **Figures 4.2-8** through **4.2-13** show the CRVFO outside the Roan Planning Area contribution to ambient $PM_{2.5}$ for the 8th highest daily average $PM_{2.5}$ and annual average $PM_{2.5}$ periods for the high, medium and low development scenarios. **Figures 4.2-14** through **4.2-16** show the CRVFO outside the Roan Planning Area contributions to ambient ozone for the fourth highest 8-hour average daily maximum concentrations for the high, medium, and low development scenarios. The maximum concentration contribution values for the CRVFO outside the Roan Planning Area are shown in the bottom right corner of the plots.



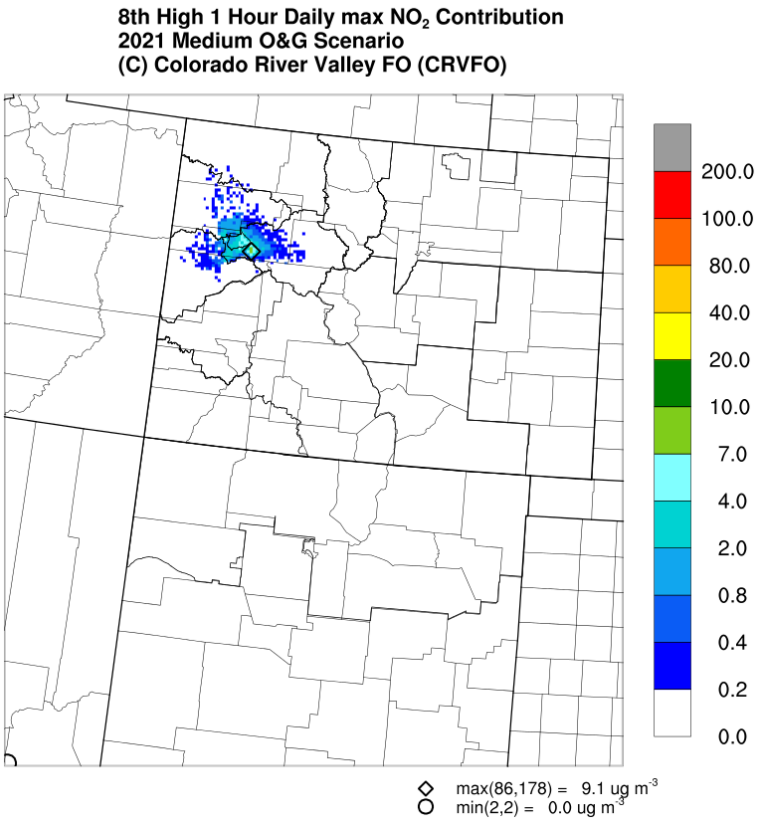
Source: CARMMS 2015.

Figure 4.2-2 CRVFO (Outside Roan) Contribution to the 8th Highest 1-hour Daily Maximum NO_2 Concentration for the 2021 High Scenario



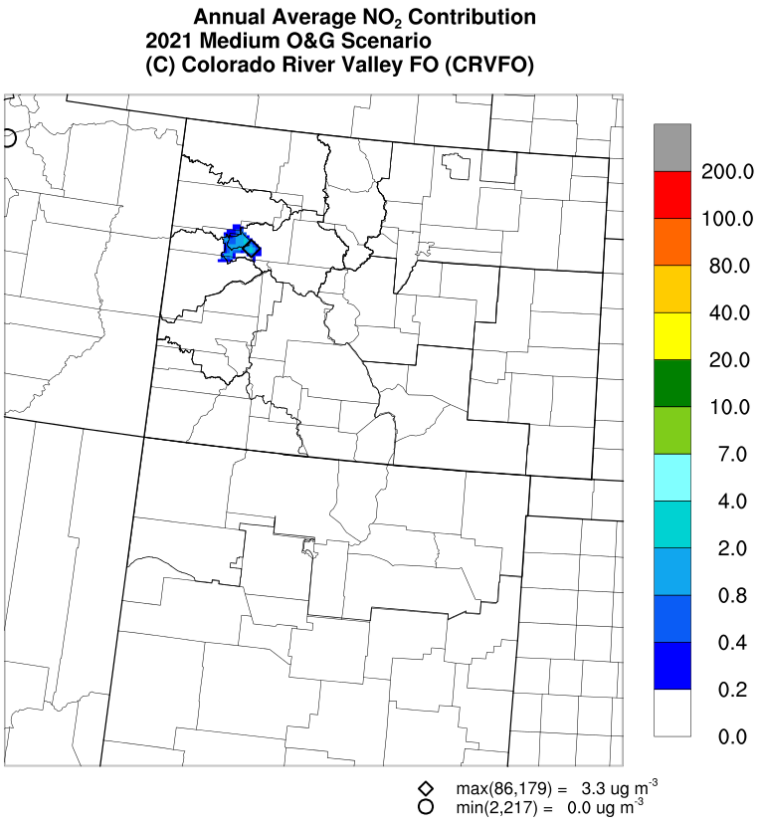
Source: CARMMS 2015.

Figure 4.2-3 CRVFO (Outside Roan) Contribution to The Annual Average NO_2 Concentration for the 2021 High Scenario



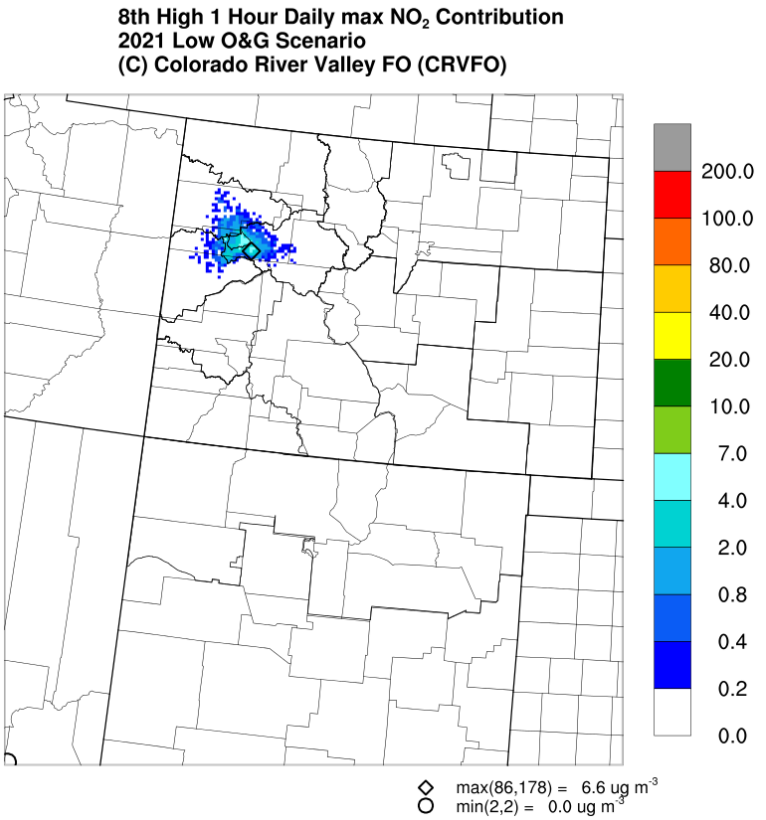
Source: CARMMS 2015.

Figure 4.2-4 CRVFO (Outside Roan) Contribution to the 8th Highest 1-Hour Daily Maximum NO_2 Concentration for the 2021 Medium Scenario



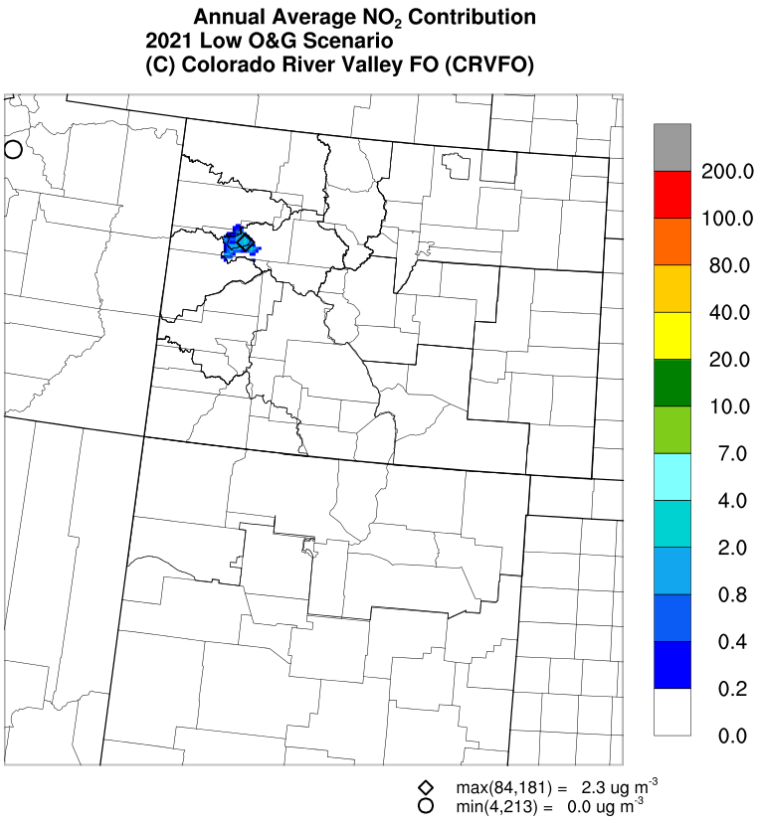
Source: CARMMS 2015.

Figure 4.2-5 CRVFO (Outside Roan) Contribution to the Annual Average NO_2 Concentration for the 2021 Medium Scenario



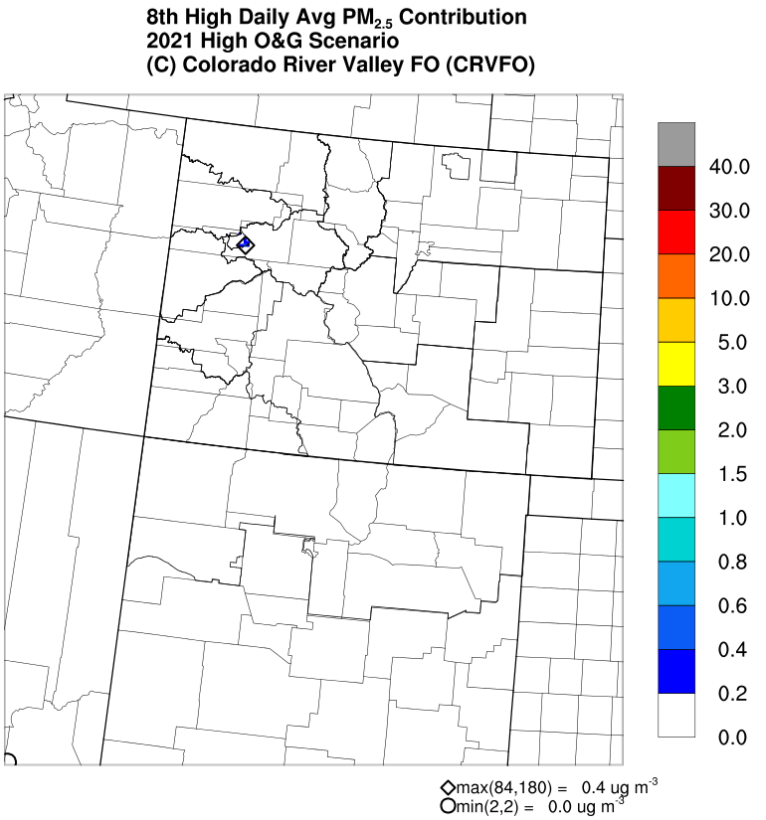
Source: CARMMS 2015.

Figure 4.2-6 CRVFO (Outside Roan) Contribution to the 8th Highest 1-Hour Daily Maximum NO_2 Concentration for the 2021 Low Scenario



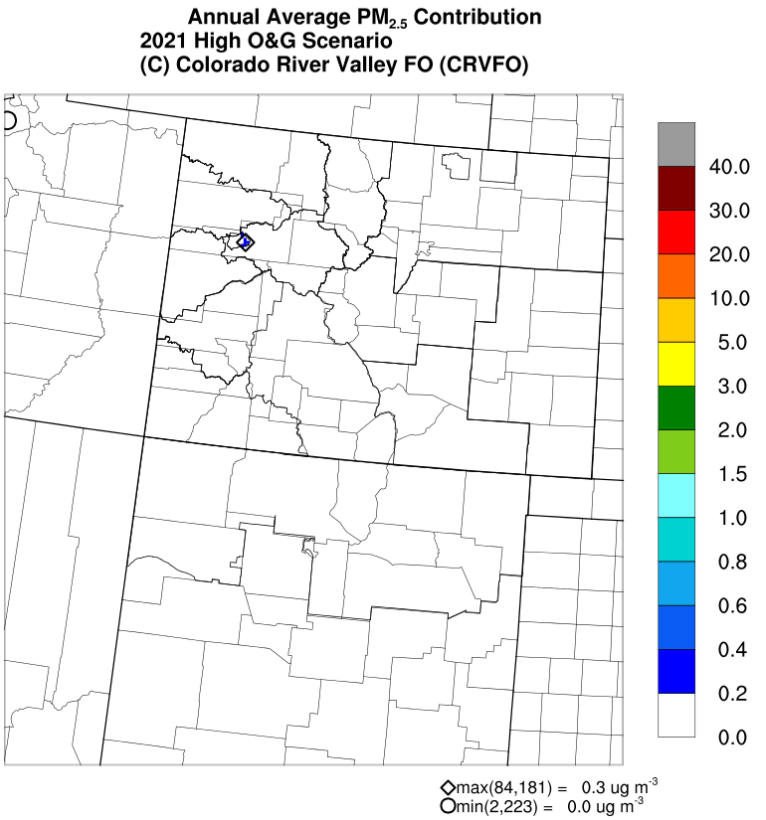
Source: CARMMS 2015.

Figure 4.2-7 CRVFO (Outside Roan) Contribution to the Annual Average NO_2 Concentration for the 2021 Low Scenario



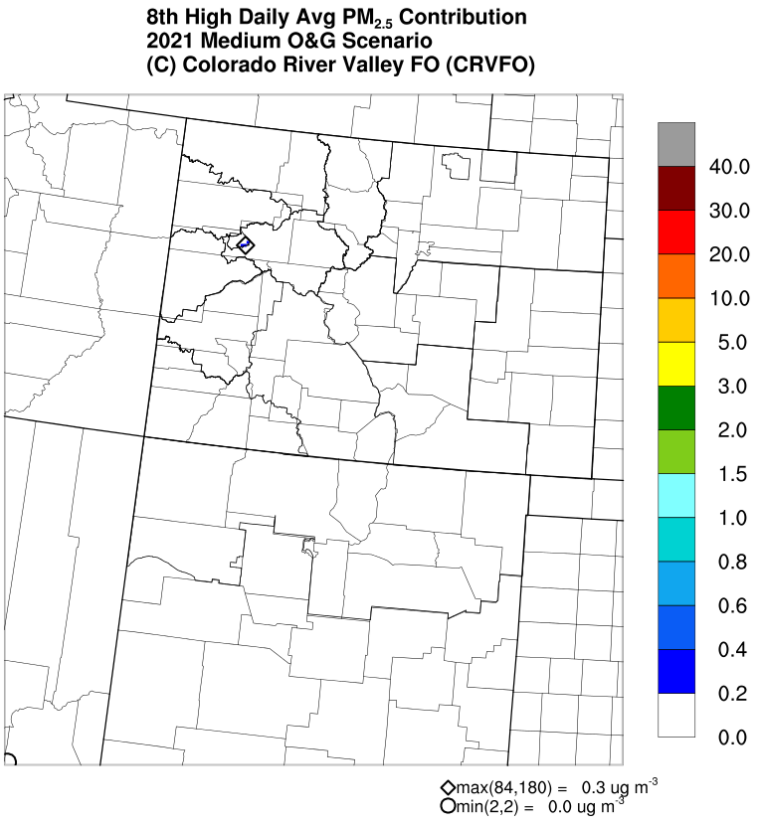
Source: CARMMS 2015.

Figure 4.2-8 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 High Scenario



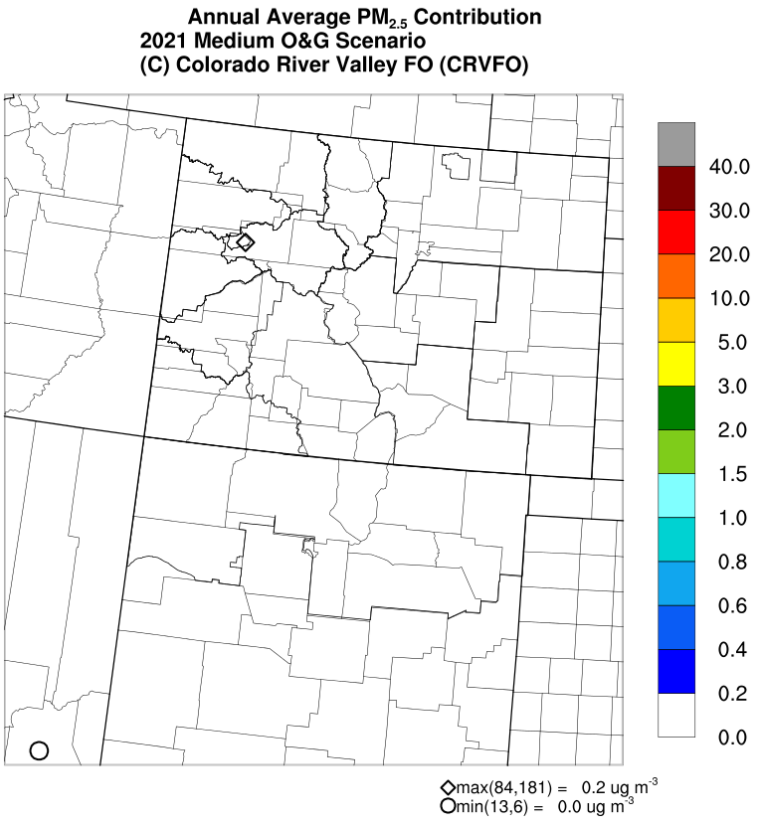
Source: CARMMS 2015.

Figure 4.2-9 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 High Scenario



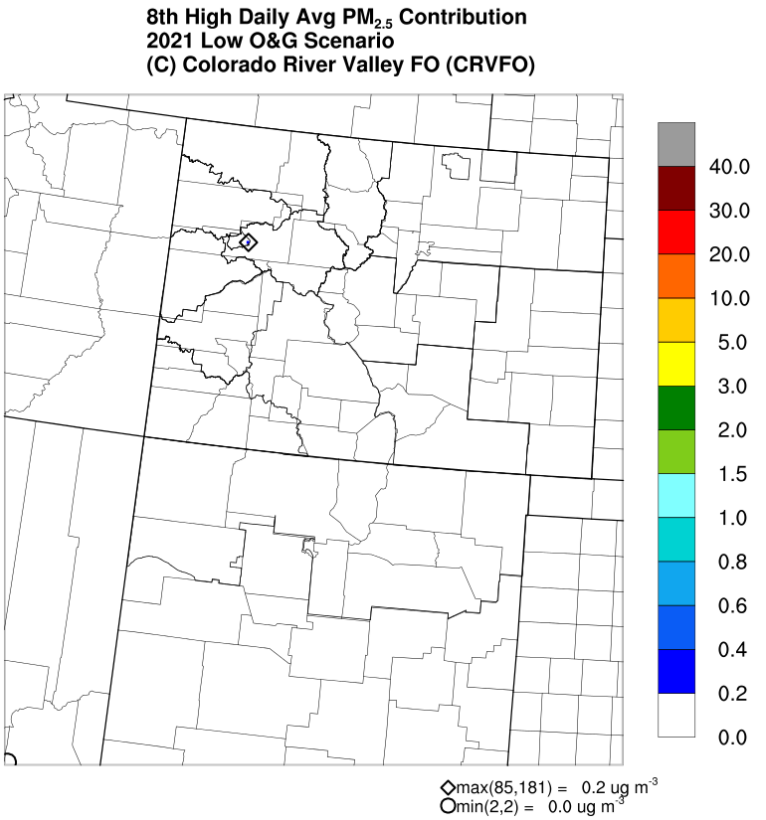
Source: CARMMS 2015.

Figure 4.2-10 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 Medium Scenario



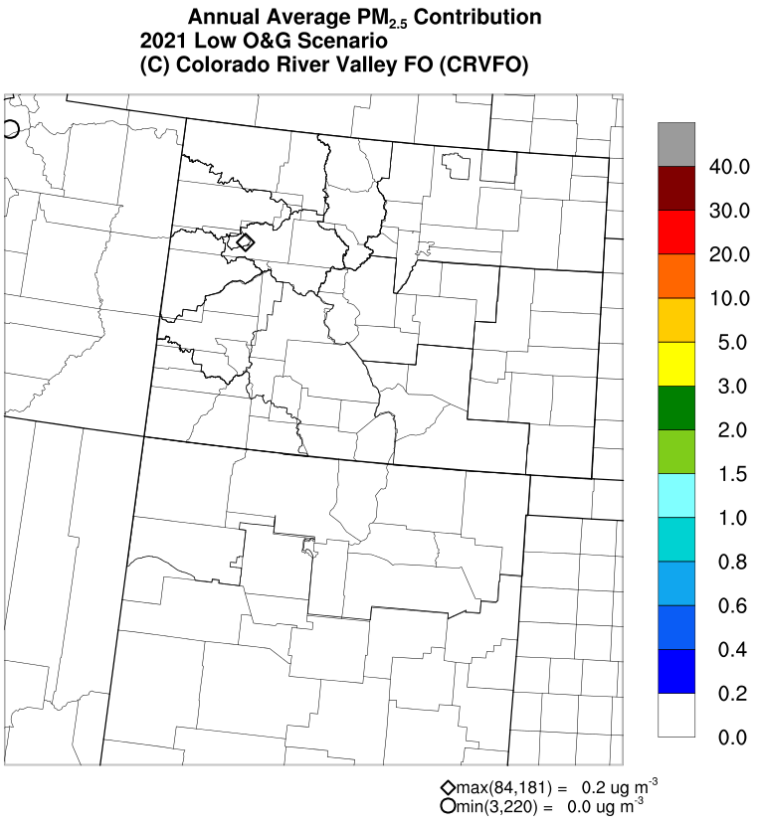
Source: CARMMS 2015.

Figure 4.2-11 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 Medium Scenario



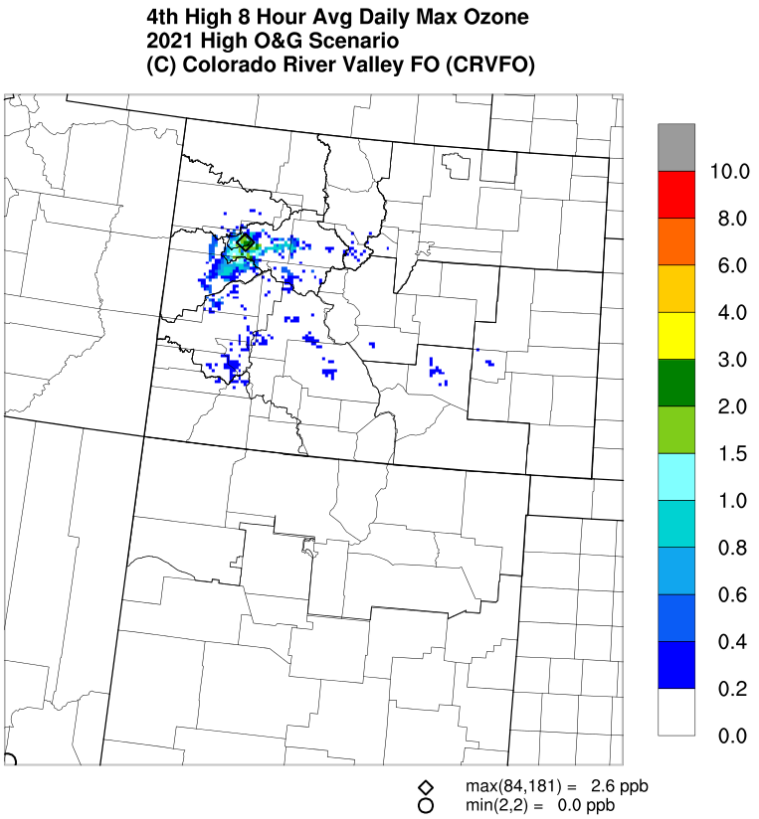
Source: CARMMS 2015.

Figure 4.2-12 CRVFO (Outside Roan) Contribution to the 8th Highest Daily Average $PM_{2.5}$ Concentration for the 2021 Low Scenario



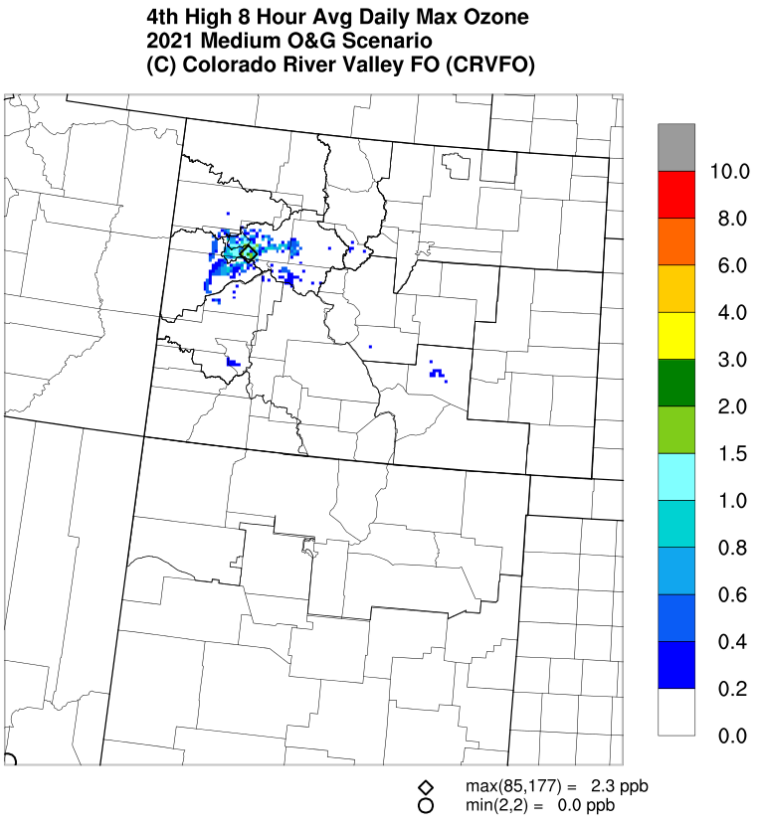
Source: CARMMS 2015.

Figure 4.2-13 CRVFO (Outside Roan) Contribution to the Annual Average $PM_{2.5}$ Concentration for the 2021 Low Scenario



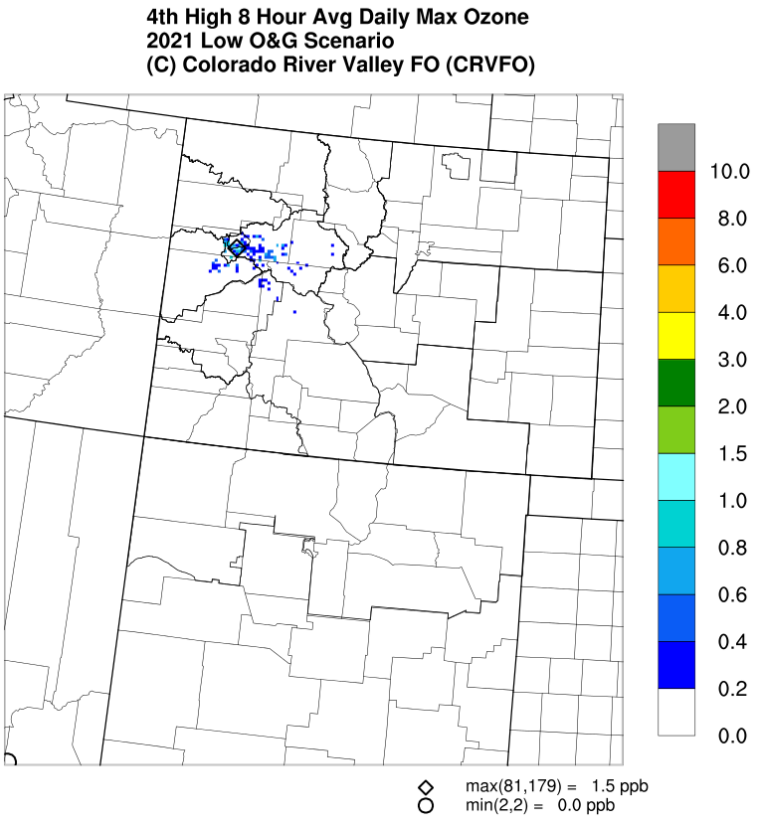
Source: CARMMS 2015.

Figure 4.2-14 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 High Scenario



Source: CARMMS 2015.

Figure 4.2-15 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 Medium Scenario



Source: CARMMS 2015.

Figure 4.2-16 CRVFO (Outside Roan) Contributions to the 4th Highest 8-Hour Average Daily Maximum Ozone Concentrations for the 2021 Low Scenario

4.2.2.4 Summary of CARMMS CRVFO Outside the Roan Planning Area Specific Modeling Results

As described earlier, air pollutant emissions associated with the CARMMS high, medium, and low emissions scenarios are expected to approximate, but not equal potential air pollutant emissions that could occur from future oil and gas developed under the alternatives. In general, new projected federal oil and gas emissions from Alternatives 1 to 4 are expected to be slightly above the CARMMS low development scenario emissions representing CRVFO (outside RPPA) for the source group specific / apportionment analysis. Emissions from Alternative 4 are expected to be the closest to the low development scenario because of the reduced level of oil and gas development as a result of leases that would be cancelled to match the USFS draft decision. Future projected emissions from Alternatives 1, 2, and 3 are expected to be above the low scenario but below the high scenario as the process for management of exploration, development, and reclamation would continue under those leases. As noted above, the potential emissions associated with new oil and gas development for Alternatives1, 2, 3, and 4 would be bound by the oil and gas development rates represented in the CARMMS high and low scenarios. Alternative 5 it is expected to see the lowest level of emissions as all previously leases would be cancelled and all producing wells would have to be plugged and abandoned under this alternative. As previously described, the fraction of the total emissions modeled for the CRVFO outside the Roan Planning Area source group that are co-located with WRNF surface is approximately 11.35 percent. Based on this, it is reasonable to assume that a similar fraction of the CRVFO outside

the Roan Planning Area source group modeled impact contributions would be associated with new projected oil and gas development on WRNF surface (or underlying minerals) for CARMMS.

CARMMS modeling for the low, medium, and high emission scenarios for the CRVFO outside the Roan Planning Area show that there are no expected days that the projected new ear 2021 federal oil and gas emissions for any scenario would have a noticeable visibility change impact (approximately 0.5 dv) at any Class I or sensitive Class II area. The maximum modeled annual nitrogen deposition contributions for each scenario represent only a small fraction of the entire cumulative critical nitrogen deposition load of 2.3 kg/ha-yr value. The critical deposition load is a cumulative metric (annual deposition load threshold for all emissions sources) and is used for this assessment since future projected CRVFO outside the Roan Planning Area oil and gas development would be made up of multiple “projects” and a project-level deposition load threshold such as the Deposition Analysis Threshold (DAT) is not appropriate for comparing potential cumulative deposition. The maximum contributions to the fourth highest daily maximum 8-hour ozone concentrations are minimal with respect to the 70 ppb 8-hour ozone standard, and the maximum contributions to modeled 8-hour ozone exceedances (modeled values above former NAAQS that are primarily predicted to occur in urban areas for Colorado [see next cumulative impacts section for more information regarding cumulative predicted modeled exceedances]) are less than 1 ppb. The maximum contribution to the modeled eighth highest maximum 24-hour $PM_{2.5}$ concentration also is minimal with respect to the 35 µg/m^3 24-hour $PM_{2.5}$ standard and less than 1 µg/m^3. As described above, the maximum contributions to modeled exceedances used for this analysis are estimated with respect to cumulative modeled ozone 8-hour concentrations above the former ozone 8-hour Standard (75 ppb). It is reasonable to assume that CARMMS predicted RPPA future oil and gas maximum contributions above the new ozone 8-hour Standard (70 ppb) would be very similar in magnitude and maybe slightly higher than maximum ozone contributions with respect to the former ozone Standard. Regardless, the maximum RPPA contributions for grid cell cumulative concentrations above the new ozone 8-hour Standard (70 ppb) would not exceed the overall maximum contributions for the RPPA future oil and gas development (see first column of numerical values in **Table 4.2-5**). It should be noted that there is currently not an acceptable ozone contribution significance threshold that has been established for Federal Land Managers and NEPA assessments for planning-level or project-level projected future oil and gas development. The EPA’s Interstate Transport Rule one percent (of the ozone NAAQS) ozone impact significance threshold is applicable to an upwind state’s ozone contributions to an actual monitored non-attainment area exceedance of the ozone Standard in a downwind state, and is not directly applicable for projected future oil and gas development NEPA assessments and ozone impacts in current designated attainment areas.

Alternatives 1, 2, and 3 would pose the highest potential for impacts on air quality as these alternatives would allow for more oil and gas development on the leases, resulting in additional emissions during construction, drilling, completion, and production activities. New future oil and gas development under Alternative 4 would have lower air quality impacts than the Alternatives 1, 2, and 3 because it would modify or cancel the 65 leases, which would reduce the associated emissions. It is anticipated that the air quality impacts for future federal oil and gas under Alternative 5 would be the lowest of all alternatives as actions under this Alternative would plug and abandon current producing oil and wells. As previously described, current Colorado-based oil and gas development is tracking near CARMMS low oil and gas development pace, but it is reasonable to assume that new federal oil and gas emissions and impacts for the CARMMS high scenario would be more applicable for the Alternatives 1, 2, and 3 (if these leases were completely developed) and the new federal oil and gas emissions and impacts for the CARMMS low scenario would be more applicable for the Alternatives 4 and 5. As previously described, the CARMMS medium scenario assumes the same level of future oil and gas development as the CARMMS high scenario but accounts for additional emissions controls as described in Section 4.2.2.1. These additional controls would reduce the level of dust emissions for unpaved surface disturbance, NO_x emissions for development and production engines and VOC and HAPs emissions for production equipment and operations. The additional emissions controls by up to 20 percent relative to the CARMMS high scenario modeled impacts for CRVFO outside the Roan Planning Area.

The CARMMS CRVFO (outside RPPA) source apportionment results spatial plots show that the 8th high daily maximum 1-hour NO_2 contributions above 0.2 µg/m^3 are confined to northwest Colorado and the highest contributions (10.4 µg/m^3, 9.1 µg/m^3 and 6.6 µg/m^3 for high, medium and low scenarios, respectively) are found in western portions of CRVFO. The modeled contributions for all pollutants, rank and averaging times do not extend far outside CRVFO and adjacent field office boundaries and the spatial extent of the modeled impacts is reduced for the medium scenario and further reduced for the CARMMS low scenario. The maximum modeled CRVFO (outside RPPA) contribution to the 4th highest 8-hour average daily maximum ozone concentrations as well as for other pollutants for the CARMMS scenarios occur in the eastern portion of CRVFO (southeast portion of the RPPA) near the I-70 corridor. The geographic setting for this part of the CRVFO includes the steep dramatic face / terrain incline of the Roan Plateau and the broad bend in the valley for the I-70 corridor and Colorado River. It is apparent that the CARMMS modeling program (i.e., CAMx) captured this topography and realistically modeled the air pollutants being pooled and trapped up against the steep plateau face along the Colorado River Valley in this part of the CRVFO.

Overall, the information above shows that the predicted air quality impact contributions associated with the three CARMMS oil and gas development scenarios that encompass anticipated new federal oil and gas development in the CRVFO outside the Roan Planning Area post-year 2011 are minimal.

4.2.2.5 Cumulative CARMMS Modeling Results

Cumulative air quality impacts from the CARMMS high, medium, and low modeling scenarios for year 2021 results are presented in this section. Cumulative modeled impact changes from the base-case year 2008 to year 2021 also are discussed.

All other emissions sources (other than new Colorado-based oil and gas development) for the CARMMS year 2021 cumulative emissions inventory were modeled at the same emissions rates for the CARMMS high, medium, and low scenarios. New future Colorado federal and non-federal oil and gas was the only source category with varying development/emissions rates for the different CARMMS modeling scenarios. The number of new projected federal and non-federal oil and gas wells (i.e., oil and gas development rate) for the medium scenario was the same as for the high scenario with additional emissions controls (beyond current regulations) applied to future Colorado –based federal oil and gas. Projected federal and non-federal oil and gas future year emissions estimates for nearby states bordering Colorado (Utah, New Mexico and Wyoming) were obtained from latest studies for future oil and gas development in those states' fields and basins. As previously described, the CARMMS cumulative emissions inventory also includes non-oil and gas emission inventories encompassing biogenic (natural) emissions, electric generating units (EGUs), fires, agriculture and mobile sources; the non-oil and gas (and oil and gas outside the region) emissions estimates for CARMMS were developed by USEPA and updated for the 3SAQS projected year 2020 emissions inventory. Future year 2021 emissions inventories for Colorado based mining were developed specifically for CARMMS and were based on latest foreseeable mining projections.

Table 4.2-9 provides a full cumulative summary of visibility and nitrogen deposition impacts for all (i.e., "world-wide") emissions sources associated with the CARMMS modeling scenario for nearby Class I and sensitive Class II areas. As shown in the table, visibility and nitrogen deposition was modeled to improve from years 2008 to 2021 for all CARMMS scenarios.

In addition to the full cumulative impacts analysis, CARMMS includes "quasi"-cumulative emissions source groups that allow for analyses that focus on ozone and AQRV impact contributions of new future Colorado-wide federal and non-federal oil and gas (all combined Colorado areas). These quasi-cumulative impact contributions were determined by subtracting the contributions of new Colorado-based federal and non-federal oil and gas development. The CARMMS defines "Source Group R" as new Colorado-based federal oil and gas and mining, and "Source Group S" as combined new federal oil

and gas and mining development and new non-federal oil and gas development within the 13 Colorado BLM Planning Areas. The difference between Source Group R and S therefore is the new non-federal oil and gas component.

Table 4.2-8 CARMMS Full Cumulative Year 2021 Modeled AQRV Impacts at Select Class I / Sensitive Class II Areas

Class I / Sensitive Class II Areas	Best 20% Days Visibility Metric (dv) 2021 Improvement from 2008	Worst 20% Days Visibility Metric (dv) 2021 Improvement from 2008	Maximum Modeled Annual Nitrogen Deposition (kg/ha-yr) 2021 High Improvement from 2008
High Development Scenario			
Black Canyon of the Gunnison	0.07	0.64	0.14
Colorado National Monument	0.09	0.68	0.57
Eagles Nest Wilderness	0.14	0.81	0.79
Flat Tops Wilderness	0.14	0.61	0.71
Maroon Bells – Snowmass Wilderness	0.16	0.77	0.80
Medium Development Scenario			
Black Canyon of the Gunnison	0.07	0.64	0.16
Colorado National Monument	0.10	0.69	0.57
Eagles Nest Wilderness	0.14	0.82	0.83
Flat Tops Wilderness	0.15	0.61	0.75
Maroon Bells – Snowmass Wilderness	0.17	0.78	0.84
Low Development Scenario			
Black Canyon of the Gunnison	0.12	0.74	0.26
Colorado National Monument	0.14	0.78	0.57
Eagles Nest Wilderness	0.16	0.85	0.98
Flat Tops Wilderness	0.20	0.68	0.96
Maroon Bells – Snowmass Wilderness	0.18	0.80	0.99

Note: Positive values mean overall improvement and deposition values are maximum for all grid cells making up the Class I area.

Source: CARMMS 2015.

The following highlights CARMMS predicted 8-hour ozone impact contributions with respect to the quasi-cumulative source groups:

- For the monitored area analysis, removing the contributions due to new Colorado –based federal oil and gas and mining (Source Group R) reduces the 2021 DVF at Rocky Flats North by 0.9 ppb to 78.6 ppb for the high scenario, by 0.3 ppb to 77.8 ppb for the low and by 0.8 ppb to 78.7 ppb for the medium scenario, which are still above the ozone NAAQS. However, when emissions from new Colorado-based non-federal oil and gas are removed in addition to the

federal oil and gas development (Source Group S), projected 2021 DVFs are 74.5, 75.8 and 74.5 ppb for the high, low and medium scenarios, respectively. Removing future non-federal oil and gas (Source Group S component) results in larger overall ozone reductions for the Colorado Front Range monitors likely reflecting the large amount of current and projected non-federal oil and gas development activity in the eastern Colorado DJ Basin.

- For the UAA, the CARMMS 2021 high, medium and low scenarios ozone DVF maximum reductions without Source Group R are 6.4, 5.6 and 2.8 ppb (respectively) and occur in the Piceance Basin. Removing Source Group S results in more reductions in the 2021 DVFs, especially in Weld County in the greater Denver area. There are predicted large reductions in 2021 DVFs in the Piceance and D-J Basins (Weld County) with the largest reductions being 12.8 ppb (high scenario), 8.5 ppb (low scenario) and 12.2 ppb (medium scenario) in the Piceance Basin of northwest Colorado.

Tables 4.2-10 through **4.2-12** show CARMMS AQRV visibility and nitrogen deposition impact contributions for Source Groups R and S at Flat Tops and Maroon Bells – Snowmass Wildernesses in northwest Colorado near the CRVFO.

Table 4.2-9 CARMMS Modeled Visibility Impacts at Flat Tops and Maroon Bells – Snowmass Wilderness Areas using FLAG 2010 Methodology

Sensitive Area	Source Group	Max Δdv	Number of Day	
			>1.0	>0.5
High Development Scenario				
Flat Tops WA	Group R	1.64	8	53
	Group S	1.84	13	100
Maroon Bells – Snowmass WA	Group R	1.21	1	27
	Group S	2.00	9	84
Medium Development Scenario				
Flat Tops WA	Group R	1.60	8	46
	Group S	1.80	13	87
Maroon Bells – Snowmass WA	Group R	1.04	1	16
	Group S	1.83	7	63
Low Development Scenario				
Flat Tops WA	Group R	1.33	6	28
	Group S	1.44	7	32
Maroon Bells – Snowmass WA	Group R	0.59	0	7
	Group S	1.00	0	12

Source: CARMMS 2015

Table 4.2-11 CARMMS Modeled Full Cumulative Visibility Impacts at Flat Tops and Maroon Bells – Snowmass Wilderness Areas using MATS Tool

Sensitive Area	Visibility Metric (dv)	2008 Base[1]	2021[1]	2021 without R	2021 without S
High Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.07	8.06	7.89
	Best 20%	0.69	0.55	0.53	0.41
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.91	7.89	7.84
	Best 20%	0.69	0.53	0.51	0.49
Medium Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.07	8.06	7.89
	Best 20%	0.69	0.54	0.53	0.41
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.90	7.89	7.85
	Best 20%	0.69	0.52	0.51	0.49
Low Development Scenario					
Flat Tops WA	Worst 20%	8.68	8.00	7.99	7.91
	Best 20%	0.69	0.49	0.49	0.42
Maroon Bells – Snowmass WA	Worst 20%	8.68	7.88	7.87	7.85
	Best 20%	0.69	0.51	0.51	0.50

[1] Full Cumulative results for 2008 Base and 2021 High, Medium and Low Scenarios.

Source: CARMMS 2015.

Table 4.2-12 CARMMS Modeled Nitrogen Deposition

Sensitive Area	Source Group	Annual N Deposition (kg N/ ha-yr)		
		2021 High	2021 Medium	2021 Low
Flat Tops WA	Group S	0.37	0.32	0.13
	Group R	0.21	0.17	0.04
Maroon Bells – Snowmass WA	Group S	0.31	0.27	0.10
	Group R	0.16	0.13	0.03

Maximum modeled source group contribution values at Class I area.

Source: CARMMS 2015

The following highlights CARMMS predicted AQRV impact contributions with respect to the quasi-cumulative source groups R and S:

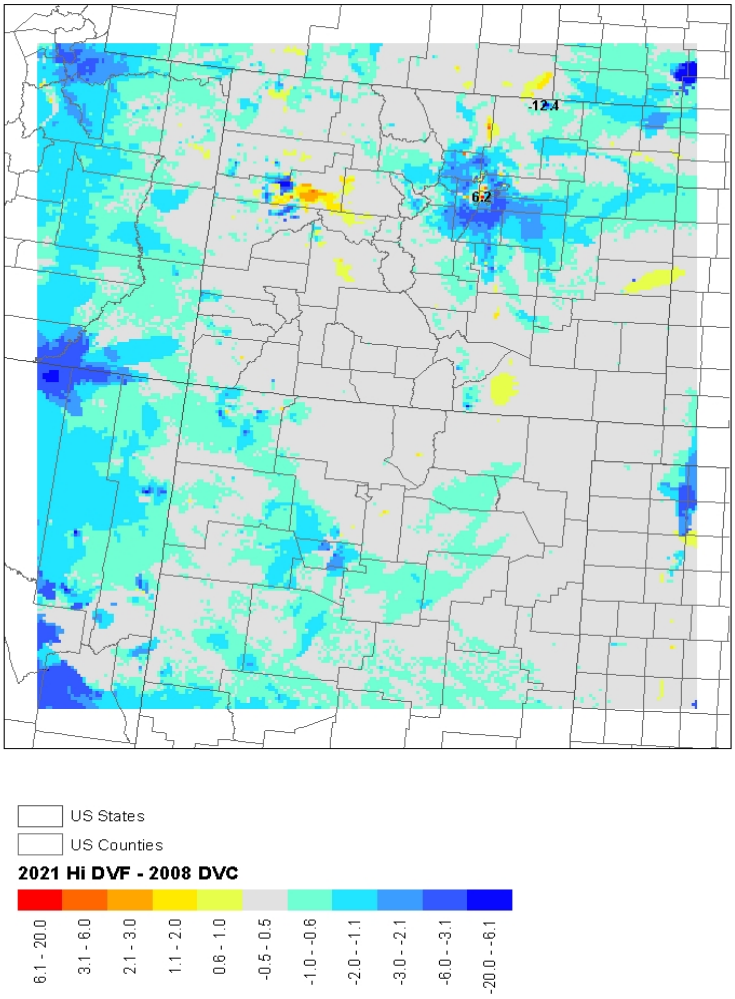
- For visibility impacts at Flat Tops Wilderness using FLAG 2010 Methodology (FLAG 2010), the number of days with significant visibility impacts for CARMMS high and medium scenarios almost double when adding in the new non-federal oil and gas component associated with Source Group S. The number of days with significant impacts and largest delta-dv are almost the same for the two source groups for the CARMMS low scenario.

- For visibility impacts at Flat Tops Wilderness using MATS cumulative analysis tool, removing the new non-federal oil and gas component associated with Source Group S gives a larger reduction response to the overall visibility metric compared to the federal oil and gas component (Source Group R) for all three CARMMS scenarios.
- For visibility impacts at Maroon Bells - Snowmass Wilderness using FLAG 2010 Methodology, it appears that the non-federal component Source Group S has a higher impact on visibility changes than Source Group R (federal only).
- For visibility impacts at Maroon Bells - Snowmass Wilderness using MATS cumulative analysis tool, removing the new non-federal oil and gas component associated with Source Group S gives an almost equal reduction response to the overall visibility metric compared to the federal oil and gas component (Source Group R) for all three CARMMS scenarios.
- For maximum nitrogen deposition at Flat Tops WA, the new federal oil and gas component is most of the annual nitrogen deposition for Source Group S (includes new federal and non-federal) when comparing Source Groups R and S. The additional emissions controls associated with CARMMS medium scenario reduce nitrogen deposition by about 20 percent of CARMMS high scenario levels at Flat Tops WA.
- For maximum nitrogen deposition at Maroon Bells - Snowmass WA, the new federal oil and gas component appears to be about half of the annual nitrogen deposition for Source Group S (includes new federal and non-federal) when comparing Source Groups R and S. The additional emissions controls associated with CARMMS medium scenario reduce nitrogen deposition by about 10 percent of CARMMS high scenario levels at Maroon Bells – Snowmass WA.

For full cumulative ozone design value projections at regional ozone monitoring sites for the CARMMS 2021 high development scenario, the maximum current year 8-hour DVC (baseline concentration centered on year 2008) is 82.0 ppb at the Rocky Flats North (CO_Jefferson_006) monitor, which is projected to be reduced to 79.5, 79.5 and 78.1 ppb for the CARMMS 2021 high, medium and low development scenarios, respectively. There are eight monitoring sites in the CARMMS 4-km domain with current year 2008 DVCs above the former ozone NAAQS (75 ppb) and CARMMS predictions show that there would be 17 monitoring sites with DVF for future year 2021 ozone concentration above the new ozone Standard (70 ppb) for the CARMMS 2021 High and Medium scenarios, and 16 monitoring sites with DVF above new ozone Standard for CARMMS Low scenario (note that there would be approximately 19 monitoring sites with year 2008 DVCs above the new ozone Standard [75ppb] and CARMMS predicts that there would only be two sites with year 2021 ozone concentration DVFs above the former ozone Standard [75 ppb] for all CARMMS scenarios). Even though there has recently been a new ozone Standard established since base year 2008, the cumulative ozone concentrations are predicted to decrease at air quality monitor locations throughout the Region. The CARMMS predicted average reductions in cumulative ozone concentrations (from base year 2008 to future year 2021) for all 37 Regional monitors in the CARMMS ozone analysis are 1.6 ppb, 1.6 ppb and 2.1 ppb for the CARMMS High, Medium and Low Scenarios, respectively. CARMMS predicts slight increases (< 1ppb) at only two Larimer County, Colorado based monitor locations for the CARMMS High and Medium Scenarios (no predicted increases at Regional monitors for the CARMMS Low Scenario).

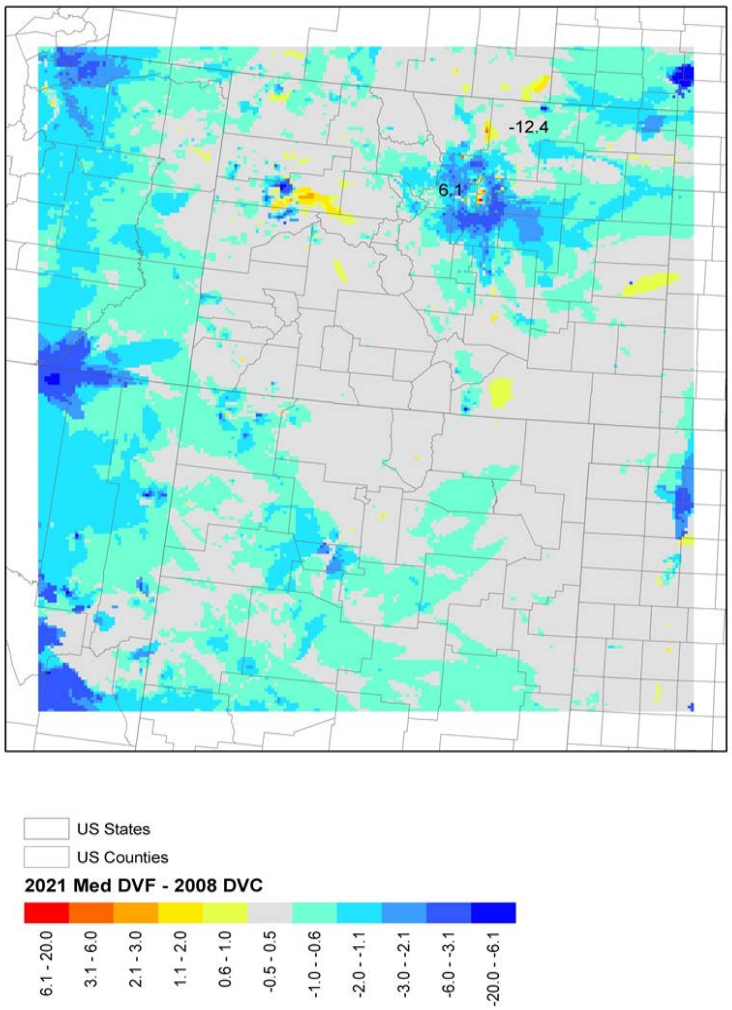
For the ozone design value projection unmonitored area analysis (UAA [analysis for areas with no monitors]), the geographical extent (i.e., size) of the overall area of ozone design value exceedances from 2008 to 2021 is reduced for all the CARMMS modeling scenarios with respect to the former ozone Standard of 75 ppb (former Standard used for UAA comparison since it is applicable for year 2008 ozone exceedance geographical extent). **Figures 4.2-17** through **4.2-19** show predicted ozone design value differences (2021 minus 2008) for the CARMMS high, medium, and low development scenarios, respectively. Also **Figures 4.2-20** through **4.2-22** show the 2021 modeled ozone design values for all scenarios. **Figure 4.2-17** shows CARMMS-predicted ozone reductions in the Denver and Salt Lake City areas for the high development modeling scenario. However, the CARMMS model also predicts areas in

which the future design values increase by approximately 5 ppb in portions of Garfield County, Colorado, near the WRNF leasing areas. The plots for the CARMMS high and medium scenarios show areas with predicted design future ozone concentration (DVF) increases in portions of Garfield County, Colorado near the CRVFO outside the Roan Planning Area. The CARMMS cumulative modeled impacts account for overall emissions increases and decreases from year 2008 to 2021 for all emissions source categories and a net increase in overall federal and non-federal oil and gas development / production in the region. Similar to the CRVFO (outside RPPA) source group / apportionment impacts, the portion of Garfield County where CARMMS cumulative output shows ozone increases is located along the I-70 corridor and Colorado River where substantial oil and gas development exists and new federal and non-federal development is projected to occur For the comparative analysis, it should be noted that the base case (2008) ozone design value (DVC) plot is presented in **Figure 3.2-8** in Chapter 3.0.



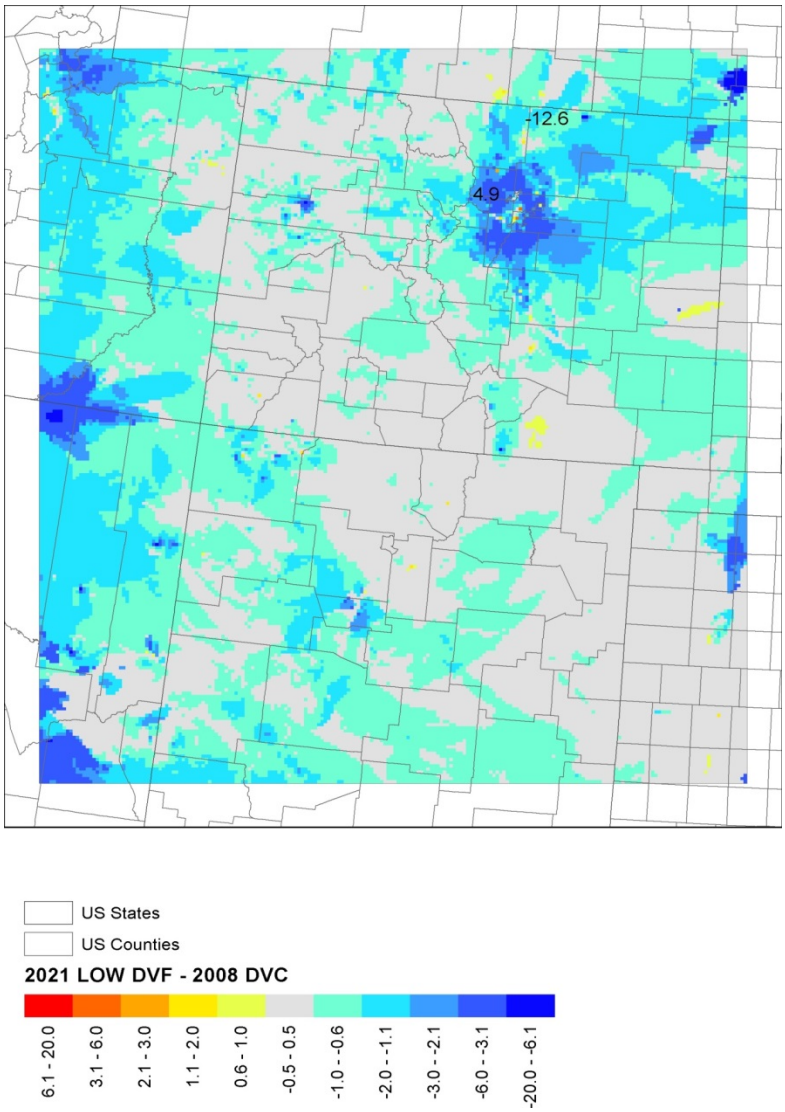
Source: CARMMS 2015.

Figure 4.2-17 Ozone Design Values Differences between the 2021 High Development Scenario and the 2008 Base Case



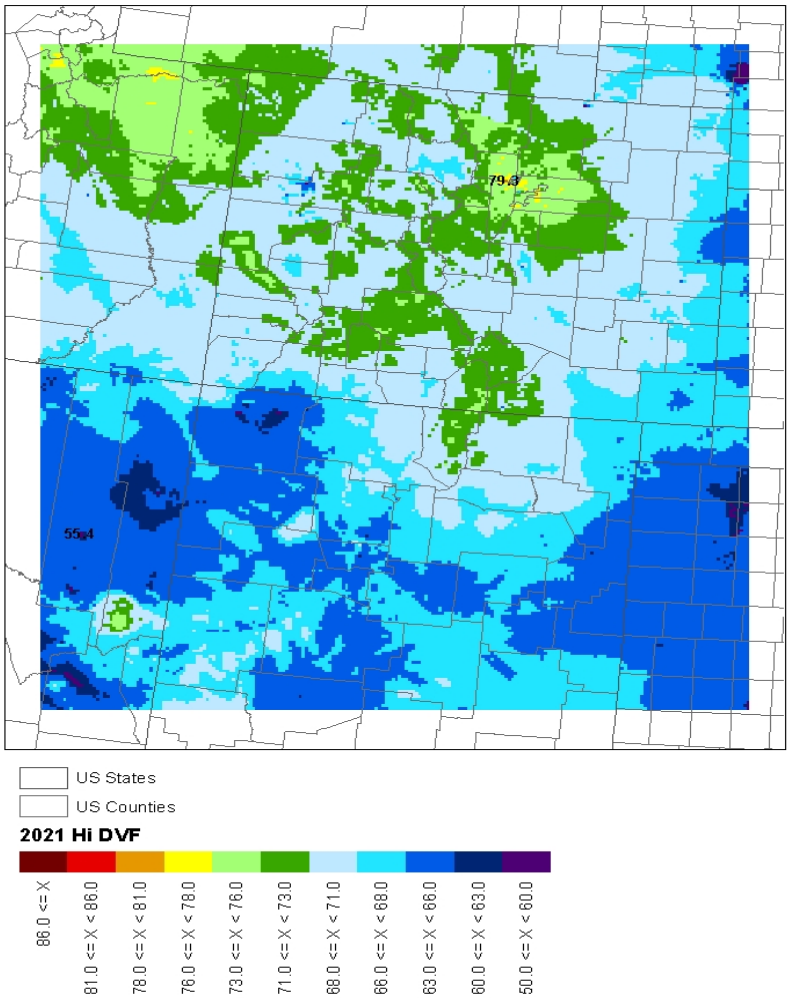
Source: CARMMS 2015.

Figure 4.2-18 Ozone Design Values Differences between the 2021 Medium Development Scenario and the 2008 Base Case



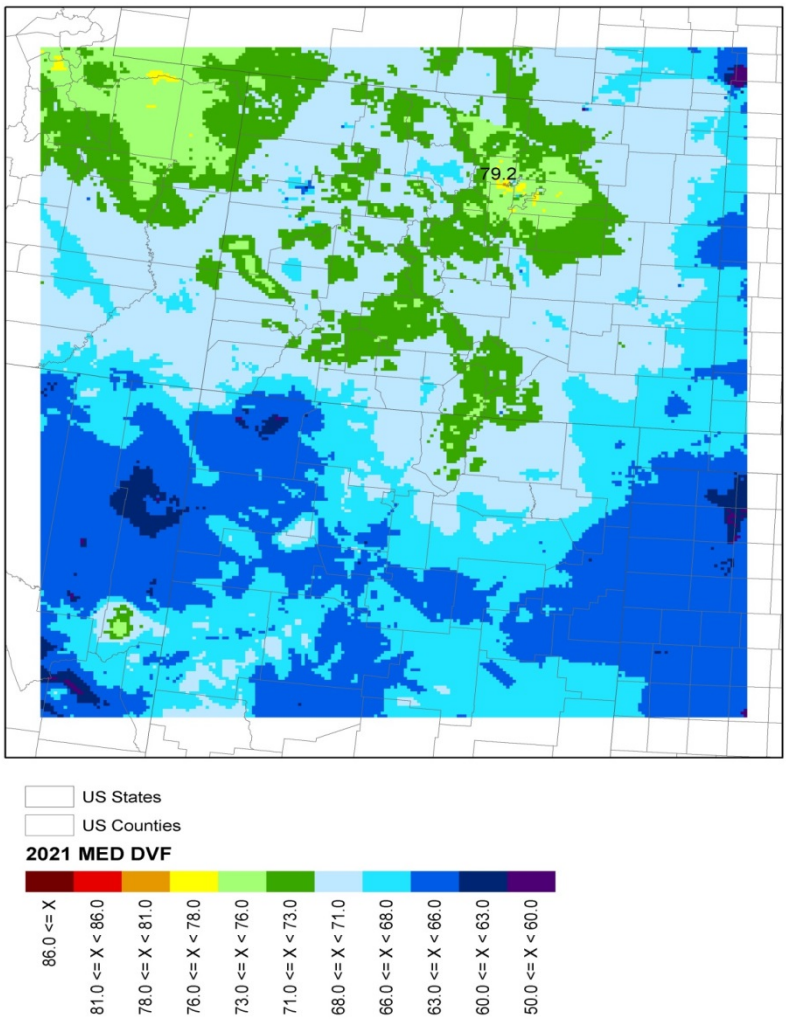
Source: CARMMS 2015.

Figure 4.2-19 Ozone Design Values Differences between the 2021 Low Development Scenario and the 2008 Base Case



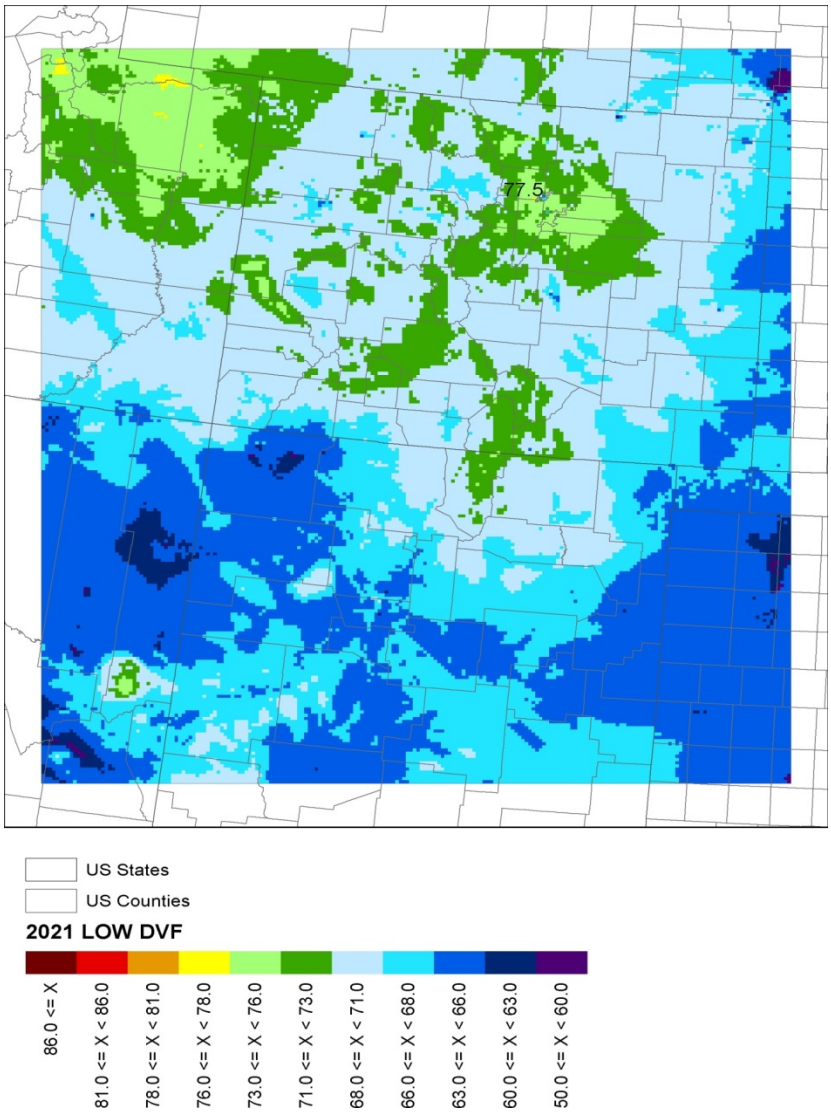
Source: CARMMS 2015.

Figure 4.2-20 CARMMS Modeled 2021 Ozone Design Value for the High Development Scenario



Source: CARMMS 2015.

Figure 4.2-21 CARMMS Modeled 2021 Ozone Design Value for the Medium Development Scenario

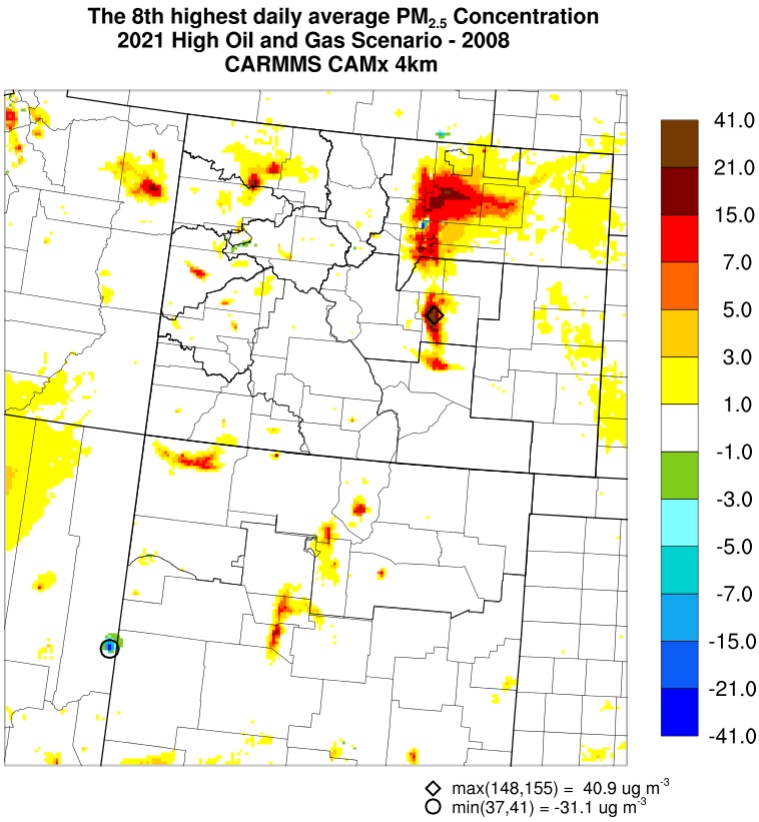


Source: CARMMS 2015.

Figure 4.2-22 CARMMS Modeled 2021 Ozone Design Value for the Low Development Scenario

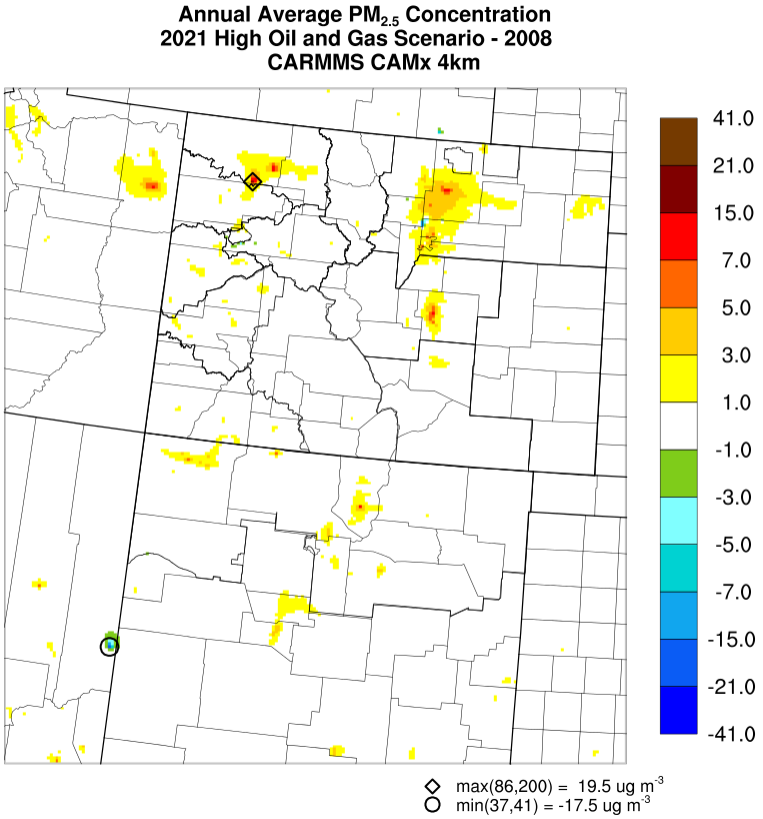
Figures 4.2-23 through **4.2-28** show CARMMS cumulative modeled differences in the 8th highest daily average and annual average $PM_{2.5}$ concentrations for the CARMMS high, medium and low scenarios. The differences are formed by subtracting the 2008 base case impacts from the 2021 scenario impacts. BLM determined through further analysis that the maximum modeled differences in eastern Colorado are primarily due to new non-federal oil and gas development in the Royal Gorge Field Office (RGFO) reflecting the large amount of current and projected non-federal oil and gas development activity in the eastern Colorado DJ Basin. The modeled differences are overestimated because future year 2021 unpaved road traffic and construction fugitive dust emissions were estimated for all new RGFO federal and non-federal oil and gas development for CARMMS, whereas the year 2008 WestJumpAQMS emissions inventory did not account for the same level of total oil- and gas-development-related traffic/construction fugitive dust per well / production. The amount of unpaved road travel for non-federal oil and gas development in the northern Denver metro area of the DJ Basin further contributes to the

overestimate of dust emissions because many of the primary roadways in that area are paved. With the exception of increases in $PM_{2.5}$ concentrations near large cities and future mining operations and non-federal oil and gas development and operations in northeast Colorado, the CARMMS high scenario full cumulative modeling results show no change in the 8th highest daily average $PM_{2.5}$ concentration in the region from years 2008 to 2021.



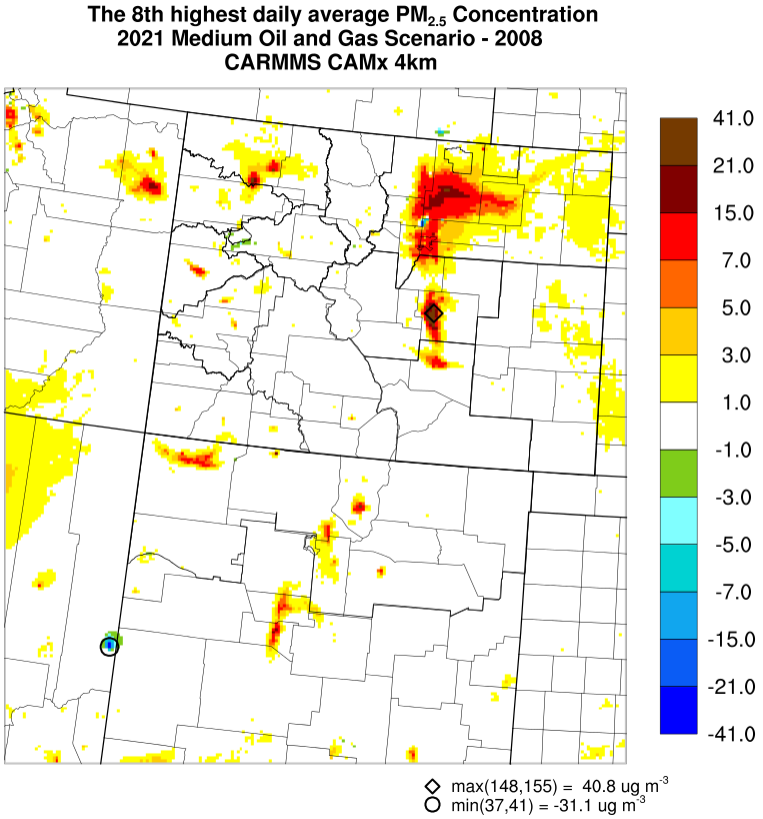
Source: CARMMS 2015.

Figure 4.2-23 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



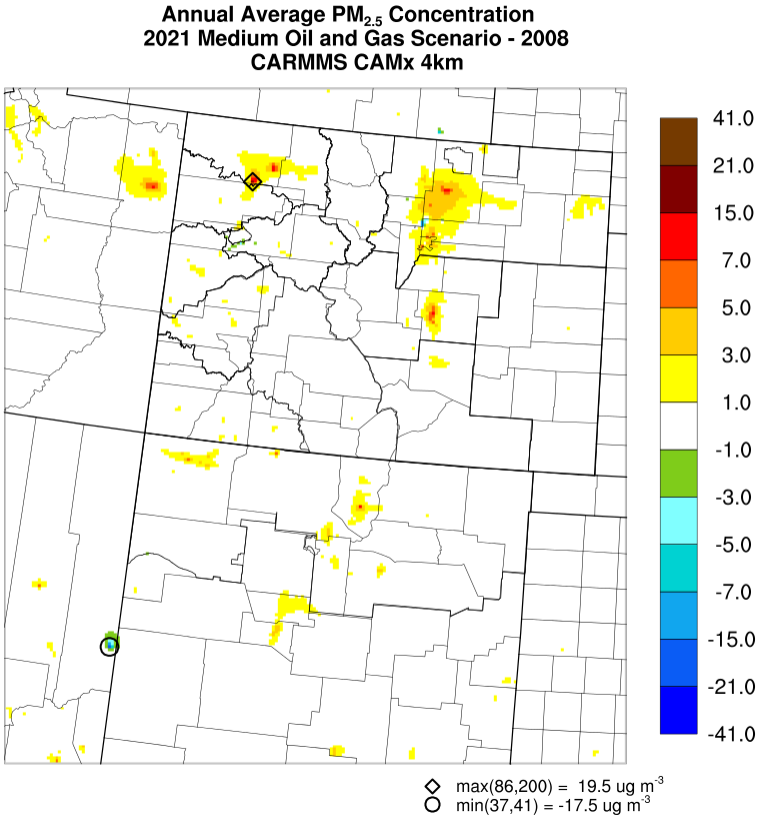
Source: CARMMS 2015.

Figure 4.2-24 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



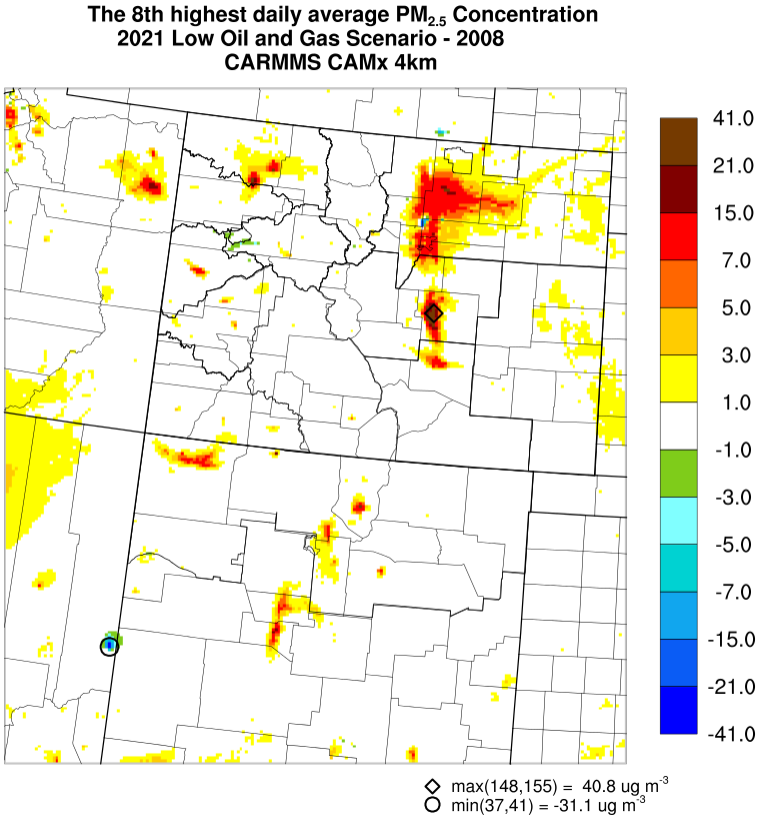
Source: CARMMS 2015.

Figure 4.2-25 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



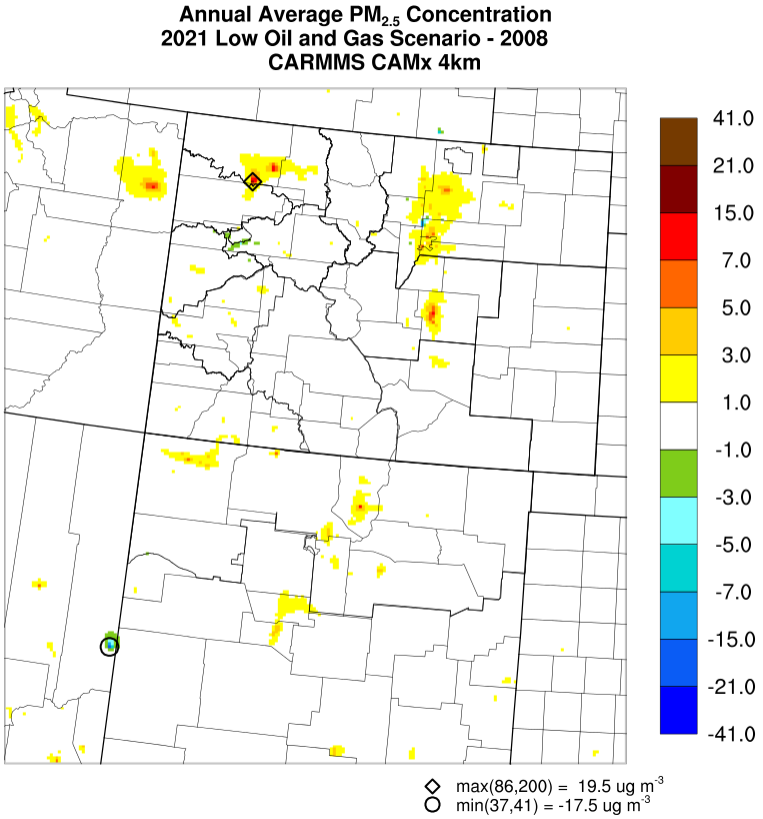
Source: CARMMS 2015.

Figure 4.2-26 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

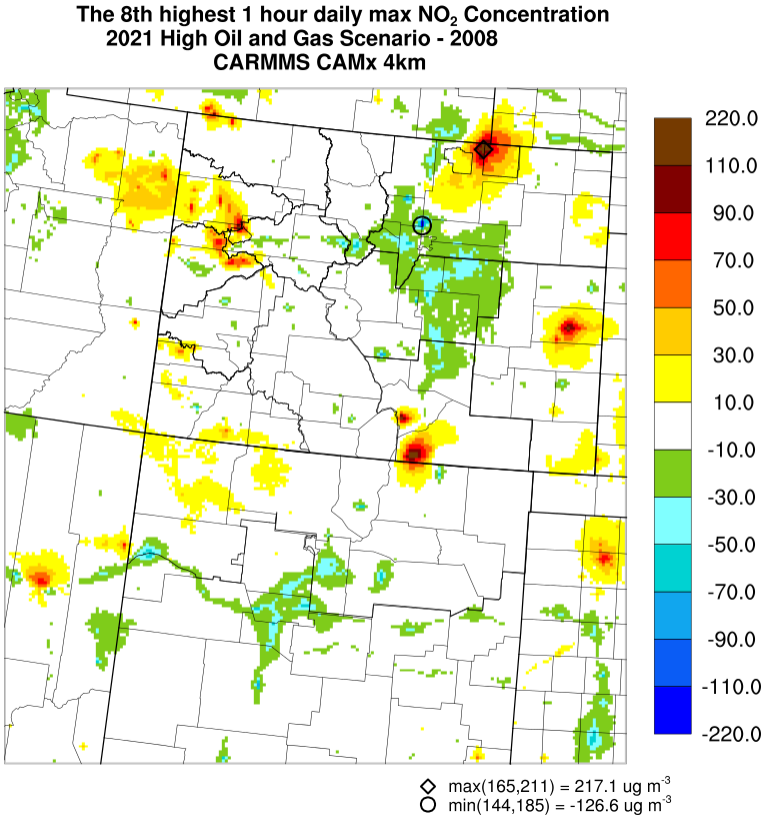
Figure 4.2-27 Eighth Highest 24-Hour $PM_{2.5}$ Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

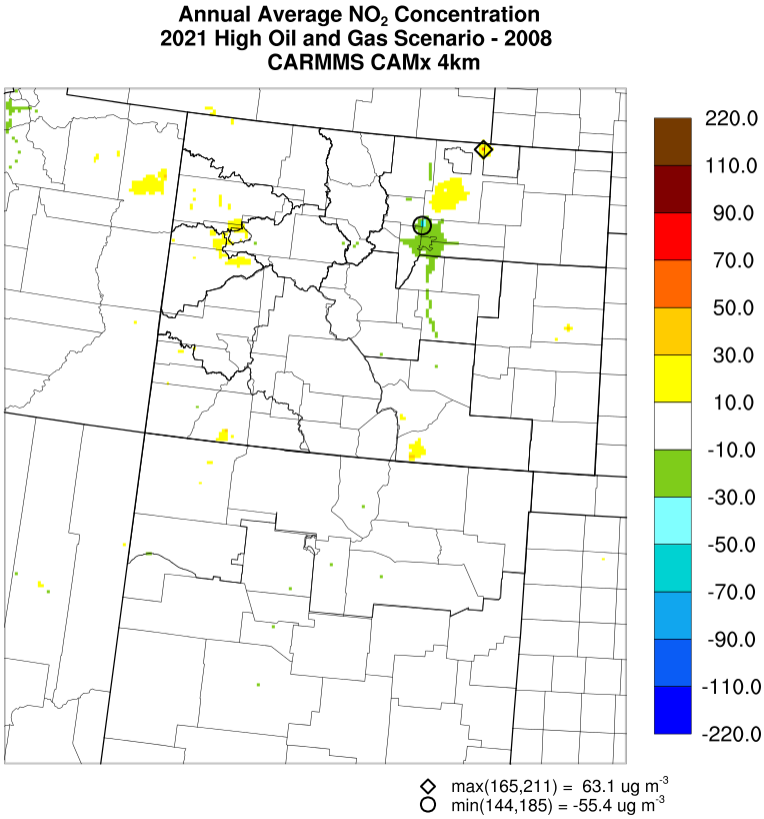
Figure 4.2-28 Annual Average $PM_{2.5}$ Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case

Figures 4.2-29 through **4.2-34** show predicted differences in the 8th highest one-hour daily maximum NO_2 concentration and in the annual average NO_2 concentration for the high, medium, and low development scenarios. Similar to $PM_{2.5}$ discussed above, the modeled differences are formed by subtracting the 2008 base case from each 2021 development scenario (e.g., high, medium, and low). The differences in 1-hour NO_2 show reductions in the Denver area, slight increases in the oil and gas development areas at Uinta, Piceance and D-J Basins, and isolated large increases in northern, eastern, and southern Colorado and eastern Arizona and New Mexico. The net increases in the eastern / southeastern Colorado areas appear to be primarily attributed to non-federal oil and gas emissions and other large non-oil and gas related facility emissions that were permitted by CDPHE and came online since base year 2008.



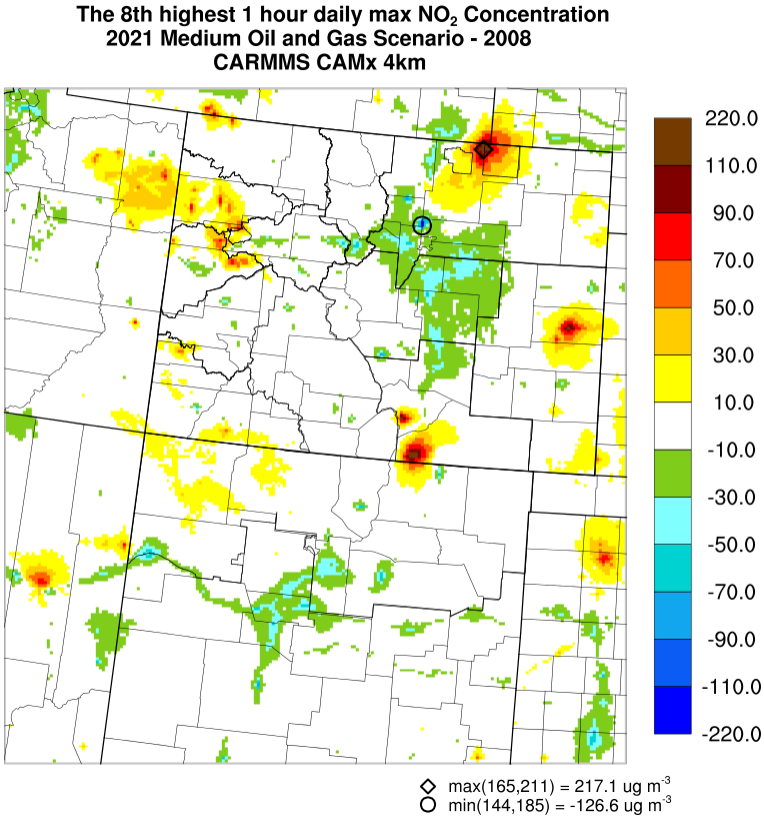
Source: CARMMS 2015.

Figure 4.2-29 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



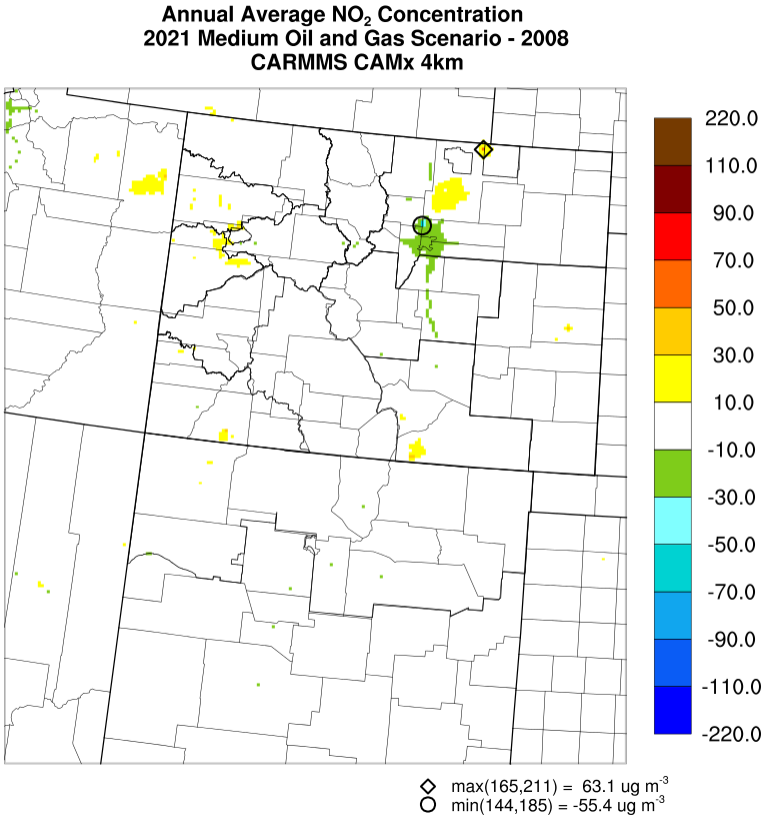
Source: CARMMS 2015.

Figure 4.2-30 Annual Average NO_2 Concentrations Differences between the 2021 High Development Scenario and the 2008 Base Case



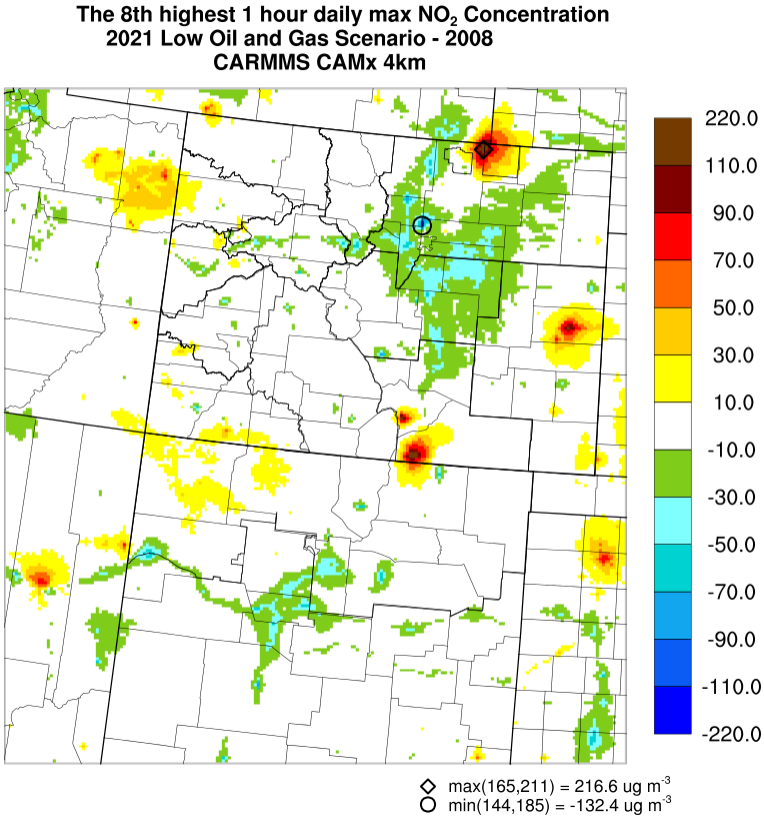
Source: CARMMS 2015.

Figure 4.2-31 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



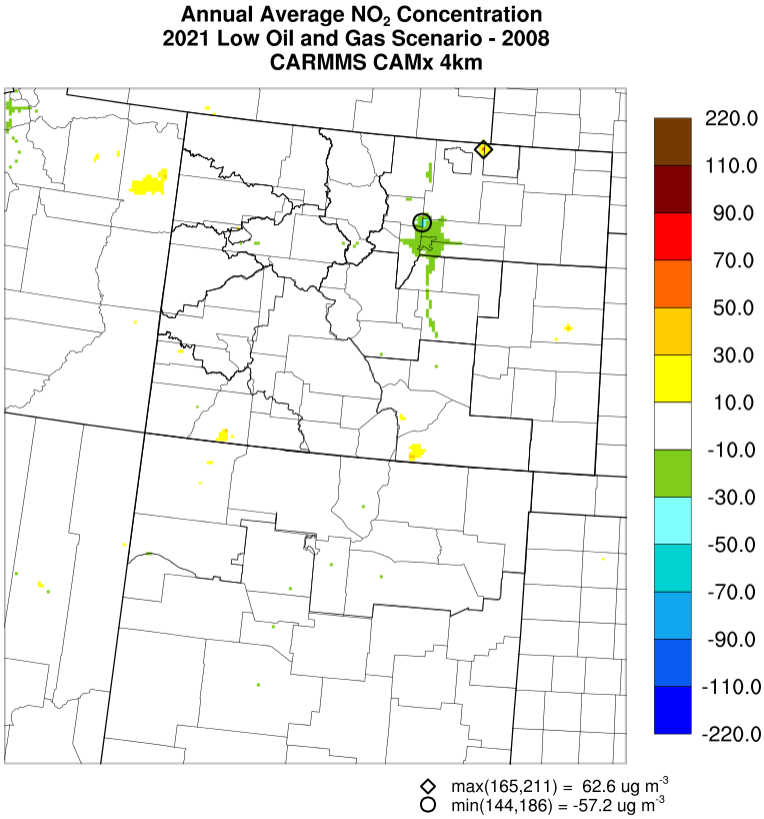
Source: CARMMS 2015.

Figure 4.2-32 Annual Average NO_2 Concentrations Differences between the 2021 Medium Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

Figure 4.2-33 Eighth Highest 1-Hour Daily Maximum NO_2 Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case



Source: CARMMS 2015.

Figure 4.2-34 Annual Average NO_2 Concentrations Differences between the 2021 Low Development Scenario and the 2008 Base Case

4.2.3 Project-Level Analysis and Near-Field Modeling Methodology

A project-specific near-field impact analysis was not performed because the scope of analysis for this EIS is regional and cumulative. BLM conducts project-specific near-field air quality impact analyses when reviewing oil and gas development proposals when detailed information for new oil and gas development timing and location and emissions source equipment and processes are known. BLM Colorado has recently developed an Instruction Memorandum (IM) to guide the adequacy, consistency, and efficiency of these analyses. The IM provides a standardized process and tools to enable field offices to assemble information necessary to analyze and disclose potential air resource impacts from oil and gas development activities. The IM requires that BLM Colorado staff follow a specific air quality analysis framework for proposed oil and gas development to determine the appropriate level of analysis and to track air pollutant emissions statewide. BLM follows a series of steps to conduct near-field air quality analyses. The first step is an evaluation of a proposed project's potential significance through development and evaluation of a project-level emission inventory. BLM field/district staff will use the BLM Colorado emissions inventory tool to complete the inventory. The tool also allows the BLM to consolidate results from projects across Colorado to provide additional analyses (e.g., a cumulative effects analysis). The second step is evaluation of the emission inventory, including assumptions and specifications for reasonableness and that the inventory is comprehensive to fully account for emissions-generating activities of the proposed action and reasonable alternatives. BLM then uses the project-level emission inventory to determine the appropriate method for conducting a near-field air quality impacts analysis.

The IM describes various analytical methods, including a dispersion screening tool, for considering near-field air-quality impacts and evaluating potential mitigation. The specific content of the IM and framework for conducting future project-specific air quality analyses can be found in a CARPP Appendix (http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality/carpp.html).

In general, individual projects will have temporary negative impacts on air quality that will mostly occur during the construction phase. Utilization of access roads, surface disturbances, and construction activities such as drilling, hydraulic fracturing, well completion, and equipment installation will all impact air quality by the generation of dust related to travel, transport, and general construction. Construction also will produce short-term emissions of criteria, hazardous, and GHG pollutants from vehicle and construction equipment exhausts. Once construction is complete, the daily activities at a site will be reduced to operational and maintenance checks that may be as frequent as a daily visit. Emissions will result from vehicle exhausts from the maintenance and process technician visits. Well pads can be expected to produce fugitive emissions of well gas, which contains mostly methane and a minor fraction of VOC. Fugitive emissions also may result from pressure-relief valves and working and breathing losses from any tanks located at the site, as well as any flanges, seals, valves, or other infrastructure connections used at the site. Liquid product load-out operations also will generate fugitive emissions of VOCs and vehicular emissions. Most operations will be subject to some portions of existing pollution control regulations and thus mitigate some or all of the expected fugitive emissions from flashing, load-outs, and leaks. Some control equipment, such as flares, will produce emissions of criteria, HAP, and GHG emissions via combustion.

4.2.3.1 Potential Near-field Impacts for the WRNF Alternatives

As previously described, a project-specific near-field impact analysis was not performed because the scope of analysis for this EIS is regional and cumulative, and project-specific near-field analyses will be completed when detailed information for future proposed actions is known. The limitations and restrictions for the various alternatives would ultimately dictate location and timing of future oil and gas development and associated emissions on the WRNF leases. **Figure 1-1** (Chapter 1.0) and **Table 2-7** (Chapter 2.0) show and describe the WRNF RFD zones (1-4) and potential number of wells for each Alternative and zone. Using this information, the following provides potential near-field air quality impacts that could occur for future oil and gas development under the Alternatives:

- Zone 1 leases are located in the western portion of the project area in the Colorado River Valley just east (approximately 5 miles) of De Beque and northwest (5 to 10 miles) of Molina and Collbran. For zone 1, the number of wells and well-pads are the same for Alternatives 1 and 2, and are the same for Alternatives 3 and 4. There are more projected new wells for Alternatives 3 and 4 than the other two Alternatives. This potentially means that there would be higher near-field air quality impacts for future oil and gas development under Alternatives 3 and 4 than for Alternatives 1 and 2. Future air quality impacts analyses would focus on impacts at existing ambient “sensitive” receptors (residences, businesses, schools, etc.) in the nearby communities. There are complex terrain features (mountain range and ridge) separating the communities of Molina and Collbran from Zone 1 leases and these terrain features would likely reduce the amount of air pollutant dispersion that would impact these communities. There would be no new federal oil and gas development under Alternative 5 for Zone 1 leases and therefore, no incremental air quality impact contributions for the absence of new oil and gas development.
- Zone 2 leases are located in the central portion of the project area and the Zone 2 leases closest to human populated areas (i.e., sensitive near-field receptors) are located approximately 5 miles southeast of Parachute, Colorado in the Colorado River Valley. Other Zone 2 leases are located further south in the project area and farther from sensitive receptors / populated communities. For the RFDS (Alternatives 1 through 4), this Zone could see the bulk of new oil and gas development for the WRNF 65 leases project area. As shown in **Table 2-7**, the number of new oil and gas wells and well-pads are the same for Alternatives 1 through 4 and much

lower for Alternative 5. For this reason, the level of potential air quality impacts would be similar for Alternatives 1 through 4. Depending on the level and location of future oil and gas development for the Zone 2 leases under Alternatives 1 through 4, a near-field modeling impacts analysis could be completed given the level of existing oil and gas in the Colorado River Valley; a refined future near-field impacts analysis would be much more probable should most of new oil and gas be developed on the Zone 2 northwest parcels in the Colorado River Valley.

- Zone 3 leases are located in the eastern portion of the project area and are located 5 to 10 miles west / southwest of Carbondale, Colorado. The level of potential new oil and gas development (well and well-pad counts) is similar for Alternatives 1 through 3 for Zone 3 and about one-third that level for Alternative 4. The level of oil and gas development for Alternative 5 for Zone 3 is almost negligible. There are complex terrain features (mountain range and ridge) separating Carbondale, Colorado from Zone 3 leases and these terrain features would likely reduce the amount of air pollutant dispersion that would impact this community. The level of future air quality impacts analysis greatly depends on where new oil and gas development occurs in Zone 3; a refined future near-field impacts analysis would be much more probable should most of new oil and gas be developed on the Zone 3 northern parcels closer to Carbondale, Colorado even though the complex terrain features suggest local unacceptable impacts would not extend over to this community.
- Zone 4 lease is located in the far north portion of the project area approximately 15 miles northwest of Meeker, Colorado. The level of potential new oil and gas development (well and well-pad counts) is similar for Alternatives 1 through 4 for Zone 4 and zero for Alternative 5. This Zone 4 parcel is located in remote area of WRNF and new oil and gas development on this lease would not likely result in significant poor air quality impacts to sensitive receptors (communities, etc.) given the level of potential new oil and gas development and location for this lease.

As described in Chapter 3.0, a recent air quality study estimated health risks attributable to exposure to air emissions from a natural gas development project in Garfield County, Colorado. The researchers found that residents living less than 0.5 mile from wells are at greater risk for health effects from natural gas development than are residents living at more than 0.5 mile from wells. No new oil and gas development on the WRNF 65 leases under any of the Alternatives would be located less than 4 miles from the populated communities described above.

Future air quality impacts analyses will give consideration to the type of well pad, its size, etc. that could have an effect on the amount of pollutants emitted. Generally larger pads with more wells would reduce the overall amount of dust (PM_{10} and $PM_{2.5}$) emissions but could increase and localize emissions of other pollutants near a well-pad because of increased drill and completion engines run times and production for a well-pad. Potential clustering of well development within the leases area could have higher localized (few kilometers) effects but lower overall impacts to the regional air quality. Clustered oil and gas development would reduce overall (total) pad and road construction related emissions and dust emissions associated with unpaved road traffic.

4.2.3.2 Protection / Mitigation Measures

As described in the CARPP, BLM tracks and assesses regional and cumulative impacts on an annual basis by comparing actual annual oil and gas development and emissions rates to modeled annual emissions rates and impacts. If actual oil and gas development and emissions are tracking at or exceeding those predicted in the CARMMS high scenario, or a future analysis, BLM may update its modeling to evaluate the potential for detrimental impacts on regional air quality for higher levels of oil and gas development, or may consider requiring the operators of future projects to use mitigation strategies contained such as those analyzed in the CARMMS medium emission scenario and described in the CARPP to reduce emissions. The current CARMMS regional analysis does not predict any

significant air quality impact contributions associated with new CRVFO (outside RPPA) federal oil and gas development, even under the high-development scenario, indicating that additional stipulations containing mitigation measures beyond the applicable state and federal requirements are not warranted under any of the alternatives. However, BLM may require particular mitigation measures as conditions of approval on a case-by-case basis, depending on the results of its project-specific analyses for future CRVFO oil and gas development.

It is anticipated that an operator would apply for either a Colorado APCD air permit for an oil and gas development site as a whole or cover individual equipment under one of Colorado's general permits for oil and gas operations. The state, as the regulatory authority for oil and gas actions, requires control of air pollutant emissions and has standards for compliance. The following highlights some of the State and Federal regulations / requirements that new CRVFO oil and gas development and operations would be subject to:

- Green completion for new hydraulically fractured natural gas wells (captures / controls VOCs, HAPs and methane)
- New pneumatic controllers must be at least low-bleed (captures / controls VOCs, HAPs and methane)
- New storage tanks with VOC emissions of 6 TPY or more have to reduce emissions by at least 95 percent (controls VOCs and HAPs)
- New well production facilities must be inspected for leaks 15-30 days after commencing operation and at least annually for facilities that emit more than 6 TPY of VOCs (potentially identifies losses of methane, and VOC and HAPs emissions).
- New glycol natural gas dehydrators with VOC emissions above 2 TPY have to control emissions by 95 percent (controls VOCs and HAPs).
- BMPs to minimize hydrocarbon emissions and the need for well venting during well maintenance and liquids unloading; records are required to be kept and made available for 2 years (reduces methane losses, and VOC and HAPs emissions)

Based on information presented in Chapter 2.0 (**Table 2-5**), the average number of wells per pad for new oil and gas development on the WRNF leases would be approximately 7 wells per pad. Using this information along with the CARMMS per well emissions rates for new CRVFO oil and gas wells, it is anticipated that new well facilities at full build-out will emit more than the emissions controls and monitoring requirement thresholds listed above. The actual emissions for new well-pad facilities will be realized when new oil and gas development occurs.

Previous BLM Colorado near-field air quality assessments for proposed oil and gas development activities in other parts of Colorado that focused on oil and gas related activities not routinely permitted / analyzed by the State suggested the need for the following air pollutant emissions controls measures; these equipment types and practices likely would be appropriate for future oil and gas projects in the CRVFO:

- Routine clean water application for at least 50% dust control for construction / development (i.e., drilling and completion) phase surface disturbance and unpaved road traffic;
- Tier-2 drilling / completion engine technology (or cleaner).

Any operator of future oil and gas development projects in the CRVFO must comply with applicable requirements, including conditions of approval designed to minimize air pollutant emissions and air quality impacts through good engineering, construction, and operating practices.

4.2.4 Greenhouse Gases and Climate Change

According to the U.S. Global Change Research Program, global warming is unequivocal, and the global warming that has occurred over the past 50 years is primarily human-caused. Standardized protocols designed to measure factors that may contribute to climate change, and to quantify climatic impacts, are presently unavailable. Moreover, specific levels of significance have not yet been established by regulatory agencies. Calculating the degree of impact any single emitter of GHGs may have on global climate, or on the changes to biotic and abiotic systems that accompany climate change is highly complex and predicting those impacts requires elaborate computer modeling programs and very large modeling platforms (i.e., computational power). Currently, no feasible and reliable tools exist to predict the impacts that GHG emissions from an individual project or collective GHG emissions from a planning area would have on the global, regional, or local climate. This analysis therefore compares total expected Planning Area GHG emissions with projected Colorado and U.S. GHG emissions. In addition, BLM discusses available information regarding expected changes to the global climatic system and the empirical evidence of climate change that has occurred to date.

The BLM acknowledges that climate change is happening and that it is affected by human activity. In this analysis, the BLM presents a qualitative discussion of the environmental effects of climate change and their socioeconomic consequences. Consistent with the revised CEQ draft guidance from December 2014, the BLM has used estimated GHG emissions associated with the proposed action as a reasonable proxy for the effects of climate change in this NEPA analysis. The BLM has placed those emissions in the context of relevant state emissions. The BLM also has acknowledged that climate science does not allow a precise connection between project-specific GHG emissions and specific environmental effects of climate change. This is consistent with the approach that federal courts have upheld when considering NEPA challenges to the following BLM federal coal leasing decisions: West Antelope II, 738 F.3d at 309; WildEarth Guardians v. BLM, Civ. Case No. 1:11-cv-1481 (RJL) (D.D.C. filed Mar. 31, 2014).

However, the BLM finds that including monetary estimates of the Social Cost of Carbon (SCC) in its NEPA analysis for this proposed action, which is not a rulemaking, would not be useful. There is no court case or existing guidance requiring the inclusion of SCC in the NEPA context. A federal Interagency Working Group on the Social Cost of Carbon (IWG), convened by the Office of Management and Budget, developed an SCC protocol for use in the context of federal agency rulemaking. The IWG issued estimates of the SCC, which reflect the monetary cost incurred by the emission of one additional metric ton of carbon dioxide (CO_2). Estimating SCC is challenging because it is intended to model effects at a global scale on the welfare of future generations caused by additional carbon emissions occurring in the present.

For this decision, there are several challenges involved in attempting to apply SCC to the analysis. For example:

- Given the global nature of climate change, estimating SCC of an individual decision requires assessing the impact of the project on the global market for the commodity in question.
- Monetizing only certain benefits or costs can lead to an unbalanced assessment. A regional economic impact analysis is often used to estimate impacts on economic activity, expressed as projected changes in employment, personal income, or economic output. Such estimates are not benefits or costs, and are not part of a benefit cost analysis.
- The SCC estimates developed by the IWG can only be applied to CO_2 emissions, not other GHG emissions such as methane. Again, monetizing only certain effects can lead to an unbalanced assessment.

BLM estimates that CRVFO outside the Roan Planning Area federal oil and gas related annual greenhouse gas emissions (including assumed end-use energy consumption CO_2 emissions) will contribute approximately 5,424,652 metric tons of CO_2(e) for the CARMMS low scenario;

7,776,632 metric tons of carbon dioxide equivalent CO_2(e) for the medium scenario; and 7,853,598 metric tons of carbon dioxide equivalent CO_2(e) for the high scenario to global GHG emissions in the maximum oil and gas production year (2021). However, the estimated CRVFO outside the Roan Planning Area oil and gas production rates estimated for purposes of CARMMS modeling have substantial uncertainty, as actual production rates could vary significantly in the future; thus the current prediction of the quantities of GHG emissions is similarly uncertain.

The Colorado Department of Public Health and Environment (CDPHE 2014) used the USEPA's State Inventory Tool to estimate future years GHG emissions inventories for Colorado. In year 2020, CDPHE estimates that Colorado's annual GHG emissions will be approximately 128,060,000 metric tons CO_2(e). The CARMMS high, medium and low emission scenarios' annual GHG emissions (excluding end-use energy consumption CO_2 emissions) for CRVFO (outside RPPA) year 2021 federal oil and gas production would represent about 0.91 percent, 0.85 percent and 0.71 percent of the state of Colorado's year 2020 annual GHG emissions, respectively. The estimated annual GHG emissions associated with the construction and operation of CRVFO (outside RPPA) federal wells for the three CARMMS scenarios thus are expected to be an extremely small component of the state's projected year 2021 GHG emission inventory.

For additional context, USEPA has recently modeled global climate change impacts from a source emitting 20 percent more GHGs than a 1,500MW coal-fired steam electric generating plant (approximately 14,132,586 metric tons per year of CO_2, 273.6 metric tons per year of nitrous oxide, and 136.8 metric tons per year of methane). The results ranged from a 0.00022 to 0.00035 degrees Celsius change in mean global temperature occurring approximately 50 years after the facility begins operation. The modeled changes are extremely small, and any downsizing of these results from the global scale would produce greater uncertainty in the predictions. USEPA concluded that even assuming such an increase in temperature could be downscaled to a particular location when considering impacts to endangered species habitat, it "would be too small to physically measure or detect" (Meyers 2008). Because the potential emissions (including assumed end-use energy consumption CO2 emissions) from future federal oil and gas development / operations in the CRVFO (outside RPPA) would be a fraction (approximately 60 percent) of the USEPA's modeled source and would be shorter in duration, BLM concludes that the projected annual CRVFO (outside RPPA) federal oil and gas related emissions related impacts on the climate would be minimal.

The following predictions were made by the USEPA for the Mountain West and Great Plains region with respect to climate change associated with cumulative (i.e., World-wide) GHG emissions:

- The region will experience warmer temperatures with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations.
- Earlier snowmelt means that peak stream flow will be earlier, weeks before the peak needs of ranchers, farmers, recreationists, and others. In late summer, rivers, lakes, and reservoirs will be drier.
- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Crop and livestock production patterns could shift northward; less soil moisture due to increased evaporation may increase irrigation needs.
- Drier conditions will reduce the range and health of ponderosa and lodge pole pine forests, and increase the susceptibility to fire.
- Grasslands and rangelands could expand into previously forested areas.
- Ecosystems will be stressed and wildlife such as the mountain line, black bear, long-nose sucker, marten, and bald eagle could be further stressed.

If these predictions are realized, as mounting evidence suggests is already occurring, there could be further impacts to resources within the region. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils. Warmer temperatures with decreased snowfall could have an impact on the ability of certain plants to sustain themselves within its current range. An increased length of the growing season in higher elevations could lead to a corresponding variation in vegetation and change in species composition. These types of changes would be most significant for special status plants that typically occupy a very specific ecological niche. Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened or endangered plants may be accelerated. Invasive plant species would be more likely to out-compete native species.

Increases in winter temperatures in the mountains could have impacts on traditional big game migration patterns. Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Warmer winters with less snow would impact the Canada lynx by removing a competitive advantage it has over other mountain predators. Earlier snowmelt also could impact cold water fish species that occupy streams throughout the planning area. Climate change could affect seasonal frequency of flooding and alteration of floodplains, which could alter riparian conditions. More frequent and severe droughts would have impacts on many wildlife species throughout the region as well as vegetative composition and availability of livestock forage in some areas. Climate change could increase the growing season within the region, however, which could result in more forage production provided there is sufficient precipitation. Drier conditions could have severe impacts on forests and woodlands. This could leave these forests and woodlands more susceptible to insect damage and at higher risk of catastrophic wildfires. Increased fire activity and intensity would increase greenhouse gas emissions.

4.3 Geology, Minerals, and Paleontology

4.3.1 Analysis Assumptions and Approach to Analysis

4.3.1.1 Analysis Area

The analysis area for geological, mineral, and paleontological resources consists of the individual lease tracts within the zones.

4.3.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for geology, minerals, and paleontological resources were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Scoping issues for geological, mineral, and paleontological resources include:

- The potential for landslides and seismic activity.
- How geology affects the potential for gas and liquid migration from drilling, hydraulic fracturing, injection of produced water, or other reasonably foreseeable activities.
- Potential for impacts to important paleontological resources from reasonably foreseeable development and how impacts can be mitigated.

4.3.1.3 Assumptions

There is a general assumption that operators would comply with federal and state laws, regulations, and permits when developing leases for oil and gas production. It also is assumed that site-specific environmental analysis would occur after an APD is submitted by the operator. At that time, when locations of facilities are known, the BLM may reasonably relocate facilities or add COAs to protect resource values and minimize potential hazards.

Assumptions to be used in the analysis of impacts to geologic hazards include the following:

- Active faults and seismic hazards may pose a risk to future infrastructure and facilities.
- There is no hazard model for induced seismicity due to oil and gas operations (Petersen et al. 2015a).
- Landslides and mass movements are a documented and present hazard not necessarily related to oil and gas development.

Assumptions to be used in the analysis of impacts to mineral resources include the following:

- Existing mineral resource recovery estimates are reasonable.
- Expected mineral resource recovery activity includes development of coalbed natural gas.
- Historically, oil exploration and production has been minimal in the analysis area, so the discussion focuses on gas development and production.
- Mineral development activities within the 65 leases in the analysis area would need to be compliant with the WRNF Land and Resource Management Plan (LRMP) (USFS 2002a).

- Production numbers are based on a 20-year well life and assume a negligible decline over the well life.

Analysis of impacts to paleontological resources is based on the following assumptions:

- Bedrock formations in the analysis area have medium to high potential (Potential Fossil Yield Classification [PFYC] ranks 3 and 5) to contain scientifically valuable fossils.
- Ground-disturbing activities pose a risk to fossil resources.
- There may a lesser risk of adverse impacts in areas with thick alluvium or grassland groundcover; higher risk areas are likely to occur on rock outcrops or bedrock with thin surficial cover.

4.3.1.4 Impact Indicators

Impact indicators for geological, mineral, and paleontological resources include the following:

- Extent of areas of geological instability and steep slopes covered by specific stipulations and general stipulation types required by each alternative.
- Number of proposed wells and projected production under each alternative.
- Potential for disturbance of areas associated with medium to high (PFYC ranks 3 and 5) fossil potential bedrock by alternative and by zone.

4.3.1.5 Methods of Analysis

For the analysis of geological hazards, the methodology includes the following:

- Review information and stipulations concerning landslides and slope instability.
- Compare each alternative in terms of the level of hazard protection and reduction of risk when resource-specific stipulations are implemented.
- Review information and natural and induced seismicity.

Methods of analysis for mineral resources include the following:

- Review information on mineral resource occurrence and the RFDS to determine the nature and extent of potential impacts and a relative comparison of development by alternative.
- Classify each alternative in terms of greater or lesser potential impact to the development of mineral resources.

Methods of analysis for paleontological resources include the following:

- Review stipulations and protection measures and compare the alternatives in terms of protection of the potential resource.
- Identify stipulations for other resources that may be protective of paleontological resources and a relative comparison of PFYC 3 and 5 areas that may be affected by development under each alternative.

4.3.2 Stipulations Providing Coverage of Geological, Mineral, and Paleontological Resources

4.3.2.1 Geological Hazards

Landslides

Given the widespread existence of landslides in the analysis area, lease stipulations limiting oil and gas activities on steep slopes or where there is an identified geologic hazard have been developed. The stipulations are meant to restrict or eliminate activities in areas of steep slopes to minimize slope failure, degradation of surface runoff, and impairment of soil productivity (USFS 2014a).

The stipulations for Alternatives 1 and 2 are derived from the WNRF and GMUGNF 1993 Oil and Gas Leasing Final EISs (USFS 1993a,b).

The stipulations for steep slopes for Alternatives 1 and 2 are divided into 2 categories: controlled surface use (CSU) for moderate slopes (40 to 60 percent) and NSO for slopes greater than 60 percent. There also are GMUGNF stipulations, a CSU for moderate slopes (40 to 60 percent) and a NSO for high hazard or slopes greater than 60 percent.

In addition to the stipulations for steep slopes, there are GMUGNF NSO and CSU stipulations for geologic hazards. The CSU stipulation is for moderate geologic hazards to “include stabilized earthflows, stabilized mudflows, stabilized landslides; slopes adjacent to failed slopes or active earthflows, mudflows or landslides and avalanche chutes; areas of rockfall; flash flood zones; and areas with potential mining related problems (i.e., subsidence, acid drainage)” (USFS 1993b). The NSO stipulation is for areas of high geologic hazard that “are characterized by active mudflows, active earthflows, active landslides and areas prone to avalanche” (USFS 1993b).

The stipulations to reduce risks from landslides and other geological hazards for Alternatives 3 and 4 are more restrictive than for Alternatives 1 and 2. Under Alternatives 3 and 4, the following stipulations would provide coverage to areas with geological hazards or steep slopes:

- NSO
  - High Geologic Hazard, GMUGNF
  - Severe or High Landscape Stability Hazards
  - Slope Greater than 50 percent
- CSU
  - 40 to 60 percent Slope, GMUGNF
  - Moderate Geologic Hazard, GMUGNF
  - Moderately High Landscape Stability Hazards
  - Slopes 30 to 50 percent

The steep slope stipulations were developed for the purpose of leasing availability analysis and may not accurately represent site conditions which only site-specific soil and geological surveys can determine. The stipulations developed to address landscape stability hazards were developed to avoid areas with site stability risks to prevent mass movements and slope failure like landslides (USFS 2014a, Appendix A).

Seismicity

None of the alternatives have stipulations or other protection measure regarding natural or induced seismicity.

4.3.2.2 Mineral Resources

There are no stipulations designed to protect oil and gas operations, but the stipulations would control the locations of the facilities. The standard lease terms, state and federal rules, BMPs, and Forest management decisions regulate all phases of oil and gas operations from the location of wells and facilities, drilling and well construction and completion, and measurement of product.

4.3.2.3 Paleontological Resources

There are no specific stipulations for the protection of fossil resources under Alternatives 1 and 2. The WNRF 1993 Oil and Gas Leasing Final EIS (USFS 1993a) includes protection of paleontological resources through a NSO stipulation designed to protect historical, archaeological, and paleontological resources. However, the stipulation has not been used to protect paleontological resources in the analysis area. Alternatives 3 and 4 provide a CSU stipulation for the protection of paleontological resources. The stipulation is consistent with the 2014 Oil and Gas Leasing Final EIS (USFS 2014a) and calls for the inventory of paleontological resources by a qualified paleontologist prior to ground disturbing activities. As described in the WRNF Oil and Gas Leasing Final EIS (USFS 2014a), the old NSO stipulation may have been too restrictive and with appropriate mitigation, the resource can be properly conserved through other means such as COAs. There is no need for protective stipulations conditions under Alternative 5 because all leases would be cancelled.

4.3.3 Impacts Common to All Alternatives

4.3.3.1 Geological Hazards

Landslides

The major geologic hazard in the analysis area is the potential for landslides and unstable slopes and hazards that can be magnified by surface-disturbing activities. Not only do natural conditions contribute to the hazard, but grading and excavation provide for conditions of instability and may contribute to diversion of runoff which also may increase the hazard. Landslides can damage roads, pipelines, and production facilities, contribute to spills of hazardous materials, and potentially cause the loss of life as in the West Salt Creek slide.

Caves and Karsts

As noted in Chapter 3.0, there are no caves in the analysis area and the formations that are susceptible to karst are too deep to be of concern for the formation of karst hazards.

Natural Seismicity

Seismic hazard increases from west to east from Zone 1 to Zone 3 with the highest potential accelerations in the Zone 3 leases in the vicinity of the active faults identified in Section 3.3.3.4. Horizontal ground acceleration may cause severe damage to poorly built masonry structures while engineered and well-built structures would have slight to moderate damage (Bolt 1993). Design and construction of natural gas production facilities and infrastructure in the vicinity of the active fault zone should be in accordance with seismic building standards.

Induced Seismicity

The induced seismicity that would be of concern for this analysis would involve underground injection of waste water and hydraulic fracturing. Currently the U.S. Geological Survey (USGS) is conducting a hazards assessment to determine the magnitude of the induced seismicity and how to address the risk where injection of waste water from oil and gas operations is suspected as the cause of increasingly frequent earthquakes in the Mid-continent and other selected areas of the United States. Although Rangely Field in the northern Piceance Basin has been identified in the past as a location of induced seismicity due to injection of fluid for secondary oil recovery, there has been little or sporadic seismic

activity since the USGS conducted testing in the 1970s (Petersen et al. 2015b). No other assessment areas were identified in the Piceance Basin. Other assessment areas in Colorado are located in the Raton Basin, the Denver-Julesburg Basin, and the Paradox Basin. Since no other hazard assessment areas have been identified, there is probably a low risk of induced seismicity in the analysis area. As the USGS continues to research the problem, it may be possible to better define the hazard within a given local area where oil and gas activities are taking place.

Regarding induced seismicity and hydraulic fracturing, the National Research Council maintains that injection of waste water poses more potential concern while hydraulic fracturing as presently conducted for production of hydrocarbons from shale poses only a slight risk (Dillon and Clarke 2015).

Although hydraulic fracturing is a source of induced seismicity in the strict definition of the term, the magnitude of induced seismicity due to hydraulic fracturing is quite small and is referred to as “micro-seismicity.” Oil and gas operators and oilfield hydraulic fracturing service companies use micro-seismicity to measure and monitor the direction and growth of fractures in order to assess the efficiency and efficacy of fracturing operations. Thousands of measurements from various shale gas basins indicated that the magnitudes are typically less than -2.5 and average -3.0 (Warpinski et al. 2012). Magnitudes of 1.0 or less are not felt by people so typical induced seismicity generated by hydraulic fracturing would not be perceived (Maxwell 2013).

4.3.3.2 Mineral Resources

With the exception of Alternative 4 (25 leases to be canceled) Alternative 5, maintaining currently held by production leases and allowing oil and gas activities on other issued undeveloped leases, would allow for the development of oil and gas resources and the associated beneficial economic and national security benefits.

4.3.3.3 Paleontological Resources

Ground-disturbing activities have the potential to cause the loss or damage to significant paleontological resources. Other effects to paleontological resources could occur by allowing greater access to fossil-bearing formations and localities.

4.3.3.4 Impacts Identified in the WRNF Final EIS

The WRNF Final EIS (USFS 2014a) goes through a lengthy review of the issues and evidence related to water usage from all stages of gas well drilling and completion, as well as induced seismicity of hydraulic fracturing (USFS 2014a, p. 143 – 150). The Final EIS states that the leasing of available lands for mineral extraction does not involve direct effects on geology and minerals, but that an indirect effect of leasing is that development would result in the eventual irretrievable extraction of fluid minerals (USFS 2014a, p.151). For more detail on the constituents commonly used in hydraulic fracturing, see Table 37 on page 148 of the WRNF Final EIS (USFS 2014a). The WRNF Final EIS uses the same RFDS (USFS 2010a) that is used in this EIS with similar basic assumptions for production. It concludes that alternatives with increased NSO stipulations and areas designated as closed to leasing would reduce the total production from federal minerals within the Forest (USFS 2014a, p. 152).

The Final EIS concludes that future development of oi land gas is not expected to affect development of locatable and other leasable minerals and would not affect landforms due to the small scale of development projected for the WRNF (USFS 2014a, p. 153).

The WRNF Final EIS recognizes that surface occupancy for fluid mineral development is possible in areas bearing important paleontological resources, but that pre-development site assessments and mitigation measures implemented prior to ground disturbance would conserve significant paleontological resources effectively. For those areas with PFYC 3 or higher, surveys would be required under the CSU

stipulation proposed in the WRNF Final EIS (USFS 2014a, p. 177) and carried forward for evaluation in Alternatives 3 and 4 of this EIS. Should important resources be found, the Final EIS recommends moving the location of disturbance, mitigating the site prior to construction, and monitoring or salvage efforts (USFS 2014a, p. 177). The WRNF Final EIS acknowledges that ground-disturbing activities associated with fluid mineral development may adversely affect paleontological resources, but also may make new discoveries that can expand knowledge but also may expose the fossils to recreational collectors (USFS 2014a, p. 179).

4.3.4 Impacts by Alternative

The following provides a comparison that the different alternatives would have on geological, mineral, and paleontological resources. The major issues of concern regard geologic hazards, natural gas production, and potential loss of scientifically significant or important fossils. The use of the word "significant" with regard to paleontological resources does not refer to the degree of impact, but to the potential value of the resources.

4.3.4.1 Alternative 1 (No Action Alternative)

<u>Geological Hazards</u>

Stipulation Coverage

Table 4.3-1 compares geologic and slope hazards stipulations to coverage provided by all stipulations. It should be noted that the slope stability stipulations are not directly comparable over all the alternatives as described above. Also, the area covered by a steep slope stipulation is limited by its very definition and development is limited by the physical attributes of the terrain. Management through stipulations is based on limiting surface disturbance on 40 to 60 percent slopes and slopes greater than 60 percent and in areas where there are identified geologic hazards. For 40 to 60 percent slopes, the CSU stipulation would be implemented to reduce the risk of landslides, protect infrastructure, and prevent impairment to soil and water resources by moving infrastructure away from steep areas (USFS 2014a, 1993a). For slopes greater than 60 percent, a NSO stipulation would be implemented to minimize susceptibility to geological hazards if CSU or standard lease terms are not adequate to provide the protection needed.

For all categories of slope and geologic hazard stipulations, protection from the hazards would rely to a great degree on implementation of CSU and NSO stipulations for other resources.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Table 4.3-1 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 1 to All Stipulations

Stipulation	Zone	Zone (acres)	Resource-specific Stipulations (% of Zone)	All CSU (% of Zone)	All NSO (% of Zone)
NSO High Geological Hazards	1	10,114	—	—	100
	2	24,930	0.3	5	39
	3	42,767	-	8	8
	4	2,562	—	—	3
NSO Steep Slopes (greater than 60 percent)	1	10,114	57	—	100
	2	24,938	34	5	39
	3	42,767	6	8	8
	4	2,562	3	—	3
CSU Moderate Geologic Hazards	1	10,114	—	—	100
	2	24,938	2	5	39
	3	42,767	0.1	8	8
	4	2,562	—	—	3
CSU Moderate Slopes (40 to 60 percent)	1	10,114	—	—	100
	2	24,938	0.1	5	39
	3	42,767	—	8	39
	4	2,562	—	—	3

Note: Stipulation boundaries overlap so cannot be totaled.

Mineral Resources

An estimated total of 593 billion cubic feet (Bcf) of gas would be produced, a reduction of 28 Bcf in the estimated amount of natural gas that could be recovered if there were no stipulations and activities are conducted under standard lease terms through implementation of the unconstrained RFDS. Liquid hydrocarbon (oil) production is not considered in the analysis because it comprises a small fraction of the commodity produced in the analysis area. Liquid/gas ratio range from 10 barrels per million cubic feet (MMcf) of gas at Mamm Creek Field to 1 barrel per MMcf or less at Parachute and Grand Valley Fields (Cumella et al. 2014).

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

In the absence of any stipulations developed specifically for paleontological resources, **Table 4.3-2** indicates how implementation of all other stipulations could provide coverage of paleontological resources under Alternative 1. In Zone 1, the total NSO acres covers most of the zone, which consists of PFYC 3 and 5 classifications, and would possibly provide the most complete coverage assuming the stipulations are implemented. The stipulations in the other zones would offer lesser degrees of coverage. However, the PFYC ranking itself would provide some measure of protection in all areas because the ranking indicates the level of management that is required to protect the resource (USFS 1999) in compliance with Forest Service management plans.

Table 4.3-2 Potential Fossil Yield Class and All Stipulations Under Alternative 1

Zone	Zone (acres)	Stipulation	% of PFYC 3	% of PFYC 5
			All Stipulations	All Stipulations
1	10,114	NSO	100	100
2	24,938	NSO	79	23
		CSU	3	6
3	42,767	NSO	1	9
		CSU	0	9
4	2,562	NSO	3	0

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.2 Alternative 2

Geological Hazards

Stipulation Coverage

Under Alternative 2, the stipulations are similar to Alternative 1 in that there are none designed specifically to cover steep slopes in Zones 1, 3, and 4 while Zone 2 has a small amount of acreage under the moderate slope CSU stipulation (see **Table 4.3-1**). Compared to Alternative 1, Zone 3 has more acreage with geological hazards and steep slopes assigned to the NSO stipulation on greater than 60 percent slopes and more overall acreage of NSO and CSU for other resources. The increased NSO coverage of lands with geological hazards or steep slopes is entirely within Zone 3, with 7 percent covered by the NSO on slopes over 60 percent, 10 percent covered by all CSU stipulations, and 19 percent covered by all NSO stipulations. The coverage of lands with geological hazards or steep slopes within Zones 1, 2, and 4 would be the same as described for Alternative 1 in **Table 4.3-1**.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

The gas production projected under Alternative 2 would be the same as described for Alternative 1.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

Similar to Alternative 1, in the absence of any stipulations developed specifically for paleontological resources, **Table 4.3-3** indicates how implementation of all other stipulations could provide coverage of important paleontological resources under Alternative 2. In Zone 1, the total NSO acres covers most of the zone, which consists of PFYC 3 and 5 classifications, and would possibly provide the most complete coverage assuming the stipulations are implemented. The stipulations in the other zones would offer lesser degrees of coverage. However, the PFYC ranking itself would provide some measure of protection in all areas because the ranking indicates the level of management that is required to protect the resource (USFS 1999) in compliance with Forest Service management plans.

Table 4.3-3 Potential Fossil Yield Class and All Stipulations Under Alternative 2

Zone	Zone (acres)	Stipulation	% of PFYC 3 All Stipulations	% of PFYC 5 All Stipulations
1	10,114	NSO	100	100
2	24,938	NSO	79	23
		CSU	3	6
3	42,767	NSO	1	10
		CSU	0	11
4	2,562	NSO	3	0

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.3 Alternative 3

Geological Hazards

Stipulation Coverage

As shown on **Table 4.3-4**, the coverage of both NSO and CSU stipulations designed to minimize adverse impacts to steep slopes and areas with landscape stability or geologic hazards is much less than NSO and CSU percentage of all the stipulations. It is possible that other stipulations (especially NSO) could provide coverage to protect sensitive locations from geologic hazards and development on steep slopes should they be implemented.

Table 4.3-4 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 3 to All Stipulations

Stipulation	Zone	% of Zone with Stipulation
NSO Steep Slopes (greater than 50 percent)	1	22
	2	7
	3	2
	4	2
NSO Severe or High Landscape Stability Hazards	1	23
	2	7
	3	2
	4	1
NSO High Geologic Hazard, GMUGNF	1	0
	2	0.3
	3	0
	4	0
CSU 40 – 60 percent Slope, GMUGNF	1	0.3
	2	0
	3	0
	4	0
CSU Moderate Slopes (30 to 50 percent)	1	29
	2	34
	3	20
	4	6
CSU Moderately High Landscape Stability Hazards	1	0.6
	2	3
	3	0.3
	4	0.3
CSU Moderate Geologic Hazard, GMUGNF	1	0
	2	2
	3	0.1
	4	0

Table 4.3-4 Comparison of Geologic Hazard and Steep Slope Stipulations under Alternative 3 to All Stipulations

Stipulation	Zone	% of Zone with Stipulation
All NSO	1	100
	2	100
	3	100
	4	100
All CSU	1	100
	2	87
	3	86
	4	100

Note: Stipulation boundaries overlap so cannot be totaled.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

Under Alternative 3, an estimated total of 590 Bcf of gas would be produced, a reduction of 31 Bcf in the estimated amount of natural gas that could be recovered if there were no constraints and activities would be conducted under standard lease terms, as projected in the RFDS.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of constraining the recovery of natural gas resources compared to the RFDS projections.

Paleontological Resources

Stipulation Coverage

The CSU stipulation designed to protect paleontological resources under Alternative 3 would effectively cover most of the high-value paleontological resources in all zones, as shown on **Table 4.3-5**. The CSU stipulation for paleontological resources combined with compliance of federal laws and Forest Service management would provide reasonable protection without having to rely on stipulations designed to minimize the impacts of other resources.

Table 4.3-5 Coverage by CSU Paleontological Resources Stipulation under Alternative 3

Zone	Zone (acres)	% of PFYC 3	% of PFYC 5	% of PFYC 3	% of PFYC 5	% of PFYC 3	% of PFYC 5
		Resource-specific Stipulation		All CSU		All NSO	
1	10,114	100	90	100	100	100	100
2	24,938	97	95	100	100	90	85
3	42,767	100	100	100	100	4	31
4	2,562	100	100	100	100	92	94

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.4 Alternative 4 (Proposed Action)

Geological Hazards

Stipulation Coverage

The coverage of resource-specific stipulations is similar to that shown in **Table 4-3-6** with the exception of Zone 3. In Zone 3, approximately 67 percent of the zone would be closed to leasing, so no development would occur in this area and no stipulations would be required to limit surface disturbance on steep slopes and areas with geologic hazards.

Impacts from Projected Future Oil and Gas Development

The CSU and NSO stipulations for slopes and geological hazards provide only a limited degree of coverage to unstable areas or restriction of natural gas development to lower risk areas. Stipulations for other resources may provide additional reduction of adverse impacts from geological hazards, assuming the hazards are present in areas that overlap those other stipulations.

Mineral Resources

Under Alternative 4, an estimated total of 550 Bcf of gas would be produced, a reduction of 31 Bcf in the estimated amount of natural gas that could be recovered if there were no constraints and activities were conducted under standard lease terms, as projected in the RFDS.

Stipulation Coverage

Stipulations are generally implemented to protect other resources from potential impacts that gas development may have on other resources.

Impacts from Projected Future Oil and Gas Development

The implementation of stipulations for the protection of other resources would have the effect of limiting the recovery of natural gas resources. Under Alternative 4, this limitation on future gas development would be greater because all or part of 25 existing leases would be canceled. Where a portion of the lease would be designated as closed to leasing, the lease boundaries would be contracted to the remaining area outside of the boundaries identified as closed to future leasing in the WRNF 2014 Draft Record of Decision (ROD). In some cases, where the lease area would be reduced to a few acres, it may not be feasible for the lessee to keep the lease. However, that decision would be left up to each lessee if this alternative were selected.

Paleontological Resources

Stipulation Coverage

Similar to Alternative 3, the CSU stipulation for paleontological resources for Alternative 4 in Zones 1, 2, and 4 effectively covers the lease areas, as shown on **Table 4.3-5**. In Zone 3, 95 percent of the PYFC 3 area and 64 percent of the PYFC 5 area would be located in the leases to be cancelled because they would be designated as closed to leasing. While this would reduce the extent of NSO and CSU stipulations, this designation would not allow any future oil and gas development, and therefore would provide greater protection from disturbance for important fossil formations.

Impacts from Projected Future Oil and Gas Development

Impacts to paleontological resources cannot be quantified because without site-specific surveys, it cannot be predicted exactly where valuable resources would be other than through the PFYC ratings. Impacts would be reduced by use of the management options provided by the PFYC system and implementation of site-specific environmental reviews at the APD stage that would occur before permits are issued and any ground-disturbing activities commence.

4.3.4.5 Alternative 5

Geological Hazards

Under Alternative 5, all leases would be cancelled, but reclamation would be conducted in compliance with Forest Service policy and guidance in a manner that would not increase the hazards on steep and unstable slopes or leave conditions that would lead to long-term instability or hazard.

Mineral Resources

As of February 2015, active producing wells on the subject leases had cumulatively produced approximately 27.6 Bcf of gas, and 1.2 million barrels of water (COGCC 2015c). The current 75 active gas wells have an estimated ultimate recovery of 1.2 Bcf of gas per well. Cancellation of the leases and plugging of the wells would result in a resource loss of an estimated 45 Bcf of gas. In that event, no taxes or royalties would accrue to federal and state agencies and also losses jobs involved with the production of the wells. Economic impacts are described in detail in Section 4.17.

Paleontological Resources

Under Alternative 5, all leases would be cancelled, but reclamation and ground-disturbing activities would take place over the short term. Although much of the reclamation activities would take place on previously disturbed ground, there is always the possibility for activities to infringe on undisturbed areas. Therefore, protection measures for fossil resources would be necessary until reclamation activities are complete.

4.3.4.6 Impact Summary

Geologic Hazards

Alternatives 1 and 2 provide similar coverage of areas with steep slopes by stipulations that would minimize geological hazards, with slightly more coverage under Alternative 2 due to some additional acreage of NSO and CSU stipulations. Under Alternatives 3 and 4, coverage of areas with geological hazards would be similar, with more coverage in the Zone 3 leases that would be close under Alternative 4.

Mineral Resources

Table 4.3-6 displays the effect of stipulations on gas production. The gas production in the unconstrained category is that production that would be estimated to occur if gas drilling and production took place under standard lease terms, as projected by the unconstrained RFDS. Alternatives 1 and 2 would result in a reduction of 28 MMcf of gas production compared to the RFDS, and Alternatives 3 and 4 would reduce production to 590 and 550 Bcf of gas, respectively, a reduction of 31 and 71 Bcf compared to the unconstrained RFDS.

Table 4.3-6 Gas Production by Alternative (all zones)

Commodity	Unit	RFDS (Unconstrained)	Alternatives 1 and 2	Alternative 3	Alternative 4	Alternative 5
Gas	Bcf	621	593	590	550	0

Paleontological Resources

The reliance on the PFYC system management objectives and stipulations of other resources under Alternatives 1 and 2 would not provide as great a degree of coverage as the CSU stipulation for paleontological resources under Alternatives 3 and 4.

There would be no stipulations for the protection of fossil resources for Alternative 5 other than the Forest Service management guidance under the PFYC system.

4.3.5 Cumulative Impacts

4.3.5.1 Cumulative Impacts Analysis Area

The CIAA for geology, minerals, and paleontological resources is the 65 existing leases.

4.3.5.2 Past, Present and Reasonably Foreseeable Future Actions

The past and present actions described in Section 4.1, in particular those involved in surface-disturbing activities and fluid mineral development, have contributed to the current conditions described in Section 3.3. There are 454 acres of identified surface disturbance within the CIAA (see Section 4.1 and **Appendix B**.

There are no additional oil and gas developments or other surface disturbing RFFAs proposed within the CIAA. There are approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments within the CIAA. This is 7 percent of the CIAA.

4.3.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Geologic Hazards

The incremental effects of all of the alternatives are difficult to quantify because of varying site conditions and unknown construction locations. However, given implementation of stipulations that would ensure appropriate design or avoidance of unstable areas in compliance with Forest Service guidance, geologic hazards are not expected to contribute to cumulative impacts in the CIAA area.

Mineral Resources

In the unconstrained production case, the amount of estimated gas production represents a small, but not unimportant increment of the total mean undiscovered oil and gas resource of 21 trillion cubic feet of gas in the Piceance Basin. Since 1999, Mamm Creek alone has produced about 1.4 trillion cubic feet of gas (COGCC 2015c). Given that context, the production differential between 0.07 trillion cubic feet of gas (the difference between the unconstrained RFD and Alternative 4), does not represent an unreasonable reduction in the overall resource base, but could represent a tangible loss in terms of revenue in production royalties, property taxes and jobs. If all leases were cancelled as in Alternative 5, it could represent an adverse impact in terms of lost revenue, especially for a smaller well operator.

Paleontological Resources

Cumulative impacts to paleontological resources would result from surface disturbance related to industrial developments (mainly oil and gas) including unauthorized collection, and natural or accelerated erosion processes in the CIAA. With the implementation of the appropriate stipulations, the projected oil and gas development resulting from leasing, when added to past and present actions and RFFAs, would not be expected to significantly contribute to adverse cumulative impacts to paleontological resources in the CIAA. There is little difference to paleontological resources between the cumulative impacts of the five alternatives.

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4.4 Soils

4.4.1 Analysis Assumptions and Approach to Analysis

4.4.1.1 Analysis Area

The analysis area for soil resources and the CIAA consists of the 65 leases within the 4 zones.

4.4.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for soils were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- Surface disturbance on erodible soils could result in increased sedimentation that may degrade water quality.
- Development could exacerbate unstable soil conditions in the Thompson Creek drainage area due to the soft sedimentary rocks and erodible Cretaceous shales.
- Development has already destabilized slopes and altered channels which contribute to excessive sedimentation threatening aquatic species.
- Dust storms have increased in frequency and strength associated with development by the oil and gas industry in Colorado and Utah.
- Surface disturbance results in dust deposition on the snow.

4.4.1.3 Assumptions

Analysis was based on the following assumptions:

- Any surface disturbance has the potential to degrade soil quality and productivity because it disrupts nutrient cycling, can affect soil permeability, and exposes the bare soil to the erosive forces of wind and water until revegetation or other ground cover is established.
- Bare soil (without vegetation or other surface cover) with a surface layer that has been altered from its natural condition is more susceptible to accelerated wind and water erosion than undisturbed soil. Erosion from disturbed areas would be minimal once vegetation is reestablished. Successful establishment of vegetation generally takes a minimum of 3 to 5 years, depending on soil and precipitation, and requires monitoring during this time.

4.4.1.4 Impact Indicators Used for Analysis

Soil resource impact indicators are listed below:

- Acres of initial surface disturbance and long-term disturbance by alternative and by zone;
- Acres of soils covered/not covered by NSO and CSU stipulations by alternative and by zone; and
- Acres of erodible soils covered/not covered by NSO and CSU stipulations, by alternative and by zone.

The risk of impacts to aquatic species related to sedimentation is discussed in Section 4.8, Aquatic Resources. Fugitive dust emissions are assessed in Section 4.2, Air Quality.

4.4.2 Stipulations Providing Coverage to Soils

Leased lands with NSO stipulations preclude infrastructure for oil and gas production such as well pads, buildings, tanks, and drilling equipment. NSO stipulations result in no ground disturbance for oil and gas activities within that lease. Soil resource-related NSO stipulations occur on steep slopes (greater than 50 to 60 percent), areas with severe landscape stability hazards, and areas of high geologic hazard within the GMUGNF.

CSU stipulations are designed to help minimize impacts to resources by increasing the flexibility to place the oil and gas associated facilities in locations that would have less impact. Soil resource-related CSU stipulations include areas of highly erodible soils, slopes of 40 to 60 percent within the GMUGNF, slopes of 30 to 50 percent within the WRNF, areas with moderately high landscape stability hazards, and areas with moderate geologic hazards within the GMUGNF.

Table 4.4-1 identifies the NSO and CSU stipulations under Alternatives 1 through 4 that would minimize potential adverse impacts of oil and gas development on soil resources. A full description of these stipulations is included in Appendix A of the 2014 WRNF Final EIS for Oil and Gas Leasing (USFS 2014a). Alternative 5 would cancel all leases and result in plugging, abandoning, and reclaiming disturbed areas; therefore, no stipulations would be applied under this alternative.

Table 4.4-1 NSO and CSU Stipulations That Minimize Impacts to Soil Resources

Stipulation	Alts 1 and 2[1]	Alts 3 and 4[1]
NSO		
Slopes Greater than 60%	X	
Slopes over 50%		X
Severe or High Landscape Stability Hazards		X
Slopes Greater than 60%—GMUGNF[2]	X	X
High Geologic Hazard—GMUGNF[2]	X	X
CSU		
Slopes 40 to 60%—GMUGNF[2]	X	X
Slopes 30 to 50%		X
Highly Erodible Soils		X
Moderate Geologic Hazard—GMUGNF[2]	X	X
Moderately High Landscape Stability Hazards		X

[1] Alternatives 1 and 2 have the same stipulations related to soils. Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

[2] The lease area includes a small portion of the GMUGNF, on which GMUGNF-specific stipulations would apply. These stipulations cover about 1 percent of the analysis area. No changes to these stipulations are being considered in the Proposed Action and alternatives; therefore, they are not reported in the subsequent tables (but are noted in table footnotes).

There are other NSO and CSU stipulations that are not designed to specifically protect soil resources but might minimize adverse impacts to soils if they were implemented. However, these stipulations are not designed for protection of soils and may not be implemented if, for instance, the resource does not exist within the boundaries of a lease based on field surveys. An operator can get an exception, modification, or waiver if the conditions on the ground, determined through subsequent environmental analysis, demonstrate that the reason for establishment of a stipulation no longer is pertinent.

4.4.3 Impacts Common to All Alternatives

Reasonably foreseeable development of oil and gas leases would result in surface disturbance to soil resources outside of the areas with NSO stipulations. NSO and CSU stipulations would help to minimize impacts to soils in steep and hazardous terrain that are susceptible to water erosion. However, soils with other limitations such as wind erodible, droughty, compaction prone, or soils with chemical constraints that may limit reclamation success (e.g., very low or high pH, soils that are saline or sodic, and soils high in heavy metals) may be disturbed by development, unless covered by other stipulations.

There would be adverse impacts to the existing quality of native soils from surface disturbance resulting from oil and gas development. Topsoil excavation, transport, storage, and redistribution would modify existing soil structure, generating changes to soils such as aeration and permeability that are likely to adversely affect soil productivity. The mixing of textural zones may create adverse chemical and physical impacts to soil quality and the existing microbial populations would likely decrease during stockpiling and storage. Due to these probable effects, the initial soil quality of reconstructed seedbeds and root zones would be less than that of the existing soil resources.

Impacts to soil resources during construction and operation activities may include:

- Soil compaction from construction equipment and operations traffic;
- Accelerated runoff and erosion due to an increase in bulk density and loss of vegetative cover;
- An increase in erosion and sedimentation while soils are unstable;
- Possible mixing of topsoil and subsoil from construction of roads and pads;
- Alterations of soil structure; and
- Changes to long-term soil productivity and soil quality from soil mixing and from long-term conversion of productive soils to well pads and roads resulting in a decline in nutrient cycling.

Impacts to soil resources during reclamation activities may include:

- Possible soil mixing during decompaction of soils and when topsoil piles are redistributed;
- An increase in runoff and erosion while soils are bare;
- An increase in wind erosion while soils are unstable;
- Alterations of soil structure as soils are redistributed; and
- Changes to soil quality, as soils are redistributed.

<u>Impacts Identified in the WRNF Final EIS</u>

Soil resources would be protected from impacts resulting from oil and gas activities where there are NSO stipulations, with protection to a lesser degree through applied CSU stipulations (USFS 2014a, p. 163 - 164). There would be no direct impacts to soil resources resulting from making lands available for oil and gas leasing. Any potential future impacts would be indirect effects resulting from the lands being leased, especially where erodible soils are disturbed (USFS 2014a, p. 165 – 167).

4.4.4 Impacts by Alternative

Table 4.4-2 provides a summary of the stipulations that would serve to protect soils susceptible to water erosion under Alternatives 1 through 4. This information is referenced in the following sections.

Alternative 5 would cancel all leases and result in plugging, abandoning, and reclaiming disturbed areas; therefore no stipulations would be applied to this alternative.

4.4.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

The impacts to soil resources that generally would be anticipated are described in Section 4.4.3. Under Alternative 1, one NSO stipulation within the WRNF is designated specifically to protect soil resources by avoiding surface disturbance on slopes over 60 percent. NSO stipulations designed to protect other surface resources also would serve to minimize impacts to soils if they are implemented without exception, waiver, or modification. **Table 4.4-6** discloses the percentage of soils covered by resource-specific NSO and CSU stipulations. The percentage of all soils protected by NSO stipulations is listed in the last column of **Table 4.4-2**. With consideration of all NSOs, 100 percent of the soils in Zone 1, 39 percent of soils in Zone 2, 8 percent of soils in Zone 3, and 3 percent of soils in Zone 4 would be precluded from surface disturbance.

Table 4.4-3 presents a summary of the acreages of water erodible soils protected by NSO and CSU stipulations. The NSO stipulation for slopes greater than 60 percent would protect approximately 99 percent of the water erodible soils in Zone 1, 34 percent of water erodible soils in Zone 2, 2 percent of water erodible soils in Zone 3, and 1 percent of water erodible soils in Zone 4 (**Table 4.4-3**). Additionally CSU stipulations for 40-to-60 percent slopes and moderate geologic hazards may offer protection to approximately 1 percent of water erodible soils in Zone 2. In Zone 3, the CSU stipulation designed to cover areas of moderate geologic hazard in the GMUGNF would minimize impacts to less than 1 percent of water erodible soils. As shown in the last column of **Tables 4.4-2** and **4.4-3**., more soils would be protected by other NSO stipulations in Zones 1, 2, and 3 than only those designed to protect soils.

Table 4.4-2 All Soils Covered by Stipulations under Alternative 1

Zone	Total Area (Acres)	Slopes Greater than 60% (% of Zone)[1]	All NSOs (% of Zone)
1	10,114	57	100
2	24,938	34	40
3	42,767	6	3
4	2,562	3	1

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-3 Water Erodible Soils Covered by Stipulations under Alternative 1

Zone	Water Erodible Soils (acres and % of Zone)	Slopes Greater than 60% (% of Water Erodible Soils)[1]	All NSOs (% of Water Erodible Soils)
1	1,311 (13%)	99	100
2	7,309 (29%)	34	40
3	12,565 (29%)	2	3
4	1,176 (46%)	1	1

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40 to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 893 acres of initial surface disturbance resulting from development of 416 gas wells on 60 pads would affect soils. While NSO stipulations would minimize adverse impacts in some areas of water erodible soils, there would be the potential for impacts to these soils where surface disturbance is allowed either off-lease or per waiver, exception, or modification. Surface disturbance would be completely precluded in water erodible soils in Zone 1. There is potential for oil and gas development to occur on 60 percent of water erodible soils in Zone 2, and 97 percent of water erodible soils in Zones 3, and 99 percent of water erodible soils in Zone 4. Development of the RFDS would result in initial surface disturbance of approximately 684, 111, and 21 acres within Zones 2, 3, and 4, respectively.

Where water erodible soils are disturbed, it would be important to ensure that vegetation or other stabilization is established quickly to minimize accelerated erosion and offsite sedimentation.

4.4.4.2 Alternative 2

Stipulation Coverage

Under Alternative 2, the level of coverage to minimize adverse effects on soil resources would be similar to Alternative 1 except Alternative 2 would add stipulations to 8 leases. This would add slightly more protection to soils in Zone 3, as shown in **Table 4.4-4** and **Table 4.4-5**.

Table 4.4-4 All Soils Covered by Stipulations under Alternative 2

Zone	Total Area (acres)	Slopes Greater than 60%: WRNF (% of Zone)[1]	All NSOs (% of Zone)
1	10,114	57	100
2	24,938	34	39
3	42,767	7	9
4	2,562	3	3

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-5 Water Erodible Soils Covered by Stipulations under Alternative 2

Zone	Water Erodible Soils (acres & % of Zone)	Slopes Greater than 60% (% of Water Erodible Soils)[1]	All NSOs (% of Water Erodible Soils)
1	1,311 (13)	99	100
2	7,309 (29)	34	40
3	12,565 (29)	4	4
4	1,176 (46)	1	1

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

Projected future oil and gas development would be similar to that described under Alternative 1, with the same amount of short-term and long-term surface disturbance. Due to some increased acreage of NSO stipulations (see **Table 4.4-4**), there would be a slight increase in the coverage of water erodible soils due to the small increase in limitations on surface disturbance from NSO stipulations, resulting in slightly fewer potential adverse impacts to water erodible soils.

4.4.4.3 Alternative 3

Stipulation Coverage

The impacts to soil resources that generally would be anticipated are described in Section 4.4.3. Under Alternative 3, NSO stipulations designated to minimize impacts to soil resources include those that limit surface disturbance on slopes greater than 50 to 60 percent and locations with severe or high landscape stability hazards. **Table 4.4-6** discloses the percentage of soils covered by resource-specific NSO and CSU stipulations. The percentage of soils protected by NSO stipulations is listed in the last column of **Table 4.4-6**. With consideration of all NSOs, 100 percent of the soils in Zone 1, 87 percent of soils in Zone 2, 86 percent of soils in Zone 3, and 92 percent of soils in Zone 4 would be precluded from surface disturbance.

The resource-specific NSO stipulations would cover approximately 2 percent of water erodible soils in Zone 1, 6 percent in Zone 2, 1 percent in Zone 3, and 1 percent in Zone 4. The CSU stipulations within the analysis area that are specific to soils include those on 30 to 50 percent slopes, highly erodible soils, areas with moderately high landscape stability hazards within the WRNF, locations with moderate geologic hazards within the GMUGNF, and 40 to 60 percent slopes within the GMUGNF. The resource-specific CSU stipulations would minimize surface disturbance within each of the zones, but may overlap in some locations.

NSO stipulations designed to protect other surface resources also would serve to minimize adverse impacts on soils (including erodible soils) if they are implemented without exception, waiver, or modification. As shown in the last column of the summary tables (**Tables 4.4-6** and **4.4-7**), more water erodible soils would be covered by other NSO stipulations in all zones than would be covered by those resource-specific NSO stipulations designed to protect soils. It is anticipated that there would be more development from locations off the leases due to the greater extent of NSOs under this alternative, compared to Alternatives 1 and 2. This would result in off-lease surface disturbance should the leases be developed, but the off-lease impacts to soils would be evaluated at the APD stage of permitting when site-specific locations are known and evaluations are completed.

Table 4.4-6 All Soils Covered by Stipulations under Alternative 3

Zone	Total Area (acres)	Resource-specific NSO Stipulations (% of Zone)		Resource-specific CSU Stipulations (% of Zone)			All NSOs (% of Zone)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50 %	
1	10,114	23	22	1	18	29	100
2	24,938	7	7	3	72	34	87
3	42,767	2	2	<1	57	20	86
4	2,562	1	2	<1	46	6	92

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-7 Water Erodible Soils Covered by Stipulations under Alternative 3

Zone	Water Erodible Soils (acres and % of Zone)	Resource-specific NSO Stipulations (% of Water Erodible Soils)		Resource-specific CSU Stipulations (% of Water Erodible Soils)			All NSOs (% of Water Erodible Soils)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50%	
1	1,311 (13%)	2	3	2	78	23	100
2	7,309 (29%)	6	6	3	79	40	80
3	12,565 (29%)	1	1	<1	79	13	85
4	1,176 (46%)	0	1	1	100	4	99

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 886 acres of initial surface disturbance resulting from development of 413 gas wells on 59 pads would affect soils. While NSO stipulations would protect some areas of water erodible soils, there would be the potential for alterations of these soils where surface disturbance would be allowed. Surface disturbance would be completely precluded in Zone 1. Based on the combination of NSO stipulations that are likely to minimize disturbance of water erodible soils under Alternative 3, there is potential for oil and gas development to occur within water erodible soils on 20 percent in Zone 2, and 15 percent in Zones 3, and 1 percent in Zone 4. Development of the RFDS would result in initial surface disturbance of approximately 684, 104, and 21 acres within Zones 2, 3, and 4, respectively. Where water erodible soils are disturbed, it would be important to ensure that vegetation or other stabilization is established quickly to minimize accelerated erosion and offsite sedimentation.

Under Alternative 3, there would be more extensive protection of erodible soils due to the larger acreage of NSO stipulations that would completely eliminate surface disturbance within the analysis area, as well as increased acreage of CSU stipulations that would require avoidance of erodible soils by surface disturbing activities. Less erodible soils would be disturbed within the analysis area, compared to Alternatives 1 and 2. However, due to the increase in NSO acreage under this alternative, it is likely that more off-lease development would occur. Depending on the surface manager at the off-lease location, there may be different constraints implemented for oil and gas development, but this would not be known until site-specific APDs are submitted.

4.4.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Under Alternative 4, the types and extent of projected surface disturbance and resulting impacts to soils would be similar to that described for Alternative 3, except in Zone 3 (**Table 4.4-8** and **Table 4.4-9**). In Zone 3, all or part of 25 leases would be cancelled and much of the surrounding area would be closed to future leasing. The lease cancellation and remaining area closed to leasing would eliminate the possibility of surface disturbance within the analysis area and off-lease. Therefore, while there would be fewer acres of NSO stipulations in Zone 3, there would be greater limitations on oil and gas development due to the cancellation of leases and the surrounding area that would be closed to leasing.

Table 4.4-8 All Soils Covered by Stipulations under Alternative 4

Zone	Total Area (acres)	Resource-specific NSO Stipulations (% of Zone)		Resource-specific CSU Stipulations (% of Zone)			All NSOs (% of Zone)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50 %	
1	10,114	23	22	1	18	29	100
2	24,938	7	7	3	72	34	87
3	42,767	0	0	0	23	4	95
4	2,562	1	2	0	46	6	92

Note: GMUGNF NSO stipulations for Slopes >60% and High Geologic Hazards cover less than 1 percent of the leases in Zone 2. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazard cover less than 1 percent of the leases in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Table 4.4-9 Water Erodible Soils Covered by Stipulations under Alternative 4

Zone	Water Erodible Soils (acres and % of Zone)	Resource-specific NSO Stipulations (% of Water Erodible Soils)		Resource-specific CSU Stipulations (% of Water Erodible Soils)			All NSOs (% of Water Erodible Soils)
		Severe or High Landscape Stability Hazards	Slope Greater than 50%	Moderately High Landscape Stability Hazards	Highly Erodible Soils	Slopes 30 to 50%	
1	1,311 (13)	2	3	2	78	23	100
2	7,309 (29)	6	6	3	79	40	80
3	12,565 (29)	<1	<1	0	40	4	87
4	1,176 (46)	0	1	1	100	4	99

Note: GMUGNF NSO stipulations for slopes >60% and High Geologic Hazard GMUGNF cover no water erodible soils. GMUGNF CSU stipulations for 40% to 60% Slope, Moderate Geologic Hazards, and Areas of Moderate Geologic Hazards cover up to 1 percent of water erodible soils in Zones 2 and 4. No changes to these stipulations are being considered in the Proposed Action and alternatives.

Impacts from Projected Future Oil and Gas Development

As shown in **Table 2-8**, an estimated 821 acres of initial surface disturbance resulting from development of 383 gas wells on 54 pads would affect soils. While NSO stipulations and the areas closed to leasing would cover some areas of water erodible soils, there is the potential for alterations of these soils where surface disturbance would be allowed either off-lease or per waiver, exception, or modification. Based on the combination of NSO and CSU stipulations with the areas that would be closed to leasing, there would be more coverage of erodible soils to minimize impacts both within the analysis area and off-lease. The designation of areas that are closed to leasing would eliminate future oil and gas development in Zone 3 within the leases to be cancelled and off those leases. The potential for development within Zones 1, 2, and 4 would be the same as Alternative 2. In Zone 3, there is potential for oil and gas development to occur on 3 percent of water erodible soils. Development of the RFDS would result in initial surface disturbance of approximately 39 acres within Zone 3.

4.4.4.5 Alternative 5

Stipulation Coverage

This alternative would not be subject to any stipulations because all the leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Under Alternative 5, all of the previously issued leases would be cancelled so there would be no reasonably foreseeable oil and gas development. The impacts associated with Alternative 5 would include any surface disturbance to soils resulting from plugging and abandoning the existing 75 wells, the removal of all ancillary equipment, and decommissioning and reclaiming all disturbed areas. Most of the areas to be disturbed have already been disturbed previously to construct the well pads and other facilities. Over time, as areas achieve reclamation and revegetation success, the soil productivity would increase compared to bare disturbed soils.

4.4.4.6 Summary of Impacts

While the acreage of surface disturbance associated with projected oil and gas development would be similar under Alternatives 1 through 4, Alternative 4 would have a lesser risk of impacts to soils based on lease stipulations, modifications, and cancellations. Under Alternative 4, there would be fewer wells, well pads, and roads constructed and less off-lease development in Zone 3 due to the lease cancellations. The least amount of potential risks to soils would result from Alternative 5 because all leases would be canceled, most of the surface disturbance would occur on previously disturbed soils, and reclamation and revegetation would be implemented for the entire analysis area.

4.4.5 Cumulative Impacts

4.4.5.1 Cumulative Impacts Analysis Area

The CIAA for soils would be the area encompassed by the leases (80,380 acres).

4.4.5.2 Past, Present, and Reasonably Foresee able Future Actions

Past and Present Actions

Past and present actions, as described in Section 4.1, have already impacted soil resources. Approximately 454 acres (0.5 percent of the CIAA) of soils have been disturbed by known past and present activities.

Past oil and gas activities have occurred within the CIAA. Although disturbance areas may be reclaimed using soil removed from the site and stockpiled for later use, soil productivity may be lower than the original natural soils after reclamation. The construction associated with past development of oil and gas wells and associated infrastructure in the analyses area have contributed to cumulative impacts including removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity. These changes to soils could increase runoff and lead to accelerated erosion and sedimentation. Older disturbances may not have been fully revegetated or reclaimed back to their original state.

Other past and present actions, such as timber harvests, livestock grazing, vegetation treatments, and land management decisions have impacted soil resources to varying degrees in the CIAA. Although it is likely that some past actions were not subject to reclamation, most current activities would be subject to reclamation, especially those regulated by federal, state, or local agencies.

Reasonably Foreseeable Future Actions

There are no RFFAs which would result in surface-disturbing activities within the soils CIAA.

As described in Section 4.1, other types of RFFAs that would occur within the CIAA include vegetation treatments and hazardous fuels reduction. Loss of vegetation and soil disturbance associated with the use of mechanical equipment could cause some short-term loss of soil functions, processes, and productivity on approximately 6,000 acres. However, these treatments would help to reduce the risk of wildfire within the CIAA, a major contributor to loss of soil function and processes.

4.4.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance. This is between 0 and 46 percent of the total cumulative long-term surface disturbance within the CIAA. With consideration of past/present actions, RFFAs, and alternatives, the total cumulative impact would affect less than 1 percent of the CIAA. If selected, Alternative 5 would reclaim existing wells that have resulted in some removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity.

4.5 Water Resources

4.5.1 Surface Water

4.5.1.1 Analysis Assumptions and Approach to Analysis

Analysis Area

As described in detail in Section 3.5.2.1, the analysis area for surface water resources includes the 6th-level subwatersheds, otherwise known as the 12-digit Hydrologic Unit Codes (HUC-12) of the watershed boundary dataset (Natural Resources Conservation Service et al. 2010), that encompass the leases under consideration. The subwatersheds comprising the analysis area are displayed by the four Lease Zones in **Figures 3.5-1** and **3.5-2**.

Scoping Issues

During the public scoping process, the following issues and concerns for surface water were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- Water quality impacts due to sedimentation and erosion caused by disturbed areas.
- Water quality impacts due to wastewater disposal, well pad and site runoff, potential spills, and hydraulic fracturing contamination.
- Water use and sources and their associated potential impacts (aquifer drawdown, streamflow reduction, adverse effects to aquatic life, wetlands, etc.).
- Interconnectivity of groundwater and surface water due to concerns with hydraulic fracturing. Potential impacts from hydraulic fracturing are discussed in Section 4.5.2, Groundwater.

Assumptions

The analyses within this section were completed considering certain assumptions. A main assumption is that operators would comply with all applicable laws and regulations, such as the Clean Water Act (CWA), and CDPHE and COGCC rules and regulations. The analysis is based on the estimated surface disturbance that would occur from the construction and maintenance of access roads, well pads, pipelines, and other work areas necessary to develop the reasonably foreseeable development of oil and gas leases projected for each alternative.

Impact Indicators Used for Analysis

The analysis of impacts to water resources considers impact indicators to allow for a quantified comparison of alternatives. The impact indicators used include the following:

- Amount of resource covered by specific stipulations and general stipulation types required by each alternative. Resource impact indicators quantified are listed below.
  - Colorado Source Water Assessment and Protection (CSWAP) sensitivity zones; percentage of coverage for CSWAP Zone 2 is the indicator reported as CSWAP areas because it includes a buffer around wells and streams to encompass the dendritic stream channel pattern up to the headwaters, but not the entire catchment area.
  - COGCC Rule 317B water supply protection zones; percentage of coverage for Rule 317B Zone 3 is the indicator reported because it includes a buffer around streams similar to CSWAP Zone 2.

  - Local Source Water Protection Plans (SWPPs); the indicator reported is the percentage of coverage for the geographic extent of the SWPP area.
  - Outstanding Waters use classification; percentage of coverage for stream reaches with this designation.
  - Impaired Waters; percentage of coverage for stream reaches with this designation.
  - Perennial rivers and streams; percentage of coverage for stream reaches with these flow regimes.
  - Highly erodible soils are discussed in Section 4.4, Soils.
  - Wetlands are discussed in Section 4.6, Vegetation.

- Amount of surface disturbance expected under each alternative as described in **Table 2-8**.
- Amount of water use expected for well development from each RFD. Water depletions related to impacts to fish species are discussed in Section 4.8, Aquatic Resources.

Methods of Analysis

The methods used to quantify the relationship between stipulations and the impact indicators relied upon geospatial overlays and intersection of the areas that would be covered by stipulations and the occurrence of the identified resources.

Impact indicators related to oil and gas development that could occur after additional approval(s) beyond the issuance of leases are analyzed using qualitative methods. Potential impacts from surface disturbance are characterized in a general sense. Potential water use has been contextualized related to current water use in the region. Estimates for these parameters are compared between alternatives.

Occurrence of the water resources parameters is largely within the subwatersheds containing RFD Zones 2 and 3; with less surface water resources occurring within Zones 1 and 4. The parameters that differentiate Zones 1 and 4 include the CSWAP areas, RFD amounts of surface disturbance, and water use expected for well development.

4.5.1.2 Stipulations Providing Coverage to Surface Water Resources

Standard lease terms apply to all leased areas and allow for the surface managing agency to require adjustments to proposed facility siting to protect resource values (e.g., increase the distance of facilities from water resources up to 200 meters and potentially more if necessary to protect those resources). They also allow for the agency's ability to place conditions of approval on operations. An example of a COA would be specification of interim and final reclamation measures, which could promote initial revegetation, thus decreasing erosion; and could encourage greater reclamation success, while decreasing the long-term erosion rates of previously disturbed sites. Additionally, as discussed in Section 3.5.13, new surface operations within the Rule 317B Internal Zone are prohibited without the issuance of a variance from the COGCC. There are additional requirements for new operations within the Intermediate Zone and External Zone.

There could be three types of stipulations in the leases according to the EIS alternatives. These three types, in order of descending protection offered, are NSO, CSU, and timing limitations (TLs). There also are planning decisions that close areas to oil and gas leasing (CTL).

NSO stipulations do not allow for surface occupancy or use in specific areas. This type of stipulation offers coverage to water resources that are found in the areas with NSO designation. NSO avoids surface disturbance of the area, thus avoiding or minimizing impacts to waters from increases in sediment or other runoff pollutants while also maintaining existing vegetative cover and soil infiltration

rates. NSO coverage also avoids occupancy by wells, pipelines, vehicles, or other equipment, thus negating the risk of releases of hazardous materials into waterways.

CSU stipulations dictate special operational constraints, but do not prohibit all activities. Certain CSU stipulations may provide coverage to water resources. This type of stipulation must be considered on a case-by-case basis because the constraints outlined vary greatly (e.g., no net increase in road densities, surveys for specific resources).

It is important to note that stipulations not related to water resources may provide coverage to water resources, but that coverage is uncertain. These are considered through the "Unrelated NSO" stipulation indicator. An example of the uncertainty might be an alternative with a NSO stipulation restricting development in critical big game winter habitat, and a location with a stream that passes through an area where existing GIS data indicated such habitat. This NSO stipulation would cover the stream as well as existing habitat. However, an illustration of the uncertainty would be if the area of indicated habitat was field surveyed and determined to not contain the characteristics of the habitat, and therefore did not warrant coverage by the NSO stipulation; then the water resources would lose coverage as well.

Resource-specific Stipulation Coverage

Table 4.5-1 lists lease stipulations that are included in certain alternatives that offer specific coverage of surface water resources.

Alternatives 1 and 2 have no stipulations specific to water resources. Stipulations designed to avoid or minimize impacts to surface water also may avoid or minimize impacts to groundwater, depending on the interconnections and the locations of the resources. Each of these stipulations is described in further detail below.

Table 4.5-1 Lease Stipulations Offering Specific Coverage of Surface Water Resources

Stipulation	Alternative 1	Alternative 2	Alternative 3	Alternative 4
NSO—Public Water Supply Source Areas			X	X
NSO—Water Influence Zones			X	X

Public water supply source areas are based on the Forest Service White River LRMP 2002 Revision stipulation, which are bounded geographically by the CSWAP program assessment areas. The Forest Service defined the NSO stipulation to cover areas within CSWAP zones 1 and 2 out to a distance of five miles from the water intakes. The geographic extent of this stipulation was updated for this EIS based on the USFS definition and the most recent CSWAP data, received from CDPHE in September 2015. The stipulation states that no surface occupancy or use is allowed within these areas.

Water influence zones are defined in the stipulation as areas within a minimum of 100 feet from each side of a perennial or intermittent stream, lake, wetland, or naturally occurring pond. This minimum distance may be wider where there is a well-developed floodplain. The stipulation states that no surface occupancy or use is allowed within these areas. However, development of road and pipeline crossings in the area of intermittent drainages is not subject to this stipulation.

4.5.1.3 Impacts Common to all Alternatives

Impacts to surface water from the leasing action alternatives would not occur from the approval of leases, but would occur upon additional approval(s) that allowed for the physical development of the leases. Although the types of impacts that would occur from oil and gas development are summarized below, the locations and timing of specific development is not known and cannot be predicted through

the leasing action. Therefore, this section discloses the potential risks that are posed to water resources through the leasing action, and analyzes the levels of coverage provided by each alternative.

If the existing leases are maintained, and the lessees pursue additional approval(s) to develop the oil and gas resources, the types of impacts expected from development would occur temporarily during construction and to a much lesser extent during the operation phase of oil and gas production.

Temporary impacts are generally expected from land disturbance during construction of access roads, well pads, flowlines, and supporting facilities. Temporary impacts would be most likely to occur during construction of stream crossings for access roads and flowlines, and at well pad locations nearest streams. This construction would disturb the vegetation, soils, and mineral substrate; which in turn would increase runoff rates during precipitation events and the spring snowmelt. By increasing the runoff and removing vegetation (the roots of which hold the soil together, and the shoots and stems of which slow the runoff), the disturbed areas would become more susceptible to erosion. Soil that is carried down gradient by runoff due to upslope erosion is deposited in streams and may create sedimentation issues.

Potential leaks or spills of petroleum products or other hazardous materials from construction and operation equipment and vehicles might impact surface water if a spill were to reach a waterway or wetland.

Water consumed for well drilling, dust abatement, and other construction uses would increase water demands, and might temporarily impact groundwater levels during water withdrawals or affect other water users depending on the sources utilized. Any water use would be subject to the rules, regulations, and processes of the Colorado Division of Water Resources.

Because the exact locations or amounts of disturbance from future development of leases are not known, the amounts of coverage provided by stipulations are used as an indicator of the risk to the water resources. Surface disturbance related to the development of these leases would have the potential of occurring outside the lease areas if the mineral resources were accessed via directional drilling; therefore the coverage provided outside the leases also are included. Additionally, the projected amount of disturbance and water needed to develop the leases also is used as an indicator of the impacts to water resources.

NSO stipulations that apply to areas near streams and areas of highly erodible soils would minimize impacts of oil and gas development by requiring disturbance to be located in other areas. CSU and TL stipulations may have beneficial effects for water resources, such as limiting increases in road densities or limiting construction disturbance activities for other resource considerations that happen to coincide with high-flow periods during snowmelt. For the purposes of this analysis, it is assumed that NSO and CTL stipulations would provide coverage to the water resource parameters by limiting development in sensitive areas and by creating vegetated buffers that would minimize impacts from surface-disturbing activities and potential releases of hazardous materials.

Impacts Identified in the WRNF Final EIS

The Forest Service Oil and Gas Leasing Final EIS included an analysis of watershed sensitivity to anthropogenic influence (see USFS 2014a at p. 80). USFS (2014a) states that “The Cache Creek, Garfield Creek, Mamm Creek, Outlet Roaring Fork River, and Rifle Creek (HUC-10) watersheds have the highest aggregate sensitivity to potential future surface disturbance impacts (on the National Forest) associated with oil and gas exploration and development.” (Parentheticals added for clarification.) These watersheds drain directly into the Colorado River and correspond to portions of leases considered within Zones 2 and 3 of this EIS. Other areas of Zone 3 also are reported to have a high susceptibility to anthropogenic influences such as oil and gas development. The watersheds containing Zones 1 and 4 are reported to have moderate susceptibility to anthropogenic influences.

Because the Forest Service concluded that the watersheds most sensitive to anthropogenic influence and the occurrence of surface water resource parameters are both found largely in Zones 2 and 3, the impact indicators used in this analysis focus on those zones while still including relevant information related to all zones.

Impact issues that were identified for surface water resources in the WRNF Final EIS include the potential effects of future oil and gas development of chemical water quality degradation or sedimentation in streams from ground disturbance during construction or leaks and spills of industrial chemicals or drilling fluids (USFS 2014a, p. 76). The WRNF Final EIS also recognizes that future development might alter the hydrology through decreases to available water due to use for well drilling and development as well as increases or changes in runoff patterns and timing from reduced infiltration rates of disturbed areas. These changes in flow regimes could impact existing erosion rates and streambank stability in downstream channels (USFS 2014a, p. 77). Watersheds were analyzed for their susceptibility to anthropogenic influences based on ecological drivers such as geology, geochemistry, and hydroclimatic regime (USFS 2014a, p. 78). Watersheds were then grouped based on ecological clusters, and two of these clusters (Cluster M5R and Cluster M6R) fall largely within the water resources analysis area evaluated in this EIS. “Overall, watersheds in the M6R cluster are considered to have the highest sensitivity to potential ground-disturbing activities such as those associated with oil and gas development” (USFS 2014a, p. 81).

4.5.1.4 Impacts by Alternative

Each alternative considered has differing amounts of resource coverage offered through lease stipulations, as well as differing estimates of reasonably foreseeable development due to the stipulation requirements. **Table 4.5-2** summarizes the coverage offered to surface water resources by alternative.

Table 4.5-2 Percent of Surface Water Resources Indicators Covered by Stipulations under Each Alternative

		Alternative				
	Resource Coverage	**1**	**2**	**3**	**4**	**5**[1]
State CSWAP Areas	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	77	45	No Stipulation
	Unrelated NSO/CTL	23	23	88	93	100
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	89	89	No Stipulation
	Unrelated NSO/CTL	0	0	92	92	
Local SWPP Areas[2]	NSO—Public Water Supply Source Areas	No Stipulation	No Stipulation	9	98	No Stipulation
	Unrelated NSO/CTL	9	11	88	99	100
Outstanding Waters	NSO—Water Influence Zones	No Stipulation	No Stipulation	99	100	No Stipulation
	Unrelated NSO/CTL	11	11	99	100	100
Impaired and Monitored Waters	NSO—Water Influence Zones	No Stipulation	No Stipulation	100	99	No Stipulation
	Unrelated NSO/CTL	52	52	100	100	100
Perennial Streams	NSO—Water Influence Zones	No Stipulation	No Stipulation	100	66	No Stipulation
	Unrelated NSO/CTL	23	23	100	100	100

[1] Although Alternative 5 would cancel all leases and protect the resources in the long-term, there would be short-term impacts associated with decommissioning existing oil and gas development in the cancelled lease areas. See Alternative 5 narrative below for additional information.

[2] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

CTL = closed to leasing.

Alternative 1 (No Action Alternative)

This alternative would reaffirm the lease stipulations on the 65 leases as they were issued. Water resources impact parameters are listed for Alternative 1 by Zone in **Table 4.5-3**.

Table 4.5-3 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 1

	Resource Coverage	Alternative 1 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	Unrelated NSO/CTL	23	100	33	8	2
COGCC Rule 317B Areas	Unrelated NSO/CTL	0	No Resource	0	No Resource	No Resource
Local SWPP Areas[1]	Unrelated NSO/CTL	9	No Resource	42	9	No Resource
Outstanding Waters	Unrelated NSO/CTL	11	No Resource	0	12	No Resource
Impaired and Monitored Waters	Unrelated NSO/CTL	52	No Resource	52	No Resource	No Resource
Perennial Streams	Unrelated NSO/CTL	23	No Resource	52	17	0

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be no surface water resources-specific stipulations under this alternative, which describes the existing leases and associated stipulations. The general NSO stipulations related to other resources would cover up to 23 percent of the CSWAP areas, 9 percent of the local SWPP areas, 11 percent of designated Outstanding Waters, 52 percent of impaired and monitored waters, and 23 percent of perennial streams.

Unrelated NSO stipulations would cover nearly all the individual CSWAPs in Zone 1; 8 percent to nearly 40 percent of the individual CSWAPs within Zone 2; 8 percent to 17 percent of the individual CSWAPs in Zone 3, and 2 percent of the CSWAP within Zone 4. None of the Rule 317B area in Zone 2 would be covered by the unrelated NSO stipulations under this alternative. Approximately 42 percent of the Rifle SWPP areas within Zone 2, and 9 percent of the Carbondale SWPP area in Zone 3 would be covered. Designated Outstanding Waters in Zone 2 (Battlement Creek) would not be covered, and approximately 1.1 miles of designated Outstanding Waters in Zone 3 (out of 9.2 miles) would be covered on North Thompson and Park creeks. Approximately 1.7 miles (out of a total 3.2 miles) of West and Middle Mamm creeks, the impaired streams in Zone 2, would be covered by unrelated NSO stipulations. Perennial streams that would be covered by unrelated NSO stipulations include Cache Creek, Cottonwood Creek, Middle Mamm Creek, and portions of West Divide Creek in Zone 2; and Middle Thompson Creek, Porcupine Creek, and portions of Freeman, North Thompson, and South Branch Middle Thompson creeks in Zone 3.

The Forest Service also has established NSO stipulations outside the existing lease zones, to provide coverage for NFS lands available for future leasing. Within those NFS lands that are included in the analysis area, the NSO stipulations cover 34 percent of the CSWAP areas, 16 percent of Rule 317B areas, and 71 percent of local SWPPs.

Impacts from Projected Future Oil and Gas Development

Initial surface disturbance of 893 acres would be expected to result from reasonably foreseeable future oil and gas development, with the majority falling in Zone 2. Zone 3 would have the second-highest amount of disturbance. The potential for portions of this disturbance to be off-lease exists where there are restrictive on-lease stipulations.

Water use under Alternative 1 is projected to be approximately 1,158 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to "Industrial" use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 2

This alternative would modify leases to address inconsistencies with the 1993 EIS and ROD. Stipulations that were not attached to leases as issued but were identified in the 1993 EIS and ROD would be added to the leases. Water resources impact parameters are listed for Alternative 2 by Zone in **Table 4.5-4**.

Table 4.5-4 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 2

	Resource Coverage	Alternative 2 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	Unrelated NSO/CTL	23	100	33	9	2
COGCC Rule 317B Areas	Unrelated NSO/CTL	0	No Resource	0	No Resource	No Resource
Local SWPP Areas[1]	Unrelated NSO/CTL	11	No Resource	42	10	No Resource
Outstanding Waters	Unrelated NSO/CTL	11	No Resource	0	12	No Resource
Impaired and Monitored Waters	Unrelated NSO/CTL	52	No Resource	52	No Resource	No Resource
Perennial Streams	Unrelated NSO/CTL	23	No Resource	52	17	0

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be no water resources-specific stipulations under this alternative. The unrelated NSO stipulations related to other resources would cover up to 23 percent of the CSWAP areas and 11 percent of local SWPP areas. The unrelated stipulations coverage for the other surface water resource parameters would be the same as that described for Alternative 1. The additional coverage for CSWAP areas and SWPP areas in Alternative 2 would be from the same coverage as under Alternative 1 but with additional coverage for Zone 3. The USFS-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.

Impacts from Projected Future Oil and Gas Development

The potential impacts to surface water resources from reasonably foreseeable future oil and gas development would be the same as that described for Alternative 1.

Alternative 3

This alternative would modify the 65 leases to match the stipulations for future leasing identified in the Proposed Action from the 2014 WRNF Final EIS. Water resources impact parameters are listed for Alternative 3 by RFD Zone in **Table 4.5-5**.

Table 4.5-5 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 3

	Resource Coverage	Alternative 3 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	NSO—Public Water Supply Source Areas	7	7	4	9	0
	Unrelated NSO/CTL	88	100	85	88	89
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	89	No Resource	89	No Resource	No Resource
	Unrelated NSO/CTL	92		92		
Local SWPP Areas[1]	NSO—Public Water Supply Source Areas	9	No Resource	42	8	No Resource
	Unrelated NSO/CTL	88		84	88	
Outstanding Waters	NSO—Water Influence Zones	99	No Resource	100	99	No Resource
	Unrelated NSO/CTL	99		100	99	
Impaired and Monitored Waters	NSO—Water Influence Zones	100	No Resource	100	No Resource	No Resource
	Unrelated NSO/CTL	100		100		
Perennial Streams	NSO—Water Influence Zones	100	No Resource	100	100	100
	Unrelated NSO/CTL	100		100	100	100

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be two surface water resources-specific stipulations under this alternative. The NSO stipulation to limit surface disturbance in Public Water Supply Source Areas would cover approximately 7 percent of the CSWAP areas within the leases; complete coverage would not be achieved because the stipulation would create NSO for areas within 5 miles upstream from the intakes, while the CSWAPs extend to the headwaters along streams as discussed in Section 4.5.1.2. The Public Water Supply Source Area NSO stipulation would cover approximately 8 percent or less of individual CSWAPs in Zones 1 and 2. The stipulation would cover all of the Oak Meadows Subdivision, Brettleberg Condos, Ski Sunlight, and Sunlight Inn and Restaurant CSWAPs, and 42 percent or less of the remaining CSWAPs in Zone 3. None of the CSWAP found in Zone 4 would be covered. This stipulation would cover approximately 89 percent of the COGCC Rule 317B areas in Zone 2. Local SWPPs would be covered at approximately 42 percent (Rifle) in Zone 2 and 8 percent in Zone 3 (2 percent of Carbondale and 33 percent of Oak Meadows Subdivison). The NSO stipulations to limit disturbance of Water Influence

Zones would cover 99 percent of the designated Outstanding Waters in the analysis area, and 100 percent of the impaired and monitored waters, as well as perennial streams. The designated Outstanding Waters that would not be covered consist of less than 0.1 mile of Battlement Creek in Zone 2 and approximately 0.1 mile of a tributary to Thompson Creek.

If they are implemented, the combined unrelated NSO stipulations designed to avoid or minimize impacts to other resources, along with the areas closed to leasing, would cover up to 88 percent of the CSWAP areas, 92 percent of the Rule 317B areas, 88 percent of local SWPP areas, 99 percent of the designated Outstanding Waters, and 100 percent of impaired and monitored waters, and perennial streams. The USFS-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.

Impacts from Projected Future Oil and Gas Development

Initial disturbance of 886 acres would be expected from reasonably foreseeable oil and gas development, with the majority falling in Zone 2. Zone 3 would have the second-highest amount of disturbance due to development of the leases. The potential for portions of this disturbance to be off-lease exists where there are restrictive on-lease stipulations.

Water use under Alternative 3 is projected to be approximately 1,152 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to “Industrial” use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 4 (Proposed Action)

This alternative would modify or cancel the 65 leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Draft ROD. Water resources impact parameters are listed for Alternative 4 by RFD Zone in **Table 4.5-6**.

Table 4.5-6 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 4

	Resource Coverage	Alternative 4 Total	Zone 1	Zone 2	Zone 3	Zone 4
State CSWAP Areas	NSO—Public Water Supply Source Areas	45	7	4	70	0
	Unrelated NSO/CTL	93	100	85	96	89
COGCC Rule 317B Areas	NSO—Public Water Supply Source Areas	89	No Resource	89	No Resource	No Resource
	Unrelated NSO/CTL	92		92		
Local SWPP Areas[1]	NSO—Public Water Supply Source Areas	98	No Resource	42	99	No Resource
	Unrelated NSO/CTL	99		84	100	
Outstanding Waters	NSO—Water Influence Zones	100	No Resource	100	100	No Resource
	Unrelated NSO/CTL	100		100	100	
Impaired and Monitored Waters	NSO—Water Influence Zones	99	No Resource	99	No Resource	No Resource
	Unrelated NSO/CTL	100		100		

Table 4.5-6 Percent of Surface Water Resources Indicators Covered by Stipulations under Alternative 4

	Resource Coverage	Alternative 4 Total	Zone 1	Zone 2	Zone 3	Zone 4
Perennial Streams	NSO—Water Influence Zones	100	No Resource	100	100	100
	Unrelated NSO/CTL	100		100	100	100

[1] Local SWPP areas include the City of Rifle municipal water source in Zone 2, and the Town of Carbondale SWPP and Oak Meadows Community SWPP in Zone 3.

Stipulation Coverage

There would be two surface water resources-specific stipulations under this alternative. The area closed to leasing along with the NSO stipulation to limit surface disturbance in Public Water Supply Source Areas within the leases would cover 45 percent of the CSWAP areas, 89 percent of the Rule 317B areas, and 98 percent of the SWPP areas. Coverage of these indicators would be the same as Alternative 3 in Zones 1, 2, and 4. Within Zone 3, additional coverage would be achieved from the areas closed to leasing; 70 percent of CSWAP areas and 99 percent of local SWPPs would be covered in Zone 3. The CSWAP areas not covered in Zone 3 would all be portions of the “far zones,” or greater than 15 miles upstream of the intakes except for less than 200 acres of Silts “near zone” CSWAP, Approximately 200 acres of Carbondale’s SWPP area in Zone 3 leases would not be covered. The NSO stipulations to limit disturbance of Water Influence Zones, when combined with the areas that would be closed to leasing, would cover all of the designated Outstanding Waters and perennial streams. The impaired and monitored waters also would be covered except for a less than 0.1 mile segment of a tributary to West Mamm Creek in Zone 2.

The unrelated NSO stipulations and CTL areas that avoid or minimize impacts to other resources would cover up to 93 percent of the CSWAP areas, 92 percent of the Rule 317B areas, and 99 percent of the SWPP areas. Similar to the specific NSO discussion above, the coverage for these indicators would be the same as Alternative 3 in Zones 1, 2, and 4. The increased coverage in Zone 3 would be due to the addition of areas closed to leasing. The Forest Service-established NSO stipulations outside the existing lease zones that provide coverage for NFS lands available for future leasing would be the same as discussed in Alternative 1.Impacts from Projected Future Oil and Gas Development

Initial disturbance of 821 acres would be expected from reasonably foreseeable oil and gas development, with the majority falling in Zone 2. Zone 1 would have the second-highest amount of disturbance due to development of the leases. The potential for portions of this disturbance to be off-lease exists where leases are not cancelled and there are restrictive on-lease stipulations. There would be no on-lease or off-lease surface disturbance to support oil and gas development within the areas of cancelled leases or designated as closed to leasing.

Water use under Alternative 4 is projected to be approximately 1,079 acre-feet from projected future drilling and completion operations over a 20-year period. Assuming an even distribution of water use over that period, the water required for well drilling and completion would be approximately 0.01 percent of the water currently allocated to “Industrial” use water rights in the region (see Section 3.5.1.3 for more information).

Alternative 5

This alternative would cancel all 65 existing leases requiring: plugging and abandonment of the producing wells; removal of access roads, well pads, and ancillary facilities; and reclamation of all disturbed areas.

Stipulation Coverage

There would be no stipulations because all leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

There would be no future development, because this alternative would cancel all the leases. However, there would be the potential for short-term impacts to surface water that would occur when the existing wells are plugged and abandoned, existing facilities decommissioned, and disturbed areas reclaimed. This disturbance would be temporary and limited to areas already disturbed by oil and gas development. Upon successful reclamation of disturbed areas, the impact to water resources would be expected to be minimal, approaching a condition better than that of the existing disturbed areas.

4.5.1.5 Summary of Impacts

Compared to the No Action Alternative, Alternatives 2 through 5 in general progressively provide increased coverage to surface water resources inside the lease boundaries through stipulations that would limit surface disturbance and minimize erosion and sedimentation. However, the increased coverage to the lease areas may have the opposite impact to the areas outside the leases by causing the disturbance to occur off-lease. Therefore, Alternatives 2 through 4 may increase the risk of impacts to water resources in the areas immediately adjoining the leases, although Alternative 4 would have less increase because of the leases cancelled due to the areas closed to leasing in Zone 3. Alternative 5 would provide the most coverage to water resources, including those outside the lease areas.

4.5.1.6 Cumulative Impacts

Cumulative Impacts Analysis Area

The CIAA for surface water resources is the same analysis area considered for direct and indirect impacts above, and includes all HUC-12 subwatersheds that contain a portion of the lease areas. **Table 3.5-1** lists these subwatersheds.

Past and Present Actions

The primary past and present actions with surface disturbance likely to affect surface water resources include surface disturbance related to mineral development, road construction, and other land development such as ROWs for pipelines, telephone lines, and communication sites. Section 4.1 presents the total quantifiable past and present surface disturbances by CIAA that have contributed to current conditions.

Reasonably Foreseeable Future Actions

As noted in Section 4.1, oil and gas RFFAs would disturb approximately 14,854 acres in the surface water CIAA. Total projected fresh water use for drilling and completion for oil and gas RFFAs is 22,304 acre-feet over a 20-year period.

There are multiple cumulative actions that may have countervailing impacts. Approximately 11,992 acres are proposed for vegetation treatments and fuels reductions in the surface water CIAA. These actions would effectively reduce the demand for water from vegetation through fire- and mechanical- vegetation cover reduction. While these actions have the potential to increase runoff and thus increase erosion and sedimentation for a temporary period, when performed correctly, the treatments can increase water yield to streams (runoff) while maintaining erosion rates at a minimum through vegetation protection practices and erosion and sediment controls.

Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The impacts from the projected future oil and gas development under Alternatives 1 through 5 would combine with surface disturbance effects from reasonably foreseeable oil and gas development likely to occur nearby. The contribution to surface disturbance under each alternative to total oil and gas RFFAs would be less than 3 percent for all alternatives. The types of cumulative impacts to surface water resources would be the same as those listed for past and present actions.

Total projected fresh water use for drilling and completion under Alternatives 1 through 4 range from approximately 1,079 acre-feet to 1,158 acre-feet over the 20-year timeframe of projected development. This fresh water use would combine with the estimated regional fresh water use for oil and gas RFFAs of 22,304 acre-feet over the same 20-year period, resulting in an average total fresh water use over a 20-year period of approximately 1,170 acre-feet per year, using the same assumptions for water recycling and drilling water used to project the water usage under the alternatives' RFD. This cumulative projection is approximately 0.2 percent of the water currently allocated to "Industrial" use in the region, which is 560,000 acre-feet per year.

4.5.2 Groundwater

4.5.2.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for direct and indirect effects consists of the individual lease tracts and the four zones that encompass the leases.

Scoping Issues

Relevant issues and concerns raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development.

- Potential future development of oil and gas leases might result in degradation of groundwater resources.
- Water depletion from drilling, hydraulic fracturing, and production activities may affect long-term availability of existing water sources.
- Groundwater (in particular, drinking water) may be contaminated from chemicals used in drilling and hydraulic fracturing operations, due to the characteristics of the oil/gas formations, aquifer formations, and their interconnectedness.

Assumptions

The following assumptions were used in the analysis of potential impacts to groundwater:

- Future exploration and development proposals would be subject to specific state and federal regulatory and permitting requirements and additional site-specific environmental analysis under NEPA.
- These subsequent analyses would address site-specific water resource conditions, establish appropriate resource protections to minimize adverse impacts, and serve as the basis for any project-level design features or best management practice requirements.
- The analysis assumes compliance with federal and state regulations, policies, and permit conditions. Therefore, while there would be some risk to drinking water from groundwater sources should there be a break in the casing, the extent of the risk cannot be predicted and is assumed to be minimal due to compliance with the regulations.

- Most, if not all, of the aquifers supplying drinking water are alluvial aquifers, as noted in Chapter 3.0, Section 3.5.6.1, which states that the alluvial aquifers have the most productive wells and most wells are concentrated in the alluvial valleys. It is assumed that the deeper aquifers that are near or connected to the oil and gas formations are not the source of drinking water that is protected by the Colorado Source Water Assessment and Protection (CSWAP) area designations due to their general poor water quality.

Impact Indicators

Impact indicators include the following metrics:

- The extent of development in areas where groundwater resources are potentially susceptible to degradation (see Aquifer Sensitivity in **Figure 3.5-6**). As noted in Section 3.5.6.2, Zones 1 and 4 leases have the greatest extent of high aquifer sensitivity, Zone 2 is primarily in an area with low aquifer sensitivity, and Zone 3 is primarily medium sensitivity. Impacts would be most severe in an area with high aquifer sensitivity, large areas of projected future oil and gas development, and few lease stipulations that would minimize adverse impacts.
- The extent of impacts that may result in potential degradation of groundwater resources, based on information collected from the intensive monitoring in the region conducted by federal, state, and local governments and private entities for over a decade.
- Potential impacts to groundwater sources in SWAP areas.

Methods of Analysis

The methods of analysis include the review of available information on groundwater quality and oil and gas activities, and an assessment of the risks that those activities may degrade aquifers. In addition, the analysis involves the identification of leasing stipulations for other resources that would be in place to protect groundwater resources under each alternative if groundwater stipulations are absent or insufficient.

4.5.2.2 Stipulations Providing Coverage to Groundwater Resources

There are no stipulations developed specifically to protect groundwater in the 1993 Oil and Gas Leasing Final EIS (USFS 1993a). Therefore, there are no groundwater stipulations to be considered for Alternatives 1 and 2. In the 2014 WRNF Oil and Gas Leasing Final EIS (Appendix A, USFS 2014a), a CSU stipulation was developed for the coverage of groundwater resources:

> *Where specific groundwater resources exist, special design, construction, operation, mitigation, or monitoring may be required. Mitigation may include use of contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface will not be allowed.*

There is a NSO stipulation developed to protect Public Water Supply Source Areas. The coverage of this stipulation related to the state-designated CSWAP areas and local SWPP areas within the leases is addressed in Section 4.5.1, Surface Water, because it protects both surface water and groundwater sources. This analysis is not repeated in this section. Timing stipulations are not considered in the analysis because these stipulations would not affect groundwater.

4.5.2.3 Impacts Common to All Alternatives

This discussion refers to Alternatives 1 through 4, but not to Alternative 5 because no drilling or development would be allowed under that alternative.

Potential impacts from oil and gas drilling and production that could occur are listed below:

- Depletion of groundwater resources due to well drilling and completions.
- Accidental spills of hydrocarbons, fuels, or chemical additives used in the well drilling and completion process on the surface. Spills from surface activities would pose the highest risk to shallower groundwater because deeper aquifers would generally be hydraulically isolated.
- Subsurface contamination of groundwater from drilling and completion. Effects could occur through loss of well integrity due to breaches in mechanical, physical, and engineered barriers designed to direct or contain subsurface fluids in drilling or completion operations of the wells.

Aquifers that could be potentially at risk from contamination are Underground Sources of Drinking Water under the Safe Drinking Water Act. Underground Sources of Drinking Water is defined by the USEPA as "an aquifer or portion of an aquifer that:

- Supplies any public water system or that contains a sufficient quantity of ground water to supply a public water system, and
- Currently supplies drinking water for human consumption, or
- Contains fewer than 10,000 milligrams per liter total dissolved solids and is not an exempted aquifer" (USEPA 2012a).

There is a low risk of depletion of groundwater resources by oil and gas well drilling because fresh water for drilling is obtained primarily from surface water sources. In addition, recycling of hydraulic fracturing water of up to 100 percent was reported in the Colorado River basin in 2013 (USEPA 2015d). Although recycling may vary depending on infrastructure and technology used by different operators, recycling rates reported by the USEPA of 80 to 100 percent are indicative that it is possible to achieve such rates. The recycling rates apply to water used for hydraulic fracturing. It is possible that drilling may have to rely on fresh water to maintain drilling fluid quality and consistency that might be compromised by the use of recycled hydraulic fracturing water. According to the development assumptions of Section 2.7.3, an average 0.77 acre-feet of fresh water would be used to drill a vertical or directional well and 6.44 acre-feet of recycled water would be used during well completion. An average of 3.22 acre-feet of fresh water and 77.3 acre-feet of recycled water would be used to drill and complete a horizontal well, respectively. In addition, 4.9 acre-feet and 9.67 acre-feet of produced water is assumed to be recovered from each vertical/directional and horizontal well, respectively, during its 20- to 30-year life.

Sources of potential groundwater contamination include leaks and spills of fluids such as fuels from storage containers, transportation accidents, leaks from impoundments, and well integrity breaches. Likely groundwater sources to be affected would be the near-surface alluvial aquifers because they are shallow, unconfined, and composed of materials that transmit fluids more easily than the solid rock that separates deeper aquifers.

In order to minimize the risk of contaminating shallow aquifers due to leaks and spills, the transportation, storage, and disposal of fuels and chemicals would be done in accordance with regulatory requirements of applicable federal and state programs. In addition, operators would maintain and implement Spill Prevention, Control, and Countermeasure (SPCC) plans for petroleum-based materials and emergency response plans for non-petroleum materials (various ingredients of fracturing fluids and well treatment chemicals).

Hydraulic fracturing has been implicated as a potential source of groundwater contamination. However to date, no contamination has been attributed to hydraulic fracturing in the analysis area (USFS 2014a). Well integrity problems rather than hydraulic fracturing appear to pose a greater risk of causing groundwater contamination (COGCC 2011). The COGCC recently strengthened rules to increase

protection of groundwater from oil and gas operations, including stricter casing and cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

A draft report recently released by the USEPA assesses the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. While specific instances where one or more mechanisms associated with hydraulic fracturing were identified as having impacted drinking water, the study did not identify widespread, systematic impacts on drinking water from mechanisms associated with hydraulic fracturing (USEPA 2015c).

Public concern about the use of hydraulic fracturing has been focused on the potential for contamination of freshwater aquifers and impacts to domestic and municipal water supplies. Hydraulic fracturing would be conducted to stimulate the hydrocarbon-bearing formation, creating additional pathways to facilitate hydrocarbon production. Agents called “proppants” (typically sand, aluminum, glass, or plastic beads with less than 1 percent of other compounds) are mixed with fresh water or produced water and then pumped into the producing formation with sufficient hydraulic pressure to create secondary porosity fractures. The proppants then prop open the secondary porosity fractures to facilitate gas and fluid movement to the borehole. Following completion of hydraulic fracturing activities, the pressure differential between the formation due to the overlying bedrock and the borehole that connects with the surface causes most of the injected fluids to flow toward the borehole and then upward to the surface along with the hydrocarbon fluids released from the formation. The composition of this mixture, called flowback water, gradually shifts over a period of several days to a few months as injected fluids that have not yet migrated back to the wellbore or that have reacted with the native rock are carried out of the formation.

In 2011, the COGCC published an analysis of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph:

> *Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing.*

Based on this information, proper implementation of hydraulic fracturing of oil and gas wells drilled to access federal fluid minerals or for accessing private fluid minerals from federal surface lands does not represent a significant adverse impact to human health and the environment.

Well integrity problems rather than hydraulic fracturing appear to pose a greater risk of causing groundwater contamination (COGCC 2011). Drilling scenarios are developed to prevent fluids and produced hydrocarbons from migrating upward into fresh water zones. Geologic and engineering reviews are conducted to ensure that the cementing and casing programs are adequate to protect all downhole resources. The COGCC recently strengthened rules to increase coverage of groundwater from oil and gas operations, including stricter casing and cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

In addition to the vertical separation of the upper extent of fractures and freshwater aquifers, the BLM and COGCC require the proper casing and cementing of wellbores to isolate aquifers penetrated by a wellbore. The BLM requires that surface casing be set from 800 to 1,500 feet deep, based on a

geological review of the formations, aquifers, and groundwater. Cement is then pumped into the space between the casing and surrounding rock to prevent fluids from moving up the wellbore and casing annulus and coming in contact with shallow rock layers, including freshwater aquifers. BLM petroleum engineers review well and cement design and final drilling and cementing logs to ensure that the cement has been properly placed. When penetration of groundwater and freshwater aquifers is anticipated, BLM inspectors may witness the cementing of surface casing and subsequent pressure testing to ensure that the annular space between the casing and borehole wall is properly sealed.

Potential impacts to groundwater resources from the proposed development would include contamination of the groundwater with produced water, drilling mud, and petroleum constituents. With proper construction practices, drilling practices, and BMPs, no significant adverse impact to groundwater aquifers is anticipated to result from future oil and gas development. For context, it should be noted that the amount of each zone projected to be disturbed for reasonably foreseeable oil and gas development is very small compared to the extent of the coverage by NSO and CSU stipulations. This comparison is presented in the tables in the following sections.

Impacts Identified in the WRNF Final EIS

The WRNF Final EIS identified potential adverse impacts to groundwater from future oil and gas development as inadvertent releases of chemicals through spills, contamination due to improperly cased and sealed wells, or due to releases from improperly constructed or maintained reserve pits (USFS 2014a, p. 92). The WRNF Final EIS states that oil and gas development and production typically do not have a significant adverse effect on groundwater quantity (USFS 2014a, p. 92). Because the oil and gas target formations are hydraulically isolated from the shallow aquifers it is unlikely that hydraulic fracturing would adversely affect underground sources of drinking water (USFS 2014a, p. 93).

The WRNF Final EIS states that use of Colorado River water is not expected to deplete the shallow groundwater supplying springs and seeps. It also points out that acquisition of fresh water from commercial sources for hydraulic fracturing and other drilling and completion stages would supplement local groundwater sources to minimize consumptive use and the resulting groundwater depletion (USFS 2014a, p. 144).

4.5.2.4 Impacts by Alternative

Alternative 1 (No Action Alternative)

Stipulation Coverage

Table 4.5-3 lists the percentage of state CSWAP and local SWPP areas that would be covered by all NSO stipulations under Alternative 1, which includes 100 percent of the CSWAP areas within Zone 1, 33 percent of the CSWAP areas and 42 percent of the SWPP areas within Zone 2, and 8 percent of the CSWAP areas and 9 percent of the SWPP areas in Zone 3 and 2 percent of the CSWAP areas in Zone 4. These CSWAP and SWPP areas were designated to assess the risk and protect groundwater supplies to local communities and the public. However, the exact source of the water, whether to protect shallow or deep aquifers supplying drinking water, is not always available from the CDPHE for security reasons.

Table 4.5-7 lists CSU and NSO stipulations for all resources under Alternative 1. There are no stipulations specifically designed to minimize adverse impacts to groundwater resources under this alternative, so the table presents the stipulations for all resources with the assumption that, should these stipulations be implemented, they also would minimize impacts to groundwater especially where NSO would be allowed within the leases. It should be noted that an NSO stipulation on the lease would most likely move the disturbance off the lease, but the location would be unknown at this time.

Table 4.5-7 CSU and NSO Stipulations for all Resources under Alternative 1

Zone	Total Acres	CSU (% of Zone)	NSO (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	0.8
2	24,938	5	39	2.7
3	42,767	8	8	0.3
4	2,562	0	3	0.8
Total	**80,381**	**6**	**29**	**1.1**

[1] See **Table 2-8** for the source of this information.

Potential impacts to groundwater under Alternative 1 would be the same as discussed above for impacts to all alternatives. In the absence of specific groundwater stipulations, the stipulations developed to minimize adverse impacts to other resources may offer some groundwater source coverage if the stipulation is extensive enough and in force. As shown in **Figure 3.5-8**, the lease zones cover areas of varying degrees of aquifer sensitivity to potential contamination. Zones 1, 3, and 4 are underlain by areas rated medium to high aquifer sensitivity. The stipulations for other resources may provide a degree of coverage, mainly in Zone 1 where the stipulation coverage is greatest. The stipulations in Zones 3 and 4 would provide less coverage of groundwater resources. Zone 2 is mainly underlain by areas that are rated low to medium sensitivity that may need less coverage. Unless stipulations for other resources have extensive coverage, they may not offer sufficient coverage for groundwater because groundwater protection has elements that are technology- or engineering-based such as closed-loop drilling mud systems and fuel containment.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-7**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development of SWAP areas, the risk of impacts to groundwater resources would be minimal.

Alternative 2

Stipulation Coverage

As noted in **Table 4.5-4**, Zones 1, 2, and 4 would have the same coverage to state CSWAP and local SWPP areas as Alternative 1; 9 percent of the state CSWAP areas (1percent more than under Alternative 1), and 10 percent of the local SWPP areas (1 percent more than Alternative 1) within the leases would be covered by stipulations in Zone 3, which includes the Oak Meadows, Carbondale, and Glenwood Springs water sources.

Table 4.5-8 lists CSU and NSO stipulations for all resources under Alternative 2.

Table 4.5-8 CSU and NSO Stipulations for all Resources under Alternative 2

Zone	Total Acres	CSU (% of Zone)	NSO (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	0.8
2	24,938	5	39	2.7
3	42,767	10	9	0.3
4	2,562	0	3	0.8
Total	**80,381**	**7**	**30**	**1.1**

[1] See **Table 2-8** for the source of this information.

Impacts from Projected Future Oil and Gas Development

The analysis of groundwater impacts for Alternative 2 would be similar to Alternative 1 except that there would be slightly more coverage by stipulations in Zone 3 due to increased total NSO acreage.

Alternative 3

Stipulation Coverage

Under Alternative 3, there are CSU stipulations that are designed to protect groundwater resources. **Table 4.5-9** compares the groundwater CSU stipulation coverage with that of stipulations for all resources under Alternative 3. Although the extent of the other stipulations would appear to provide adequate coverage of groundwater sources, technology- and engineering-based measures to protect groundwater resources cannot be implemented through the other stipulations. As noted in **Table 4.5-5**, 7 percent of CSWAP areas in Zone 1, 4 percent of the CSWAP areas and 42 of the SWPP areas in Zone 2, and 9 percent of the CSWAP areas and 8 percent of the SWPP areas in Zone 3 would be covered by the NSO stipulation designed to protect public water supply source areas. In addition to the NSO stipulation coverage of SWAP areas, under Alternative 3 there is a CSU stipulation to protect groundwater resources that WRNF may implement to require special analysis and mitigation plans where specific groundwater resources exist. Special design, construction, operation, mitigation, or monitoring may be required (USFS 2014a, Appendix A, p. 498.) This CSU stipulation also would cover 1,390 acres of the Carbondale Crystal Well SWPP area, approximately 1 acre of the Oak Meadows SWPP area.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-9**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development of SWAP areas, the risk of impacts to groundwater resources would be minimal.

Table 4.5-9 Comparison of Groundwater CSU Stipulations Under Alternative 3 to all CSU and NSO Stipulations

Zone	Zone Total (acres)	Groundwater Resource CSU Stipulation (% of Zone)	CSU of all Resources (% of Zone)	NSO of all Resources (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	100	0.8
2	24,938	5	100	87	2.7
3	42,767	3	100	86	0.2
4	2,562	3	100	99	0.8
Total	**80,381**	**3**	**100**	**89**	**1.1**

[1] See **Table 2-8** for the source of this information.

Alternative 4 (Proposed Action)

Stipulation Coverage

Table 4.5-10 compares the groundwater CSU stipulation coverage with that of the stipulations for other resources under Alternative 4. Compared to Alternative 3, additional acreage would be CTL under Alternative 4. The CTL acreage is included with the NSO percentage in **Table 4.5-10** and applies only to Zone 3. Closing the leases is likely to provide additional limitations to minimize adverse impacts to groundwater sources (SWAP areas) in Zone 3 because no development could occur to access those leases, whether on-lease or off-lease. This would be more restrictive than implementation of NSO stipulations. As under Alternative 3, the measures to minimize potential impacts to groundwater resources may be dependent on engineering and technology measures that may not be implemented by relying on stipulations for other resources. As noted in **Table 4.5-6**, coverage of the combination of areas closed to leasing and NSO stipulation designed to protect public water supply source areas in Zones 1, 2, and 4 would be the same as Alternative 3. Zone 3 coverage would increase to 70 percent of the CSWAP areas and 99 percent of the SWPP areas. Existing leases within Zone 3 would be further protected by the cancellation of all or part of 25 leases under this alternative, precluding any future oil and gas development. This lease cancellation and closure to leasing of the surrounding area in the WRNF within a large part of Zone 3 would further minimize adverse impacts to the CSWAP and SWPP areas compared to Alternative 3.

Table 4.5-10 Comparison of Groundwater Stipulations Under Alternative 4 to all CSU and NSO Stipulations and CTL Areas

Zone	Zone Total (acres)	Groundwater Resource CSU Stipulation (% of Zone)	CSU of all Resources (% of Zone)	NSO/CTL of all Resources (% of Zone)	Initial Surface Disturbance from Future Oil and Gas Development (% of Zone) [1]
1	10,114	0	100	100	0.8
2	24,938	5	100	87	2.7
3	42,767	3	100	95	0.1
4	2,562	3	100	99	0.8
Total	**80,381**	**3**	**100**	**93**	**1.0**

[1] See **Table 2-8** for the source of this information.

Impacts from Projected Future Oil and Gas Development

The surface disturbance from future oil and gas development would be a small portion of the analysis area, as shown in **Table 4.5-10**. The low percentage of disturbance can be used as an indicator to show that most of the area would be undisturbed by development that could adversely impact groundwater. Combined with the coverage from stipulations that would minimize disturbance and development within CSWAP and SWPP areas, the risk of impacts to groundwater resources would be minimal.

Alternative 5

There would be no stipulations in effect for the coverage of groundwater resources. Plugging, abandonment, and reclamation activities would be conducted in accordance with federal and state requirements for spill prevention and containment. Once reclamation is completed, there would be less potential to adversely affect groundwater under this alternative because no oil and gas development would occur from this action. Alternative 5 would have the least potential to adversely affect groundwater resources because oil and gas drilling and development would not occur.

Summary of Impacts

There are no groundwater coverage stipulations in Alternatives 1 and 2. It may be possible that stipulations for other resources may offer some coverage for groundwater, but stipulations for other resources may not be adequate. Protection of groundwater resources would rely on operators' compliance with federal and state requirements.

Alternatives 3 and 4 have a groundwater stipulation that covers limited areas of potential concern. Stipulations for other resources would not be adequate to protect groundwater because they do not contain the technological and engineering controls necessary to lower the risk of contamination. Alternative 4 provides more potential coverage for groundwater when taking into account the leases that would be canceled and closed to future leasing.

4.5.2.5 Cumulative Impacts

Cumulative Impacts Analysis Area

Cumulative effects area would extend to water resources that may be affected by oil and gas development on the leases and within a 2-mile buffer around the leases analyzed for direct and indirect effects.

Past and Present Actions

Past and present activities are described in detail in Section 4.1. In the region, groundwater has been and is beneficially used for agricultural, commercial, domestic, industrial, municipal, recreational, and wildlife purposes. In the WRNF, groundwater is primarily used for domestic (special-use-permit holders, campgrounds, and administrative sites), wildlife, livestock, and ecosystem support (groundwater discharging as springs to wetlands and streams). While not a major source of water in the WRNF, groundwater, where used, is primarily for domestic purposes. The water quality is generally good but can be highly mineralized (USFS 2014a).

Some groundwater from deep in the Mesaverde formation is produced from existing natural gas wells. This water obtained at great depth (nearly 8,000 feet below the ground surface) is typically of very poor quality, and not considered usable to support wetlands, stream flow, aquatic life, or human uses. This water is generally managed by disposing of it at certified disposal wells or other facilities off the WRNF.

One water disposal well in the WRNF in the Divide Creek area receives water from on-Forest gas production from wells within the Divide Creek Unit. The produced water from these wells is injected into a deep horizon about 8,000 feet below the ground surface. The deep strata where produced water is being

withdrawn or injected is not known to be in hydraulic communication with near-surface strata providing water for on-Forest uses.

Reasonably Foreseeable Future Actions

Groundwater consumption and development is anticipated to increase; thereby decreasing groundwater resources. Industrial use, including from oil and gas development, is anticipated to increase on federal, state, private and other lands within and adjacent to the WRNF. According to the RFDS of the region, a total of 330 acre-feet of fresh water and 2,750 acre-feet of recycled water will be used to drill and complete, respectively, vertical or directional wells. A total of 55 acre-feet of fresh water and 1,310 acre-feet of recycled water will be used to drill and complete, respectively, horizontal wells. In addition, 2,090 acre-feet and 80 acre-feet of produced water is assumed to be recovered from the vertical/directional and horizontal wells, respectively, during their 20- to 30-year lives.

Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The oil and gas industry's reliance on surface water resources and recycling of fracturing fluids and/or produced water rather than the use of fresh groundwater resources would cause little cumulative impact on groundwater availability. As stated in the WRNF Final EIS oil and gas development and production typically do not have a significant adverse effect on groundwater quantity (USFS 2014a, p. 92). Because the oil and gas target formations are hydraulically isolated from the shallow aquifers it is unlikely that hydraulic fracturing would adversely affect underground sources of drinking water (USFS 2014a, p. 93).

With an anticipated increase in wells and water use, the failure of wells in the region – not just those related to oil and gas development – could increase the communication between surface water and groundwater, thereby increasing the risk of water contamination. In addition, increased activity in the CIAA would increase the risk of spills and groundwater contamination. As noted in the WRNF Final EIS (USFS 2014a), potential drilling of natural gas or oil wells could affect groundwater resources in discrete areas, particularly if unintended spills or well failures occur. Compliance with stipulations, BMPs, and existing rules and regulations would combine to reduce the potential of groundwater contamination. Further, the likelihood that an unintended release would occur simultaneously with another event that could exacerbate or be exacerbated by a release is low and unlikely to create a cumulative effect.

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4.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

This section addresses the potential impacts of reasonably foreseeable oil and gas development within the leases on vegetation resources including vegetation cover types, wetland and riparian habitats, special status plant species and significant plant community habitats, and the potential for establishment and spread of noxious and invasive weeds (collectively referred to as "vegetation"). The future oil and gas development analyzed for each alternative is based on the RFDS projections that are anticipated to follow the leasing decision under each alternative. Section 3.6.2 lists the vegetation cover types, defines special status plant species and significant plant communities, and describes each habitat type in more detail.

4.6.1 Analysis Assumptions and Approach to Analysis

4.6.1.1 Analysis Areas

For vegetation resources there are two separate analysis areas: general vegetation analysis area and special status plant species analysis area.

The general vegetation analysis area is comprised of the 65 leases (lease area), which are divided into four zones. The general vegetation analysis area applies to vegetation communities, riparian/wetland habitats, and noxious weed analyses and encompasses approximately 80,380 acres.

The special status plant species analysis area is defined as the lease area (Zones 1, 2, 3, and 4) plus a 300-meter extension beyond the edge of the lease boundary (off-lease area). The special status plant species analysis area applies to both special status plant species suitable habitats and significant plant community habitat analyses and encompasses approximately 110,768 acres.

4.6.1.2 Scoping Issues

Scoping issues identified for vegetation cover types, noxious weeds, and riparian/wetland habitats to be considered include:

- Remediation of forested areas and concern about effectiveness of management plans.
- Maintenance of plant diversity along wildlife corridors and key wildlife areas.
- Impacts on already existing fire-prone conditions, especially Gambel oak shrublands.
- Maintenance of existing conservation easements.
- Habitat fragmentation and the establishment of noxious weeds, especially along the Thompson Divide area (riparian and instream habitat especially).
- Impacts of noxious weeds on threatened and endangered species.
- Concerns over hydrological changes and impacts to wetlands and riparian areas.

Scoping issues identified for special status plant species and significant plant communities to be considered include:

- Impacts to special status plants, especially within the area locally known as the Thompson Divide.
- Threats to DeBeque phacelia due to natural gas development.
- Cumulative impacts to rare plant species.

- Inadequate protections for rare plant species.
- Need for field surveys to identify special status plants prior to leasing.

While many of the above issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. All issues listed above would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

4.6.1.3 Assumptions

Assumptions were made concerning the impacts of making lands available to lease for oil and gas exploration and development as they relate to vegetation as a whole.

Assumptions for general vegetation communities, noxious weeds, and riparian/wetland habitats include:

- The RFDS included disturbance acreages and development assumptions for wells, pipelines and road by zone.
- Forest Service vegetation data (FSVeg) and National Wetland Inventory are used to represent the vegetation communities and riparian/wetland habitat in the analysis area, and are the basis for modeled potential habitat.
- All future development would need to be compliant with the WRNF LRMP, GMUGNF LRMP, GJFO RMP, and CRVFO RMP (for development on adjacent BLM lands due to WRNF NSO stipulations).
- Adverse impacts to vegetation could occur during or after initial disturbance. Impacts also could occur as a result of the continued use, maintenance, or reclamation of any resulting infrastructure.
- There is a likelihood of noxious weeds spreading and/or proliferating as disturbance expands.
- All non-resource-specific NSO stipulations would minimize impacts to vegetation resources if implemented. It is not assumed that CSU or TL stipulations not specific to vegetation resources would reduce impacts to general vegetation communities, noxious weeds, and riparian/wetland habitats.

Assumptions for special status plant species and significant plant communities include:

- Areas where sensitive plant species and significant plant communities may exist are modeled and may not be based on known occurrences. Botany surveys would be required to be performed by a qualified botanist during appropriate survey periods for all potential special status plant species prior to any ground-disturbing activity.
- The decision to make lands available for leasing could lead to future oil and gas development. The impacts from that development would not be realized until a later time under a separate decision at the APD stage of permitting, and would require site-specific NEPA analysis.
- The decision whether to make lands on the WRNF available to lease for potential future oil and gas exploration and development could result in future development on adjacent BLM, state, and private lands. Therefore, adverse impacts to rare plants could be realized on lands other than the NFS lands when leased fluid minerals are accessed from surface locations off-lease. Because the off-lease locations are unknown at this time, the impacts to vegetation cannot be quantified.

- All future development activities would need to be compliant with the WRNF LRMP, GMUGNF LRMP, GJFO RMP, and CRVFO RMP (for development pushed off onto adjacent BLM lands due to WRNF NSOs.
- Water depletions associated with well drilling can affect downstream river flows and the availability of water for Ute ladies' tresses.
- Adverse impacts to rare plants could occur during or after initial disturbances. These impacts also could occur as a result of the continued use, maintenance, or reclamation of any resulting infrastructure. This infrastructure could remain on the landscape for up to 30 years with additional time necessary to achieve full reclamation.
- All non-resource-specific NSO stipulations would minimize impacts to special status plant species and significant plant communities if implemented.

In addition to the assumptions listed above, it is assumed that all operators will comply with laws and regulations (e.g., CWA, Endangered Species Act [ESA], etc.) and the analysis assumes implementation of all laws and regulations.

4.6.1.4 Impact Indicators Used for Analysis

Impact indicators identified to analyze the effects of the alternatives on vegetation communities, noxious weeds, and riparian/wetland habitats include:

- Vegetation communities: acre (percent) of surface disturbance by vegetation type and alternative
- Riparian/wetland habitats: acre (percent) of wetland habitat that may be degraded or lost, by alternative
- Noxious weeds: Qualitative and quantitative (acres and percent of surface disturbance) analysis

Impact indicators for special status plant species and significant plant communities include:

- The extent of potential adverse impacts to special status plant species and significant plant communities from reasonably foreseeable oil and gas development is compared by alternative by calculating the estimated acres and percentage of the following habitats that may be degraded or lost.
  - Potential habitat for federally listed, BLM, and Forest Service sensitive plant species
  - Critical habitat for federally listed species
  - Presence of known individuals or populations within the analysis area
- The potential for adverse impacts to special status plant species and significant plant communities is compared by alternative by calculating the estimated acres and percentage of the areas where sensitive plant species habitat would overlap with NSO areas. The assumption would be that NSOs, even if not developed to address these species, would still minimize impacts to special status plant species and significant plant communities by limiting surface disturbance.

4.6.1.5 Methods of Analysis

Methods of analysis for general vegetation communities, noxious weeds, and riparian/wetland habitats include the following for each alternative:

Vegetation Communities

- Identify vegetation community types within the lease area.
- Identify stipulations by alternative that pertain to specific vegetation communities (some are NSO, some are CSU).
- Identify acres of impact per lease zone using surface disturbance projections contained in Chapter 2.0.
- Estimate acres of impact per zone to calculate percentage of each vegetation community's approximate disturbance under each alternative.

Riparian and Wetland Habitats

- Same as vegetation communities' methodology (above), with consideration of fen and other riparian/wetland NSO and CSU stipulations.

Noxious Weeds

- Noxious weed analysis is addressed qualitatively based on the assumption that where more acreage of disturbance and vehicle access is projected, there is a greater likelihood of noxious weeds spreading and establishing.
- Identify weed prevention and treatment management practices that would be applied to all leases and ground-disturbing activities within the lease area.
- Identify reclamation/restoration requirements that would be applied to all leases and ground-disturbing activities within the lease area.

Special Status Plant Species and Significant Plant Communities

- Identify rare plant potential habitat within the lease area.
- Disclose acres of each lease without NSO stipulations in each type of rare plant habitat to identify those locations that may be open to surface disturbance.
- Identify acres of potential surface disturbance per lease zone using surface disturbance projections contained in Chapter 2.0.
- Estimate acres of impact to calculate the percentage of each sensitive species' modeled habitat's approximate disturbance per lease from reasonably foreseeable oil and gas development.

4.6.2 Stipulation Coverage of Vegetation Resources

In order for oil and gas leasing within the analysis area to be consistent with environmental laws and regulations, this analysis considers proposed lease stipulations to reduce potential impacts of oil and gas development on vegetation communities, riparian/wetland habitats, and special status plants and significant plant communities. There are no specific lease stipulations related to noxious weeds. The methodology in developing stipulations is discussed in Section 1.4.6, "Lease Stipulations," and the rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS. The definition of the resource and purpose of the stipulation is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS and in Appendix B of the 1993 Final EIS. The definition of the resource and purpose for GMUGNF resources is identified on each stipulation form in Appendix C of the 1993 GMUGNF Oil and Gas Leasing Plan Amendment.

The following subsections identify the NSO and CSU stipulations that were included in the WRNF 1993 Alternative (Alternative 1, the No Action Alternative) and those proposed under the action alternatives to reduce potential disturbance impacts of oil and gas development on vegetation communities,

riparian/wetland habitats, noxious weeds, and special status plant species and significant plant communities. There are no TL stipulations associated with vegetation.

Standard lease terms allow for reasonable measures that may be required to minimize adverse impacts to other resource values, land uses, or land users. Standard lease terms are described in more detail in Section 1.1.5.1.

4.6.2.1 Resource-specific Stipulations

Table 4.6-1 identifies five NSO and three CSU stipulations specific to vegetation resources. Only the Riparian/Wetland – GMUGNF NSO stipulation applies to Alternatives 1 and 2. All other NSO and CSU stipulations apply to Alternatives 3 and 4 only. There are no TL stipulations associated with vegetation resources.

Table 4.6-1 Vegetation Resource-specific Stipulations

Stipulation	Alternatives 1 and 2[1, 3]	Alternatives 3 and 4[2, 3]
NSO		
Alpine	N/A	X
Fen Wetlands		X
Water Influence Zones (WIZ)		X
Threatened, Endangered, Proposed and Candidate (TEPC) Plant Species Populations and Habitats		X
CSU		
Spruce-Fir Old Growth and Old Growth Recruitment Stands	N/A	X
Plant Species of Local Concern, including Significant Natural Plant Communities		X
Sensitive Plant Species		X

[1] Alternatives 1 and 2 have the same stipulations.

[2] Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

[3] Under Alternatives 1,2, 3, and 4, the Riparian/Wetland GMUGNF NSO stipulation would be applied to approximately 2.9 acres of GMUGNF-managed lands within the leases. This comprises about <0.1 percent of the Analysis Area. The stipulations under consideration in this EIS would not be applied to this acreage.

Definitions: NSO: No Surface Occupancy; CSU: Controlled Surface Use.

NSO Stipulations

The Alpine NSO stipulation would preclude surface disturbance in alpine habitats for the purpose of preventing significant or permanent impairment to alpine vegetation and preventing impacts to rare plant and wildlife species dependent on alpine habitats. There are no exceptions or waivers associated with this stipulation. A modification may be granted if an environmental analysis demonstrates, through specific surveys, that the area of proposed activities is not alpine habitat (Appendix A, USFS 2014a). Under Alternatives 1 and 2, Alpine NSO is unchecked because alpine habitat is not identified within the lease area.

The Fen Wetlands NSO stipulation precludes surface disturbance in all areas within 330 feet of fen wetlands within the leasing area in order to maintain species richness, plant diversity, soil nutrient levels, water budgets, and flow patterns to fen wetlands in order to sustain their ecological function. There are

no exceptions for this stipulation. A modification may be granted if an environmental analysis determines that the wetland is not a fen wetland. However, it should be noted that the NSO stipulation for WIZ (floodplains, streams, wetlands, lakes, or naturally occurring ponds) may still apply to these areas. A waiver may be granted if an environmental analysis determines that the areas mapped as fen wetlands in the entire leasehold do not possess wetland attributes (Appendix A, USFS 2014a).

The WIZ (Stream, Lakes, Floodplains, Wetlands or Naturally Occurring Ponds) NSO stipulation precludes surface disturbance in all areas within a minimum horizontal width of 100 feet from each side of the water-dependent features, but may be wider in areas with well-developed floodplains. An exception may be granted if an environmental analysis finds the nature of the Proposed Action could be conditioned so as not to negatively impact the water resources identified. Consideration must include the degree of slope, soils, importance of the amount and type of wildlife and fish use, water quality, riparian vegetation, and other related resource values. A modification may be granted if an environmental analysis determines that project design or mitigation measures can be used to prevent impacts to WIZ. Consideration must include the variability in terrain, degree of slope, soils, importance of the amount and type of wildlife and fish use, water quality, riparian vegetation, and other related resource values. If wetlands are present, no exceptions or modifications would be granted unless compliance can be demonstrated with Executive Order (EO) 11990. A waiver may be granted if an environmental analysis determines that the areas mapped as WIZ in the entire leasehold do not possess those attributes (Appendix A, USFS 2014a).

The TEPC Plant Species Populations and Habitats NSO stipulation precludes surface disturbance of occupied and potential habitats necessary for the maintenance or recovery of species listed under the ESA (including proposed and candidate species) or by the State of Colorado as threatened or endangered. An exception may be granted if an environmental analysis demonstrates that the activity would have negligible impacts and would not cause adverse effects to species or their critical habitats. If an exception is granted, monitoring, special design, construction, and implementation measures, including relocation of operations by more than 200 meters (656 feet), may be required. In such situations that an exception may be granted, the activity would be subject to additional COAs and reclamation standards to ensure resource values are maintained. Granting of an exception is a discretionary action, which the operator should not routinely expect. A modification may be granted if an environmental analysis determines that the species has relocated; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or recovery of the species. If a species is delisted, the stipulation will continue to apply for 5 years after de-listing to satisfy monitoring requirements. Other requirements will apply if the species remains classified as sensitive, or is otherwise protected. A waiver may be granted if an environmental analysis determines that the species is delisted, becomes extinct or if the site has been unoccupied by the species for a minimum period of 15 years (Appendix A, USFS 2014a). Under Alternatives 1 and 2, TEPC Plant Species Populations and Habitats NSO is unchecked because populations are not mapped. This stipulations would be addressed during site specific NEPA.

As noted in **Table 4.6-1**, A Riparian/Wetland – GMUGNF NSO stipulation, applied to about 3 acres of the lease area, precludes surface disturbance in wetlands and floodplains per EOs 11990 and 11988, respectively, within the GMUGNF. The purpose of the EOs is to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and floodplains and to avoid new construction in wetlands wherever there is a practical alternative. Additionally, it is recognized that there is a direct relationship between impacts on wetlands and floodplains and effects on water quality and aquatic ecosystems. There is a high risk of irreversible and irretrievable impacts on aquatic ecosystems with operations and development in wetlands, floodplains, and riparian areas within the GMUGNF. Waivers, exceptions, or modifications for this stipulation would be considered if it can be shown through environmental analysis and the application of mitigation measures that the impacts to wetlands, floodplains, and riparian resources will be minimized and that no

other alternative route for a road or pipeline is feasible because of environmental effects (Appendix C, USFS 1993b). In such cases, the NSO stipulation for WIZ may still apply to portions of these areas.

CSU Stipulations

The Spruce-Fir Old Growth and Old Growth Recruitment Stands CSU stipulation is applied to maintain spruce-fir old growth and old growth recruitment stands through the retention of ecological functions of old growth spruce-fir forests and conservation of spruce-fir old growth recruitment forest stands. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the old growth or old growth recruitment stands. A modification may be granted if an environmental analysis determines that the old growth or old growth recruitment stands have decreased through natural causes (e.g., wildland fire, insects, blowdown, etc.); or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the old growth or old growth recruitment stands. There are no waivers associated with this stipulation (Appendix A, USFS 2014a).

The Plant Species of Local Concern CSU stipulation is applied to maintain and manage viable and well-distributed habitats for all existing native and desired nonnative plants, including significant natural plant communities. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. A modification may be granted if an environmental analysis determines that the species is no longer present; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the species and would minimize or eliminate threats affecting the status of the species. A waiver may be granted if an environmental analysis determines that the species is no longer designated as a Species of Local Concern or if the site has been unoccupied by the species for a minimum period of 15 years (Appendix A, USFS 2014a).

The Sensitive Plant Species CSU stipulation is applied to avoid disturbance to sensitive plant species and significant natural plant communities that would result in a trend toward federal listing or loss of viability. An exception may be granted if an environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. A modification may be granted if an environmental analysis determines that the species is no longer present; the occupied habitat has increased or decreased; or that the nature or conduct of the activity, as proposed or conditioned, would not impair values associated with the maintenance or viability of the species and would minimize or eliminate threats affecting the status of the species. A waiver may be granted if an environmental analysis determines that the species is no longer designated as Forest Service sensitive or if the site has been unoccupied by the species for a minimum period of 15 years. (Appendix A, USFS 2014a)

4.6.2.2 All Other NSO Stipulations

Implementation of other (non-vegetation resource) NSO stipulations may minimize impacts to vegetation resources from potential surface-disturbing impacts. Depending on the alternative, these may include, but are not limited to geology/soils (steep slopes and sensitive soils), water resources and aquatic habitat (WIZ), and wildlife (sensitive habitat). However, if the resources these stipulations were designed to address are not found to occur on the leases, the coverage provided by these stipulations to vegetation resources would not be realized. The degree of coverage from the implementation of all NSO stipulations would therefore be overestimated if not all stipulations are implemented.

4.6.3 Impacts Common to All Alternatives

This analysis focuses on potential future surface-disturbing impacts to vegetation resources that could result from making lands available to lease or plugging and abandoning active wells. Surface-disturbing activities from oil and gas development (e.g., construction of well pads, access roads, power lines, and

pipelines) or from reclaiming oil and gas wells (plugging and abandoning) and infrastructure would be similar across all alternatives, but would vary in the overall number of acres impacted and the timing and distribution of disturbance and reclamation. Impacts by alternative are presented in Section 4.6.4.

4.6.3.1 Impacts Identified in the 2014 Final EIS

The 2014 Final EIS for Future Oil and Gas Leasing on the WRNF (USFS 2014a) included an analysis of impacts of future leasing decisions on noxious weeds (see pages 379-385), rare plants (see pages 231-260). Impacts to riparian and wetland areas were tangentially addressed within the surface water impacts analysis (see pages 76-87), and in the rare plants analysis. Impacts to general vegetation were discussion generally within the terrestrial wildlife habitat analysis (see pages 181-219). A biological evaluation was prepared for all potentially affected sensitive plant species that could occur within the analysis area. Impacts identified for vegetation resources within the WRNF Final EIS were considered indirect based on the action of making lands available for future oil and gas leasing. The 2014 Final EIS identified the following direct and indirect effects from reasonably foreseeable disturbance:

- Direct: Trampling of individuals, breaking, crushing, or uprooting plants, driving machinery or skidding material over plants, smothering or covering individuals or populations by slash, chips, soil, dust, or fallen trees resulting in interrupted photosynthesis and reproduction.
- Indirect: Increased dust, changes in vegetation composition and cover, introduction of a gravel layer to the soil surface, increased vectors and habitat for competitive invasive plant species, changing local hydrologic patterns in plant habitat, increased localized fire potential, changed soil conditions in plant habitat, changed foraging behavior of livestock/wildlife in and adjacent to developed areas, changed distribution of recreation activities in and adjacent to developed areas, and impacts on plant pollinators or mycorrhizae (USFS 2014a, page 238).

Impacts under each alternative were compared based on stipulations protecting vegetation habitat available to lease for future oil and gas development and the potential for the RFDS to occur in these habitats. As noted in the 2014 Final EIS, while a very small portion of the leases overlap with the GMUGNF; there would be low potential for the RFDS to occur in these areas (USFS 2014a, page 43).

4.6.4 Vegetation Communities

Surface disturbance from oil and gas development would directly impact vegetation communities and riparian/wetland habitats through vegetation removal and mechanical damage to plants during construction of infrastructure. Plant community composition, species diversity, and the relative occurrence of functional groups and successional stages of those communities would all be affected by oil and gas development. Additional indirect impacts to vegetation from surface disturbance could include soil compaction; erosion; damage to soil structure; mixing of soil horizons; changes in hydrology; loss of biological soil crusts; alteration of soil microbial communities; shifts in soil nutrient availability; reduction in pollinators; and changes to plant species diversity, density or health as a result of noxious weeds (see Section 4.6.3.2). These impacts could affect recovery or reclamation of vegetation communities and riparian/wetland habitats following disturbance. Vehicle traffic on oil and gas access roads could have an impact on vegetation beyond the acreage of disturbance due to the fugitive dust generated from vehicle travel depositing on vegetation, most intensively within approximately 300 feet of the edges of roads. Plant health and vigor may be reduced due to impaired photosynthesis caused by dust accumulation on leaf surfaces. Dust generation and deposition on nearby vegetation also could occur during construction of well pads, road, and pipelines.

Projected oil and gas development under any alternative would result in the disturbance of relatively low percentages of any plant species, plant community, or structural stage. However, where concentrated development occurs over large areas, surface-disturbing activities could affect the overall health of the plant communities and riparian/wetland habitats.

4.6.4.1 Riparian/Wetland Habitats

Riparian/wetland habitats are relatively scarce resources that are vulnerable to degradation. Because of their limited availability, riparian/wetland habitats could potentially have the highest percentage of surface occupancy impacts as compared to other vegetation types.

Development of well pads and roads, and pipelines in or near these areas may produce erosion and sedimentation, compaction and damage to fragile soils, loss of vegetation, and effects to ecosystem function. Any changes in the timing and magnitude of streamflow or introduction of chemical pollutants such as fuels and industrial chemicals also may affect riparian ecosystems. Development also increases the potential for non-native species to invade riparian areas.

While eliminating surface disturbance in and near riparian areas (i.e., implementation of NSO stipulations) is generally assumed to minimize or eliminate these impacts, where development occurs outside of the NSO stipulations, depending on proximity, there is a slight potential for indirect impacts from airborne dust that may settle on riparian vegetation.

4.6.4.2 Noxious Weeds

Surface disturbance and removal of existing vegetation would increase opportunities for the establishment and spread of noxious weeds and other non-native invasive plant species. This could in turn reduce native plant species diversity, native plant densities, desirable plant cover, soil microbial community species composition and function, and overall ecological health of vegetation communities. Decreased ecological health would make vegetation communities and riparian/wetland habitats less resistant to drought, fire, insect pests, livestock and wildlife grazing pressures, non-native species invasion, and other natural disturbances or stressors. Roads act as common vectors for the introduction of noxious weeds and non-native plants, wildlife, and diseases. These noxious weeds and non-native species and diseases can lead to habitat degradation, competition with native species, and potentially reduced survival of native species. Native plant communities could be indirectly impacted by herbicides used to control noxious weeds and other invasive species, potentially resulting in collateral mortality or loss of plant productivity.

The potential for the introduction and spread of noxious weeds would depend on the amount of surface disturbance, the proximity to existing populations, and the BMPs used by Operators to minimize the establishment and spread by noxious weeds. Standard leasing terms allow the BLM to require the relocation of operations up to than 200 meters (approximately 660 feet), noxious weed inventories, or other requirements to minimize impacts of surface disturbance. These may include requirements to clean equipment, use certified weed-free seed and mulch, re-vegetate disturbed areas, and monitor and treat existing weed infestations. While development in close proximity to existing noxious weed populations may increase the potential for weed proliferation, it also offers an opportunity for noxious weed control, since active weed management on the part of the Operator would be required. Similarly, constraining new development to locations with existing populations of noxious weeds also would minimize the potential for establishment of new noxious weed populations in areas where they do not currently exist.

4.6.4.3 Special Status Plant Species and Significant Plant Communities

For all alternatives, any activities that might affect federally listed species would be subject to consultation with the USFWS under Section 7 of the ESA. At the site-specific APD stage of permitting, if adverse effects are likely, the land-managing agency would propose conservation measures, often with advice from the USFWS, which would be applied as COAs. If, during the formal consultation process, either adverse impacts, jeopardy of the species, or destruction or adverse modification of critical habitat is determined to be likely, the USFWS would identify reasonable and prudent alternatives that would avoid the adverse impacts or the likelihood of jeopardy to the species in a Biological Opinion.

Sensitive plant species, plant species of local concern, and significant plant communities all have the potential to be directly and indirectly impacted by oil and gas development. Efforts would be made at the individual project level to minimize direct impacts to special status plant species and habitats. Although agency policy directs management of these species such that they do not trend towards federal listing, they do not receive the same level of protection as federally listed species. Therefore, direct mortality from oil and gas development is possible under any of the alternatives.

Special status plants and significant plant communities could be indirectly impacted by all of the same impacts described for vegetation communities and riparian/wetland habitats in Section 4.6.3.1. These impacts include habitat degradation from noxious weeds and other invasive non-native plant species, harm from herbicide drift during treatment of weeds, physiological impacts from dust deposition, impacts to pollinators and their habitats, shifts in neighboring plant species composition within special status species habitats, and degradation of soils and their microbial communities. These impacts may lead to the loss or degradation of suitable habitat for special status plant species and significant plant communities.

While implementation of NSO stipulations is generally assumed to minimize these impacts, where development occurs outside of the NSO stipulations, depending on proximity, there is a potential for indirect impacts on special status plant species or significant plant communities from deposition of airborne dust, invasive species, herbicide drift from chemical treatment of invasive species, and impacts to pollinators.

4.6.5 Impacts by Alternative

The impacts to vegetation resources by each alternative are analyzed as follows:

- Calculating the percentage of the analysis area covered by resource-specific stipulations and all other NSO stipulations within the analysis areas.
- Evaluating the potential for impacts to vegetation resources based on the relative amount of potential oil and gas exploration opportunities (the RFD) and extent to which the RFDS may be developed in key vegetation communities and habitats.

4.6.5.1 Alternative 1 (No Action Alternative)

Alternative 1 is the No Action Alternative that would reaffirm the existing lease stipulations on the 65 leases as they were originally issued.

<u>Stipulation Coverage</u>

Under Alternative 1, there would be no resource-specific NSO, CSU, or TL stipulations associated with general vegetation or riparian/wetland habitats[1].

General Vegetation

Table 4.6-2 displays the amount of general vegetation cover that would be covered all (combined) NSO stipulations under Alternative 1.

[1] As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2.

Table 4.6-2 Stipulation Coverage of General Vegetation Cover under Alternative 1

Zone	Acres of Vegetation Cover by Zone[1,2]	All NSOs (percent coverage)
1	10,113	100
2	24,938	39
3	42,766	8
4	2,562	3

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF spatial dataset compared to the FSVeg GMUGNF dataset.

[2] Vegetation communities cover the total area of each zone.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) would be covered by the Riparian/Wetland GMUGNF NSO stipulation.

With consideration of all NSO stipulations proposed under this Alternative, there would be no part of Zone 1 open to on-lease oil and gas development as long as all stipulations are implemented without exceptions or waivers. An estimated 61 percent of Zone 2, 92 percent of Zone 3, and 98 percent of Zone 4 would be open to surface-disturbing activities associated with oil and gas development

Riparian/Wetland Habitats

Table 4.6-3 displays the amount of riparian/wetland habitats covered by all NSO stipulations under Alternative 1.

Table 4.6-3 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 1

Zone	Riparian/Wetland Habitat Acreage (percent of zone)[1]	All NSOs (percent coverage)[2]
1	1,718 (17)	100
2	2,668 (11)	38
3	7,895 (18)	8
4	382 (15)	<1

[1] Riparian/wetland habitat was determined by analyzing the following spatial data sources: National Wetland Inventory data, FSVeg data, USFS WIZ data, and USFS Fen data.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

With consideration of all NSO stipulations, none of the riparian/wetland habitats in Zone 1 would available for surface-disturbing activities associated with oil and gas development as long as all stipulations are implemented without exceptions or waivers. An estimated 62 percent of the riparian/wetland habitats in Zone 2, 92 percent of habitat in Zone 3, and 99 percent of habitat in Zone 4 would be open to surface-disturbing activities associated with oil and gas development.

Noxious Weeds

As shown in **Table 4.6-2**, resource-specific NSO stipulations would fully preclude surface disturbance in less than 1 percent of Zone 2, but with consideration of all NSO stipulations, surface-disturbing activities associated with oil and gas development would be precluded in all of Zone 1, 39 percent of Zone 2, 8 percent of Zone 3, and 3 percent of Zone 4. **Table 4.6-4** displays the acres of known noxious weed infestations relative to NSO stipulation coverage in each zone under Alternative 1.

Table 4.6-4 Stipulation Coverage of Known Populations of Noxious Weeds under Alternative 1

Zone	Acres of Known Populations of Noxious Weeds[1]	All NSOs (percent coverage)
1	2	100
2	1,105	51
3	310	2
4	<1	<1

[1] Known population acreages are based on data from both WRNF and GMUGNF.

With consideration of all NSO stipulations, no surface-disturbing activities would occur in Zone 1, so there would be no impacts relative to known noxious weed populations in Zone 1. About half of the area within Zone 2 would be precluded from surface disturbance, but the density of known noxious weed infestations is greatest within this zone. Most of Zone 3 lacks NSO coverage, so the risk of disturbance within known weed infestations is high. Impacts within the small acreage of Canada thistle in Zone 4 would be prevented where this infestation occurs due to all NSO coverage.

Special Status Plant Species

The special status plant species and significant plant communities are analyzed by the habitat categories listed below.

- Federally listed plant species suitable habitat: DeBeque phacelia (*Phacelia submutica*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*), and Colorado hookless cactus (*Sclerocactus glaucus*).
- Special status plant species (BLM sensitive species, Regional Forester's Sensitive Plant Species) suitable habitat types: alpine, fen, forested, and non-forested habitat.
- Significant plant community habitat.

There are no resource-specific stipulations associated with vegetation resources. The following subsections analyze resource-specific stipulations and all other stipulations with respect to vegetation resources within the special status plant species analysis area for Alternative 1.

Table 4.6-5 displays amount of special status plant species and significant plant community suitable habitats and the percent of that habitat covered by individual resource specific NSO stipulations and all NSO stipulations. A 300-meter extension from the leasing area is included in the analysis, because this area could be subject to indirect impacts from on-lease oil and gas development, and because of potential for direct impacts in that area if oil and gas development infrastructure were constructed off the lease to access fluid minerals within the lease using directional or horizontal drilling.

Table 4.6-5 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 1

Location	Suitable Habitat [1] Acreage (percent of zone)	All NSOs (percent coverage)[3]
DeBeque Phacelia Suitable Habitat		
Off-lease[2]	121 (<1)	94
Zone 1	3,729 (37)	100
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Ute Ladies'-tresses Suitable Habitat		
Off-lease[2]	355 (1)	95
Zone 1	4,829 (48)	100
Zone 2	92 (<1)	0
Zone 3	0	N/A
Zone 4	0	N/A
Colorado Hookless Cactus Suitable Habitat		
Off-lease[2]	121 (<1)	94
Zone 1	3,729 (37)	100
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Special Status Plant Species Suitable Alpine Habitat		
Off-lease[2]	1 (<1)	100
Zone 1	0	N/A
Zone 2	0	N/A
Zone 3	0	N/A
Zone 4	0	N/A
Special Status Plant Species Suitable Fen Habitat		
Off-lease[2]	150 (<1)	10
Zone 1	0	N/A
Zone 2	4 (<1)	100
Zone 3	113 (<1)	12
Zone 4	10 (<1)	0
Special Status Plant Species Suitable Forested Habitat		
Off-lease[2]	11,254 (37)	39
Zone 1	6,518 (64)	100
Zone 2	10,844 (43)	47
Zone 3	36,478 (85)	8
Zone 4	2,182 (85)	3

Table 4.6-5 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 1

Location	Suitable Habitat [1] Acreage (percent of zone)	All NSOs (percent coverage)[3]
Special Status Plant Species Suitable Non-forested Habitat		
Off-lease[2]	4,904 (16)	61
Zone 1	2,924 (29)	100
Zone 2	12,985 (52)	34
Zone 3	6,123 (14)	11
Zone 4	379 (15)	<1
Significant Plant Community Habitat		
Off-lease[2]	6,308 (21)	
Zone 1	1,993 (20)	100
Zone 2	306 (1)	0
Zone 3	11,415 (27)	9
Zone 4	0	N/A

[1] Suitable habitats were determined by Forest Service modeling for significant plant species; significant plant community habitat is based on Colorado Natural Heritage Program data, see Section 3.6.5 for more information.

[2] The "off-lease" area is the 300-meter extension from the leasing area. Total NSO column is reported to address the potential for off-lease development. Individual stipulations are not reported for off-lease areas because they are covered by stipulations unrelated to this EIS. For off lease areas only, the total NSO percentage includes both existing NSO and areas that are designated as closed to leasing.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Under Alternative 1, there would be no resource-specific stipulations identified to preclude or minimize surface disturbance within special status plant species and significant plant communities. Without consideration of non-resource related NSO stipulations, all special status plant species habitat on the WRNF would be available to oil and gas development activities prior to site-specific surveys and ESA consultation at the APD stage of permitting. With consideration of all NSO stipulations, the potential for development in special status plant species and significant plant community habitat would as follows.

- **DeBeque phacelia:** Within Zone 1, all (100 percent) DeBeque phacelia suitable habitat in Zone 1 would be covered by non-resource-related NSOs. There is no suitable habitat for DeBeque phacelia in Zones 2, 3, and 4. Ninety-four percent of DeBeque phacelia suitable habitat in off-lease areas is covered by existing NSO stipulations.
- **Ute ladies'-tresses:** One hundred percent of suitable habitat would be covered by non-resource-related NSOs in Zone 1. In Zone 2, there would be no NSO stipulations covering suitable habitat. There is no suitable habitat for Ute ladies'-tresses in Zones 3 and 4. An estimated 95 percent of Ute ladies'-tresses suitable habitat in the off-lease area is covered by existing NSO stipulations.
- **Colorado hookless cactus:** One hundred percent of suitable habitat would be covered by all other NSOs in Zone 1. There is no suitable habitat for Colorado hookless cactus in Zones 2, 3, and 4. An estimated 94 percent of Colorado hookless cactus suitable habitat in the off-lease area is covered by existing NSO stipulations.

- **Special status plant species:** All suitable alpine habitat within the analysis area is located in off-lease area and is closed to leasing for future oil and gas development.
  - There is no suitable fen habitat in Zone 1. One hundred percent of suitable fen habitat in Zone 2 and 12 percent of suitable fen habitat in Zone 3 would be covered by NSOs. No suitable fen habitat in Zone 4 would be covered by NSO stipulations. In off lease areas, an estimated 68 percent of suitable fen habitat is precluded from surface development (10 percent is covered by existing NSOs; and an additional 58 percent is closed to leasing).
  - One hundred percent of suitable forested habitat in Zone 1, 47 percent of suitable forested habitat in Zone 2, 8 percent of suitable forested habitat in in Zone 3, and 3 percent of suitable forested habitat in Zone 4 would be covered by NSOs. In off-lease areas, an estimated 82 percent of suitable forested habitat is precluded from surface development (39 percent is covered by existing NSOs, and an additional 43 percent is closed to leasing).
  - One hundred percent of suitable non-forested habitat in Zone 1, 34 percent of suitable non-forested habitat in Zone 2, 11 percent of suitable non-forested habitat in Zone 3, and less than 1 percent of suitable non-forested habitat in Zone 4 would be covered by NSOs. An estimated 74 percent of suitable non-forested habitat in the off-lease area is covered by existing NSOs; an additional 13 percent is closed to leasing.

- **Significant plant community habitat:** One hundred percent of significant plant community habitat in Zone 1 and 9 percent in Zone 3 would be covered by NSOs. No significant plant community habitat within Zone 2 would be covered by NSO stipulations. There is no significant plant community habitat in Zone 4. In off-lease areas, 31 percent of significant plant community habitat is covered by existing NSOs; an additional 37 percent is closed to leasing.

Impacts from Projected Future Oil and Gas Development

The RFDS under Alternative 1 projects up to 416 wells on an estimated 60 well pads, resulting in 892 acres of short-term (construction) disturbance and 387 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts by zone are discussed below.

The Zone 1 RFDS (36 wells on 5 well pads) would result in 76 acres of construction surface disturbance and 33 acres of operations disturbance within the 10,114-acre zone. With consideration of all NSOs, surface-disturbing activities associated with the RFDS could not be conducted on any of the 10,113 acres of vegetation within the Zone 1 leases. This includes all general vegetation cover, all riparian/wetland habitat; all suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus; all special status plant species suitable forested and non-forested habitat; and all significant plant community habitat within this zone. All known populations of noxious weeds (2 acres) would be avoided and the potential for introducing new weed infestations to the zone would be minimized by the NSO stipulations present in all zone acreages. If NSO stipulations were exempted, there would be no resource-specific CSU stipulations that could require surveys or special development techniques to otherwise minimize disturbance.

The Zone 2 RFDS (319 wells on 46 well pads) would result in 684 acres of construction surface disturbance and 296 acres of operations disturbance within the 24,938-acre zone. Initial surface disturbance associated with the RFDS would comprise about 3 percent of the lease. Portions of the Zone 2 RFDS could occur in any or all of the 92 acres of Ute ladies'-tresses suitable habitat (the only federally listed plant species within Zone 2). NSO stipulations would preclude surface disturbance in special status species suitable fen habitat, but the full Zone 2 RFDS could occur in special status plant species suitable forested or non-forested habitats (which comprise 64 and 29 percent of the zone, respectively). If the full Zone 2 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 2. If the full Zone 2 RFDS were to occur in

suitable non-forested habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 2. The full Zone 2 RFDS could not be developed within significant plant community habitat because there are only 306 acres of this habitat present in the Zone 2, but if the full extent of significant plant community habitat without NSO stipulations were developed, this would affect 100 percent of all such habitat within Zone 2. With consideration of all NSOs, the full Zone 2 RFDS could be developed within riparian/wetland habitats (since surface disturbing activities would not be precluded in 61 percent of the riparian/wetland areas present within this zone). If the full Zone 2 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect about 26 percent of all such habitat in the zone. Known populations of noxious weeds would be present in the areas that are available for on-lease development; however, the BLM could require minor project relocations or impose conditions of approval at the site-specific level to control existing populations and minimize the potential for spread to areas of new surface disturbance.

The Zone 3 RFDS (52 wells on 7 well pads) would result in 111 acres of construction surface disturbance and 48 acres of operations surface disturbance within the 42,766-acre zone. Most of the lease zone would have standard lease terms or timing limitations that do not address vegetation resources. Surface disturbance associated with the RFDS would comprise less than 1 percent of the lease. There would be no impacts to any suitable habitat for federally listed plant species, as none are present in this zone. The full Zone 3 RFDS could occur in special status plant species suitable fen, forested, or non-forested habitats (which comprise <1, 85, and 14 percent of the zone, respectively); significant plant community habitat (which occur in 27 percent of the zone); or riparian/wetland areas (which comprise 18 percent of the zone). If the full Zone 3 RFDS were to occur in suitable fen habitat, construction surface disturbance would affect almost 100 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all such habitat in Zone 3. If the full RFDS were to occur in suitable non-forested Zone 3 habitat, construction surface disturbance would affect 3 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect about 1 percent of all such habitat in Zone 3. All known populations of noxious weeds would be present in the areas that are available for on-lease development.

The Zone 4 RFDS (10 wells on 1 well pad) would result in 21 acres of construction surface disturbance and 9 acres of operations surface disturbance within the 2,562-acre zone. The zone would be primarily covered by standard lease terms or timing limitations that do not address vegetation resources. Surface disturbance associated with the RFDS would comprise less than 1 percent of the lease. There would be no impacts to any suitable habitat for federally listed plant species, as none are present in this zone. The full Zone 4 RFDS could occur in special status plant species suitable forested or non-forested habitats (which comprise 85 and 15 percent of the zone, respectively). If the full Zone 4 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 4. If the full Zone 4 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 4. The full Zone 4 RFDS also could occur in riparian/wetland habitat (which comprises 15 percent of the zone). If the full Zone 4 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 4. Portions of the Zone 4 RFDS also could occur in the 10 acres of suitable fen habitat affecting up to 100 percent of all such habitat in Zone 4. There would be no impacts to any significant plant community habitat as none are present in this zone.

Directional or horizontal drilling techniques may be used to develop some or all of the RFDS from off-lease locations. Within 300 meters of leases, almost all suitable habitat for federally listed species is precluded from development through closure or NSO stipulations. About 18 acres of suitable habitat for Ute ladies'-tresses and 7 acres of suitable habitat for DeBeque phacelia and Colorado hookless cactus are available for surface disturbing activities. Surface disturbance in off-lease areas is precluded in all

off-lease special status species suitable alpine habitat. While the majority of off-lease suitable fen, forested, and non-forested habitat and significant plant community habitat also is precluded from surface disturbance, portions of the RFDS could still be developed in those habitats given the percentage of coverage relative to the amount of total habitat. After consideration of off-lease stipulations and closures approximately 48 acres of suitable fen habitat, 2,025 acres of suitable forested habitat, 1,275 acres of suitable non-forested habitat, and 2,018 acres of significant plant community habitat are open to surface disturbing activities.

Surveys would be conducted during site-specific NEPA to ensure compliance with the ESA, and any activities that may affect federally listed species would be subject to consultation with the USFWS under Section 7 of the ESA. Depending on stipulation coverage, the BLM can require minor or major project relocations to minimize the potential for spread to areas with new surface disturbance. Under all stipulations may impose conditions of approval at the site-specific level to control existing populations.

4.6.5.2 Alternative 2

Alternative 2 would modify 8 of the 65 existing leases to address inconsistencies with the 1993 EIS and ROD. This alternative would add stipulations to eight leases (identified in the 1993 EIS and ROD), but not attached to leases as they were issued.

Stipulation Coverage

Under Alternative 2, there would be no resource-specific NSO, CSU, or TL stipulations associated with general vegetation or riparian/wetland habitats[2].

General Vegetation

The only change between Alternative 1 and Alternative 2 would occur in Zone 3 (see Alternative 1, Section 4.6.4.1), where additional stipulations would preclude surface disturbance in an additional 1 percent of the 42,766 acres of vegetation cover within the zone.

Riparian/Wetland Habitats

The only change between Alternative 1 and Alternative 2 would occur in Zone 3 (see Alternative 1, Section 4.6.4.1), where additional stipulations would preclude surface disturbance in an additional 1 percent of the 7,895 acres of riparian and wetland habitat within the zone.

Noxious Weeds

Alternative 2 would have NSO stipulations applied to an additional 1 percent of vegetation cover within Zone 3; however, there would be no changes to the percentage of coverage of known noxious weed populations within this zone as compared to Alternative 1.

Special Status Plant Species

Alternative 2 would have NSO stipulations applied to an additional 1 percent of vegetation cover within Zone 3. The additional stipulations would preclude surface disturbance in an additional 1 percent of suitable forested and non-forested habitats and 3 percent of significant plant community habitat within the zone. There would be no changes to the stipulation coverage of suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus, or suitable habitat alpine habitat because Zone 3 does not contain those habitats.

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[2] As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 2 would result in the same amount surface disturbance as Alternative 1. The potential for the RFDS to affect vegetation resources would be similar to Alternative 1 except that in Zone 3, there would be slightly fewer acres of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat available for on-lease development of the RFD.

4.6.5.3 Alternative 3

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in the Alternative 2 from the 2014 WRNF Final EIS. There are four NSO stipulations specific to vegetation under Alternative 3:

- Alpine
- Fen Wetlands
- WIZ
- TEPC Plant Species Populations and Habitats.

There are three CSU stipulations specific to vegetation resources:

- Spruce-Fir Old Growth and Old Growth Recruitment Stands
- Plant Species of Local Concern, including Significant Natural Plant Communities
- Sensitive Plant Species

Section 4.6.2 provides a description of these stipulations. As with all stipulations within the lease area, it is possible that resource-specific stipulations may overlap each other. As noted in Section 4.6.2.1, within the GMUGNF, an existing NSO stipulation is applied to riparian and wetland communities that precludes surface disturbance in 2.9 acres (less than 0.1 percent of general vegetation communities) of leases in Zone 2).

Stipulation Coverage

General Vegetation

Table 4.6-6 displays the amount of general vegetation cover that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations under Alternative 3.

Within Zone 1, CSUs for Species of Local Concern and Sensitive Plant Species would be applied to constrain development in the majority of the 10,113-acre zones. Under the Sensitive Plant Species CSU, surveys and special design, construction and implementation measures may be required to ensure that disturbance that would not result in a trend toward federal listing or loss of viability of any Sensitive Plant Species. Under the Species of Local Concern CSU, surveys and special design, construction, and implementation measures may be required to maintain and manage viable and well-distributed habitats for all species. Exceptions to either CSU may be granted if a site-specific environmental analysis determines that the activity would not impair values associated with the maintenance or viability of the species. If implemented, the TEPC NSO stipulation also would preclude surface disturbance in 73 percent of the lease. Sixteen percent of Zone 1 would preclude surface disturbance under the WIZ NSO. One hundred percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 2, the CSU for Sensitive Plant Species could be applied to 95 percent of the 24,938-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone

acreage. An estimated 87 percent would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 3, the CSU for Sensitive Plant Species could be applied to 66 percent of the 42,766-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone acreage. An estimated 86 percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Within Zone 4, the CSU for Sensitive Plant Species could be applied to 89 percent of the 2,562-acre zone. Other resource-specific CSU and NSO stipulations would provide minimal coverage of zone acreage. An estimated 92 percent of all vegetation cover would be precluded from surface disturbance if all NSOs were implemented.

Riparian/Wetland Habitats

Table 4.6-7 displays the amount of riparian/wetland habitat that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations under Alternative 3.

The TEPC NSO would cover 83 percent of Zone 1 and the Fen NSO stipulation would preclude surface disturbance in 7, 8, and 21 percent of riparian/wetland habitat in Zones, 2, 3, and 4, respectively. Under all zones, the Sensitive Plant Species CSU would apply to the majority of riparian/wetland habitat. Under this CSU, surveys and special design, construction, and implementation measures may be required to ensure that disturbance would not result in a trend toward federal listing or loss of viability of any Sensitive Plant Species. Under all zones, the WIZ NSO would preclude surface disturbance in 93, 85, 63, and 67 percent of riparian/wetland habitat in Zones 1, 2, 3, and 4, respectively. This stipulation may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO). Within Zone 1, the Species of Local Concern CSU would overlay over 85 percent of all riparian/wetland habitat. Under this CSU, surveys and special design, construction and implementation measures during site-specific development may be required to minimize impacts to these species. The coverage afforded to riparian/wetland habitat by other CSU resource-specific stipulations would be minimal. With consideration of all stipulations developed under Alternative 3, surface disturbance would be fully precluded in 100 percent of Zone 1, 98 percent of Zone 2, 98 percent of Zone 3, and 96 percent of Zone 4 riparian/wetland habitats if all NSOs were implemented.

Noxious Weeds

As shown in **Table 4.6-8**, with consideration of all NSO stipulations, surface-disturbing activities associated with oil and gas development would be precluded in all of Zone 1 and Zone 4, 95 percent in Zone 2, and 77 percent in Zone 3.

Table 4.6-6 Stipulation Coverage of General Vegetation Cover Under Alternative 3

Location[1]	Acres of Vegetation Cover[1,2]	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 1	10,113	1	81	100	0	16	73	0	100
Zone 2	24,938	7	11	95	0	9	2	<1	87
Zone 3	42,766	13	0	66	<1	13	0	2	86
Zone 4	2,562	5	0	89	0	12	0	4	92

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF dataset compared to the FSVeg GMUGNF dataset.

[2] Vegetation communities cover the total area of each zone.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) would be covered by the Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-7 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 3

Location[1]	Riparian/ Wetland Habitat Acreage (percent zone)[1,]	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 1	1,718 (17)	<1	85	100	0	93	83	0	100
Zone 2	2,668 (11)	7	2	96	0	85	2	7	98
Zone 3	7,895 (18)	9	0	82	0	63	0	8	98
Zone 4	382 (15)	5	0	96	0	67	0	21	96

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF dataset compared to the FSVeg GMUGNF dataset.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-8 Stipulation Coverage of Known Populations of Noxious Weeds under Alternative 3

Zone	Acres of Known Populations of Noxious Weeds[1]	All NSOs (percent coverage)
1	2	100
2	1,105	95
3	310	77
4	<1	100

[1] Approximately 7 acres or 0.01 percent of the total 80,380 acres is not included in the total due to differences in resolution between the FSVeg WRNF spatial dataset compared to the FSVeg GMUGNF dataset.

Special Status Plant Species

Table 4.6-9 displays the amount of special status plant species and significant plant community suitable habitats that would be covered by individual resource-specific NSO or CSU stipulations and all NSO stipulations proposed under Alternative 3. A 300-meter extension from the leasing area is included in the analysis because this area could be subject to indirect impacts from on-lease oil and gas development, and because of potential for direct impacts in that area if oil and gas development infrastructure were constructed off the lease to access fluid minerals within the lease using directional or horizontal drilling. With consideration of all NSO stipulations, the potential for development in special status plant species and significant plant community habitat would as follows:

- **DeBeque phacelia:** Within Zone 1, CSU stipulations for Species of Local Concern and Sensitive Plant Species would be applied to 99 percent of the 3,729 acres of suitable habitat. The NSO for TEPC would overlay almost all of the same acreage, and the NSO for WIZ would overly about 22 percent of suitable habitat. All (100 percent) DeBeque phacelia suitable habitat in Zone 1 would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for DeBeque phacelia in Zones 2, 3, and 4. Ninety-four percent of DeBeque phacelia suitable habitat in off-lease areas is precluded from surface disturbance by existing NSO stipulations.
- **Ute ladies'-tresses:** The CSU stipulation Sensitive Plant Species and the NSO for TEPC would be applied to almost all of the Ute ladies'-tresses suitable habitat within the lease zones (4,829 acres in Zone 1 and 92 acres in Zone 2). Within Zone 1, the CSU stipulation for Species of Local Concern would overlay about 96 percent of this habitat and the WIZ NSO would overlay about 18 percent. One hundred percent of suitable habitat would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for Ute ladies'-tresses in Zones 3 and 4. An estimated 95 percent of Ute ladies'-tresses suitable habitat in the off-lease area is precluded from surface disturbance by existing NSO stipulations.

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
DeBeque Phacelia Suitable Habitat									
Off-lease[2]	121 (<1)								94
Zone 1	3,729 (37)	0	99	99	0	22	97	0	100
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A
Ute Ladies'-tresses Suitable Habitat									
Off-lease[2]	355 (1)								95
Zone 1	4,829 (48)	0	96	99	0	18	100	0	100
Zone 2	92 (<1)	0	0	100	0	43	100	0	100
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	NA
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	NA
Colorado Hookless Cactus Suitable Habitat									
Off-lease[2]	121 (<1)								94
Zone 1	3,729 (37)	0	99	99	0	22	97	0	100
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Special Status Plant Species Suitable Alpine Habitat									
Off-lease[2]	1 (<1)								100
Zone 1	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 2	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 3	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A
Special Status Plant Species Suitable Fen Habitat									
Off-lease[2]	150 (<1)								68
Zone 1	0	NA	NA	NA	NA	NA	NA	NA	N/A
Zone 2	4 (<1)	1	3	100	0	100	3	100	100
Zone 3	113 (<1)	5	0	96	0	100	0	100	100
Zone 4	10 (<1)	0	0	100	0	100	0	100	100
Special Status Plant Species Suitable Forested Habitat									
Off-lease[2]	11,254 (37)								82
Zone 1	6,518 (10)	1	85	100	0	9	78	0	100
Zone 2	10,844 (43)	17	4	91	0	11	1	<1	93
Zone 3	36,478 (85)	15	0	62	<1	10	0	2	87
Zone 4	2,182 (85)	6	0	87	0	9	0	2	94
Special Status Plant Species Suitable Non-Forested Habitat									
Off-lease[2]	4,904 (16)								74
Zone 1	2,924 (29)	<1	67	100	0	20	64	0	100
Zone 2	12,985 (52)	<1	1	99	0	8	1	<1	82

Table 4.6-9 Stipulation Coverage of Special Status Plant Species and Significant Plant Community Suitable Habitat under Alternative 3

Location	Suitable Habitat[1] Acreage (percent of zone)	Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[3]				All NSOs (percent coverage)
		Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland	
Zone 3	6,123 (14)	1	0	84	<1	29	0	4	82
Zone 4	379 (15)	0	0	100	0	28	0	14	81
Significant Plant Community Habitat									
Off-lease[2]	6,308 (21)								68
Zone 1	1,993 (20)	0	99	99	0	18	99	0	100
Zone 2	306 (1)	3	0	76	0	13	0	0	60
Zone 3	11,415 (27)	10	0	59	0	12	0	2	92
Zone 4	0	NA	NA	NA	NA	NA	NA	NA	N/A

[1] Suitable habitats were determined by Forest Service modeling for significant plant species; significant plant community habitat is based on Colorado Natural Heritage Program data, see Section 3.6.5 for more information.

[2] The "off-lease" area is the 300-meter extension from the leasing area. Total NSO column is reported to address the potential for off-lease development. Individual stipulations are not reported for off-lease areas because they are covered by stipulations unrelated to this EIS. For off leas areas only, the Total NSO percentage includes both existing NSO and areas that are designated as closed to leasing.

[3] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

- **Colorado Hookless Cactus:** Within Zone 1, CSU stipulations for Species of Local Concern and Sensitive Plant Species would be applied to 99 percent of the 3,729 acres of suitable habitat. The NSO for TEPC would overlay almost all of the same acreage, and the NSO for WIZ would overly about 22 percent of suitable habitat. One hundred percent of suitable habitat would be precluded from surface disturbance if all NSOs were implemented. There is no suitable habitat for Colorado hookless cactus in Zones 2, 3, and 4. An estimated 94 percent of Colorado hookless cactus suitable habitat in the off-lease area is precluded from surface disturbance by existing stipulations.
- **Special status plant species*:*** NSO coverage of suitable habitat types would be as follows:
  - All suitable alpine habitat within the analysis area is located in off-lease area and is CTL for future oil and gas development.
  - There is no suitable fen habitat in Zone 1. Within Zones 2, 3, and 4, the Fen NSO, WIZ NSO, and the Sensitive Plant Species CSU would cover all suitable habitat. The WIZ NSO may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO). In off-lease areas, an estimated 74 percent of suitable fen habitat is precluded from surface development (10 percent through existing NSOs; an additional 58 percent is closed to leasing).
  - Within Zones 1, 2, and 4, the Sensitive Plant Species CSU would be applied to between 87 and 100 percent of all suitable forested habitat within those zones; within Zone 3, the Sensitive Plant Species CSU would cover about 60 percent of all suitable forested habitat. Additionally, within Zone 1, the Species of Local Concern CSU and the TEPC NSO would overlay 85 and 78 percent all suitable forested habitat, respectively, but would cover little or no suitable forested habitat within the other zones. The WIZ NSO would overlay relatively small percentages at 9, 11, 10, and 9 percent of all suitable forested habitat in Zones 1, 2, 3, and 4, respectively. All (100 percent) suitable forested habitat in Zone 1, 93 percent of suitable forested habitat in Zone 2, 87 percent of suitable forested habitat in Zone 3, and 94 percent of suitable forested habitat in Zone 4 would be precluded from surface disturbance if all NSOs were implemented. Off lease, an estimated 82 percent of suitable forested habitat is precluded from surface development (39 percent through NSOs; an additional 43 percent is CTL).
  - The Sensitive Plant Species CSU would overlay almost all suitable non-forested habitat in all four zones. Coverage would range from 84 (in Zone 3) to 100 percent (Zones 1 and 4). Additionally, within Zone 1, the Species of Local Concern CSU and the TEPC NSO would overlay 67 and 64 percent all suitable non-forested habitat, respectively. The WIZ NSO would overlay 20, 8, 29, and 28 percent of all suitable non-forested habitat in Zones 1, 2, 3, and 4, respectively. All (100 percent) suitable non-forested habitat in Zone 1, 82 percent of suitable non-forested habitat in Zone 2, 82 percent of suitable non-forested habitat in Zone 3, and 81 percent of suitable non-forested habitat in Zone 4 would be precluded from surface disturbance if all NSOs were implemented. Off lease, an estimated 74 percent of suitable non-forested habitat is precluded from surface development (61 percent though existing NSOs, and an additional 13 percent is closed to leasing).
- **Significant plant community habitat:** Within Zone 1, significant plant community habitat would be covered by 4 resource-specific stipulations (Sensitive Plant Species CSU, Species of Local Concern CSU, WIZ NSO, and the TEPC NSO). Within Zones 2 and 3, the Sensitive Plant Species CSU would be applied to 76 and 59 percent of significant plant community habitat, respectively, and the WIZ NSO would be applied to 13 and 12 percent of significant plant community habitat, respectively. There would be very little coverage afforded by other stipulations, except in Zone 3, where 10 percent of the habitat would be covered by the Spruce-fir Old Growth CSU and 12 percent would be covered by the WIZ NSO. One hundred percent of significant plant community habitat in Zone 1, 60 percent of significant plant community habitat in

Zone 2, 92 percent of significant plant community habitat in Zone 3 would be precluded from surface disturbance if all NSOs were implemented. There is no significant plant community habitat in Zone 4. In off-lease areas, an estimated 74 percent of significant plant community habitat is precluded from surface development (31 percent through existing NSOs; an additional 37 percent is closed to leasing).

Impacts from Projected Future Oil and Gas Development

The RFDS under Alternative 3 projects up to 413 wells on an estimated 59 well pads, resulting in 886 acres of short-term (construction) disturbance and 384 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts by zone are discussed below.

The Zone 1 RFDS (36 wells on 5 well pads) would result in 76 acres of construction surface disturbance and 33 acres of operations disturbance within the 10,114-acre zone. With consideration of all NSOs, surface-disturbing activities associated with the RFDS could not be conducted on any of the Zone 1 leases. This includes all riparian/wetland habitat; all suitable habitat for DeBeque phacelia, Ute ladies'-tresses, Colorado hookless cactus; all special status plant species suitable habitat; and all significant plant community habitat within this Zone. All known populations of noxious weeds (2 acres) would be avoided and the potential for introducing new weed infestations to the zone would be minimized by the total preclusion of surface disturbance through NSO stipulations. If NSO stipulations were exempted, most riparian and special status species also would be covered by one or more CSU stipulations that could require surveys or special development techniques to minimize habitat disturbance.

The Zone 2 RFDS (319 wells on 46 well pads) would result in 684 acres of construction surface disturbance and 296 acres of operations disturbance within the 24,938-acre zone. Surface disturbance would be precluded in all suitable habitat for Ute ladies'-tresses (the only federally listed plant species within Zone 2) through a resource-specific NSO stipulation. While NSOs overlay the majority of special status plant species suitable habitat and significant plant community habitat in Zone 2, given the percentage of NSO coverage relative to the amount of total habitat, the entire RFDS could still be developed in suitable forested and non-forested habitat and significant plant community habitat; however, most (between 76 and 99 percent) of these habitats would be covered by resource-specific CSUs that could require surveys or special development techniques to minimize habitat disturbance. With consideration of all NSOs (none of which are resource-specific), about 760 acres of suitable forested habitat, 2,335 acres of suitable non-forested habitat, and 122 acres significant plant community habitat would be open to surface disturbance. If the full Zone 2 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 2. If the full Zone 2 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 2. The RFDS could not be developed in full within significant plant community habitat because there are only 306 acres present in Zone 2, but if the full extent of acreage without NSO stipulations were developed, this would affect about 40 percent of all such habitat within Zone 2. All suitable fen habitat (4 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. A portion of the RFDS could be developed in the 267 acres of riparian habitat that are not covered by NSO stipulations. Most, but not all, riparian habitat would be covered one or more CSU stipulation that could require surveys or special development techniques to minimize disturbance. If all 267 acres without NSO stipulations were developed, this would affect about 10 percent of riparian/wetland habitat within the Zone 2. About 5 percent of the known noxious weed populations in Zone 2 are present in areas in which surface disturbance would not be precluded.

The Zone 3 RFDS (49 wells on 7 well pads) would result in 104 acres of construction surface disturbance and 45 acres of operations surface disturbance within the 42,766-acre zone. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the full RFDS could occur in special status plant species suitable

forested or non-forested habitat, or in significant plant community habitat. Between 59 and 84 percent of these habitats would be subject to resource-specific CSUs. With consideration of all NSOs covering these habitats (none of which are resource-specific), about 1,742 acres of suitable forested habitat, 1,102 acres of suitable non-forested habitat, and 9,132 acres of significant plant community habitat would be open to surface disturbance. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all suitable forested habitat in Zone 3. If the full Zone 3 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 3 percent of all such habitat in Zone 3. If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. All suitable fen habitat (10 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. About 80 percent of the approximately 7,900 acres of riparian/wetland habitat in Zone 3 would be covered by a resource-specific CSU stipulation that could require surveys or special development techniques to minimize disturbance. If all NSO stipulations were implemented, about 2 percent (158 acres) of Zone 3 riparian/wetland habitat would be available to surface disturbing activities. If the full Zone 3 RFDS were to occur in riparian/ wetland habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 3. Twenty-three percent of known noxious weed populations within Zone 3 are present in areas that would not be precluded from surface disturbance.

The Zone 4 RFDS (10 wells on 1 well pad) would result in 21 acres of construction surface disturbance and 9 acres of operations surface disturbance within the 2,562-acre zone. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the full RFDS could occur in special status plant species suitable forested or non-forested habitat; however, almost 90 percent of suitable forested habitat and 100 percent of suitable non-forested habit would be subject to resource-specific CSUs. With consideration of all NSOs covering these habitats (none of which are resource-specific), about 130 acres of suitable forested habitat and 72 acres of suitable non-forested habitat would be open to surface disturbance. If the full Zone 4 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect 1 percent of all such habitat in Zone 4. If the full Zone 4 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 6 percent of all such habitat in Zone 4. All suitable fen habitat (10 acres) would be precluded from surface disturbance by NSO stipulations as well as covered by a resource-specific CSU stipulation. With consideration of all NSOs, about 23 percent (88 acres) of all riparian/wetland habitat in Zone 4 would be available for surface disturbance. Most acreage would be subject to resource-specific CSUs. If the full Zone 4 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 5 percent of all such habitat in Zone 4. All known populations of noxious weeds (less than 1 acre) would be avoided if NSO stipulations were implemented.

Directional or horizontal drilling techniques may be used to develop some or all of the RFDS from off-lease locations. Within 300 meters of leases, almost all suitable habitat for federally listed species is precluded from development through closure or NSO stipulations. About 18 acres of suitable habitat for Ute Ladies'-tresses and 7 acres of suitable habitat for DeBeque phacelia and Colorado hookless cactus are available for surface disturbing activities. Surface disturbance in off-lease areas is precluded in all off-lease special status species suitable alpine habitat. While the majority of off-lease suitable fen, forested, and non-forested habitat and significant plant community habitat also is precluded from surface disturbance, portions of the RFDS could still be developed in those habitats given the percentage of coverage relative to the amount of total habitat. After consideration of off-lease stipulations and closures approximately 48 acres of suitable fen habitat, 2,025 acres of suitable forested habitat, 1,275 acres of suitable non-forested habitat, and 2,018 acres of significant plant community habitat are open to surface disturbing activities.

Surveys would be conducted during site-specific NEPA to ensure compliance with the ESA, and any activities that may affect federally listed species would be subject to consultation with the USFWS under

Section 7 of the ESA. Depending on stipulation coverage, the BLM can require minor or major project relocations to minimize the potential for spread to areas with new surface disturbance. Regardless of specific stipulations, the BLM may impose conditions of approval at the project-specific level to mitigate impacts to existing special status plant species and significant plant community populations or habitat.

4.6.5.4 Alternative 4 (Proposed Action)

Alternative 4 is the Proposed Action and modifies or cancels the existing 65 leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Final EIS. Lease modification would be the same as under Alternative 3. Alternative 4 proposes 25 lease cancellations, all within Zone 3.

Stipulation Coverage

General Vegetation

Table 4.6-10 displays the Zone 3 vegetation cover that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The combination of proposed lease stipulations and proposed lease cancellations would preclude surface disturbance in about 95 percent of Zone 3 (about 9 percent more than under Alternative 3). Unlike NSO stipulations, however, lease cancellations would offer no potential for exceptions, modification, or waivers that would allow surface disturbance. Proposed lease cancellation would remove 68 percent of the original zone acreage from leasing availability; the remaining acreage in Zone 3 would comprise 14,307 acres. A resource-specific CSU would be applied to about 72 percent of the remaining acreage. The WIZ NSO would be applied to about 15 percent of the remaining acreage. With consideration of all NSOs (none of which are resource-specific), about 98 percent of remaining acreage in Zone 3 would be precluded from surface disturbance.

Riparian / Wetland Areas

Table 4.6-11 displays the Zone 3 riparian/wetland habitat that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The combination of proposed lease stipulations and proposed lease cancellations would preclude surface disturbance about 89 percent of all riparian/wetland habitat in Zone 3 (13 percent more than under Alternative 3). However, the lease cancellation would remove 3,574 (45 percent) of the 7,895 acres of riparian/wetland habitat in Zone 3 from leasing availability. Cancelled acreages would not be subject to exceptions, modifications, or waivers. A resource-specific CSU would be applied to 58 percent of the remaining riparian/wetland habitat and the WIZ NSO would be applied to about 47 percent of the remaining habitat. With consideration of all NSOs (none of which are resource-specific), 94 percent of the remaining riparian/wetland habitat in Zone 3 would be precluded from surface disturbance.

Noxious Weeds

Approximately 8 percent of known noxious weed populations would be within cancelled leases (in Zone 3). The potential for spread of these populations through surface disturbance associated with new oil and gas development would be eliminated in these areas. Conversely, any opportunity for Operator control of these populations through COAs also would be eliminated in these areas. However, Forest Service treatment of noxious weeds would continue.

Table 4.6-10 Zone 3 Stipulation Coverage of General Vegetation Cover under Alternative 4

Vegetation Cover			Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (% coverage)	NSO plus Closed (% original acreage)
Original Zone Acreage[1]	Acres Cancelled	Remaining Zone Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
42,766	28,459	14,307	4	0	72	<1	15	0	1	98	95

[1] Acreage of Zone 3 with no lease areas cancelled.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Table 4.6-11 Zone 3 Stipulation Coverage of Riparian/Wetland Habitats under Alternative 4

Vegetation Cover			Resource-specific CSU Stipulations (percent coverage)			Resource-specific NSO Stipulations (percent coverage)[2]				All NSOs (% coverage)	NSO plus Closed (% original acreage)
Original Zone Acreage[1]	Acres Cancelled	Remaining Zone Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
7,895 (18)	3,574	4,321	<1	0	58	0	47	0	1	94	89

[1] Acreage of Zone 3 with no lease areas cancelled.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Special Status Plant Species

Table 4.6-12 displays the Zone 3 suitable habitat for special status plant species and significant plant communities that would be within cancelled leases, available for leasing, covered by individual resource-specific NSO or CSU stipulations, and covered by NSO stipulations under Alternative 4.

The differences between Alternative 3 and Alternative 4 for special status plant species and significant plant communities are summarized below.

- **DeBeque Phacelia Suitable Habitat Ute Ladies'-tresses Suitable Habitat Colorado Hookless Cactus Suitable Habitat**: There would be no difference between Alternatives 3 and 4, as there is no suitable habitat in Zone 3.
- **Suitable Alpine Habitat*:*** There would be no difference between Alternatives 3 and 4, as there is no suitable habitat in Zone 3.
- **Suitable Fen Habit**: The combination of NSO lease stipulations and proposed lease cancellations would preclude surface disturbance in about 100 percent of suitable fen habitat (same as under Alternative 3); however, under Alternative 4, cancelled lease acreages would not be subject to exceptions, modifications, or waivers. Eighty percent of the 113 acres of suitable fen habitat in Zone 3 would be within cancelled leases. All of the remaining acreage would be covered by resource specific NSO and CSU stipulations. Of this remaining acreage, the WIZ NSO may still apply to modifications of other resource specific NSO stipulations (e.g., Fen NSO).
- **Suitable Forested Habitat:** With consideration of both NSO and lease cancellations, 95 percent of the Zone 3 suitable forested habitat would be precluded from surface disturbance if all NSOs were implemented. This is 7 percent more than Alternative 3. Sixty-seven percent of the 36,478 acres of suitable forested habitat in Zone 3 would be within cancelled leases and therefore not subject to exceptions, modification, or waivers. The CSU stipulation for Sensitive Plant Species would be applied to approximately 68 percent of the remaining suitable forested habitat; coverage afforded by other resource-specific NSO and CSU stipulations would be minimal. Surface disturbance would be precluded on 85 percent of the remaining suitable forested habitat acreage if all NSOs were implemented.
- **Suitable Non-Forested Habitat**: With consideration of both NSO and lease cancellations, 86 percent of the Zone 3 suitable non-forested habitat would be precluded from surface disturbance if all NSOs were implemented. This is 4 percent more than Alternative 3. Sixty-three percent of the 6,123 acres of suitable non-forested habitat within Zone 3 would be within cancelled leases. The CSU stipulation for Sensitive Plant Species would be applied to approximately 96 percent of the remaining suitable non-forested habitat; coverage afforded by other resource-specific NSO and CSU stipulations would be minimal. Surface disturbance would be precluded on about 88 percent of the remaining suitable non-forested habitat if all NSOs were implemented.
- **Significant Plant Community Habitat:** With consideration of both NSO and lease cancellations, 98 percent of the Zone 3 significant plant community habitat would be precluded from surface disturbance if all NSOs were implemented. This is 1 percent more than Alternative 3. Sixty-four percent of the 11,415 acres of significant plant community habitat within Zone 3 would be within cancelled leases. The CSU stipulation for Sensitive Plant Species would be applied to about half of the remaining habitat, but surface disturbance would be precluded on about 90 percent of the remaining significant plant community habitat if all NSOs were implemented.

Table 4.6-12 Zone 3 Stipulation Coverage of Special Status Species Habitat /Wetland Habitats under Alternative 4

Habitat Type	Habitat Acreages Within Zone			Resource-specific CSU Stipulations (%of remaining acreage)			Resource-specific NSO Stipulations (% of remaining acreage)[2]				All NSOs (% remaining acreage)	NSO plus Closed (% original acreage)
	Original Acreage (% zone)[1]	Acres Cancelled	Remaining Acreage	Spruce-Fir Old Growth	Species of Local Concern	Sensitive Plant Species	Alpine	WIZ	TEPC	Fen Wetland		
Special Status Plant Species Suitable Fen Habitat	11;3 (<1)	90	23	1	0	100	0	100	0	100	100	100
Special Status Plant Species Suitable Forested Habitat	36,478 (85)	24, 620	11,858	3	0	68	<0.1	11	0	1	85	95
Special Status Plant Species Suitable Non-Forested Habitat	6,123 (14)	3,829	2,294	<0.1	0	96	<0.1	<0.1	0	3	88	86
Significant Plant Community Habitat	11,415 (27)	7,351	4,064	6	0	50	0	11	0	0	90	98

[1] Zone percentage based on a 42,766-acre zone.

[2] Under all alternatives, 2.9 acres (or <0.1 percent of the analysis area) is covered by an existing Riparian/Wetland GMUGNF NSO stipulation. The alternatives analyzed in this EIS do not consider any changes to this stipulation.

Impacts from Projected Future Oil and Gas Development

RFDS under Alternative 4 projects up to 383 wells on an estimated 55 well pads, resulting in 821 acres of short-term (construction) surface disturbance and 356 acres of long-term (operations) surface disturbance. Potential impacts to these areas from surface disturbance are described in Section 4.6.3. Impacts from the RFDS are summarized by zone.

Impacts in Zones 1, 2, and 4 would be the same as Alternative 3.

Within Zone 3, 28,459 acres of leases within the 42,766-acre zone would be cancelled, reducing the area available for development to 14,307 acres. The Zone 3 RFDS would be reduced to 18 wells on 3 well pads. This would result in 39 acres of construction surface disturbance and 17 acres of operations surface disturbance. There would be no direct impacts to any suitable habitat for federally listed plant species, as none are present in this zone. On-lease development of the RFDS could occur in special status plant species suitable forested or non-forested habitat, or in significant plant community habitat. Between 50 and 96 percent of these habitats would be subject to resource-specific CSUs. With consideration of lease cancellations and NSOs in the remaining lease acreage, about 1,778 acres of suitable forested habitat, 275 acres of suitable non-forested habitat, and 406 acres of significant plant community habitat would be open to surface disturbance. If the full Zone 3 RFDS were to occur in suitable forested habitat, construction surface disturbance would affect less than 1 percent of all such habitat in remaining Zone 3 leases (and less than 1 percent of the original Zone 3 habitat acreage). If the full Zone 3 RFDS were to occur in suitable non-forested habitat, construction surface disturbance would affect 2 percent of all such habitat in remaining Zone 3 leases (and about 1 percent of the original Zone 3 habitat acreage). If the full Zone 3 RFDS were to occur in significant plant community habitat, construction surface disturbance would affect 1 percent of all such habitat in remaining Zone 3 leases (and less than 1 percent of the original Zone 3 habitat acreage). All remaining suitable fen habitat (23 acres) would be precluded from surface disturbance by NSO stipulations and covered by a resource-specific CSU stipulation. With consideration of lease cancellations and NSOs, about 2,115 acres of riparian/wetland habitat would be open to surface disturbance, half of which would be covered by a resource-specific CSU stipulation. If the full Zone 3 RFDS were to occur in riparian/wetland habitat, construction surface disturbance would affect 1 percent of all such habitat in remaining Zone 3 leases (less than 1 percent of the original Zone 3 habitat acreage). Portions of known noxious weed populations within Zone 3 would be present in the areas that are available for on-lease development.

The potential for off-lease development would be the same as under Alternative 3.

4.6.5.5 Alternative 5

Under Alternative 5, all leases would be cancelled, and producing wells would be plugged and abandoned. Existing wells, access roads, and ancillary facilities would be removed, and all disturbed areas would be reclaimed. Under Alternative 5, 75 wells on 16 well pads would be reclaimed, resulting in 86 acres of short-term disturbance.

Within Zone 2, there would be approximately 37 acres of disturbance associated with the reclamation of well pads and 39 acres associated with roads. Within Zone 3, surface disturbance associated with the reclamation would comprise 1 acre from well pads and 9 acres from roads. No surface disturbance would occur in the off-lease area, Zone 1, or Zone 4 because there are no existing wells in these areas. Impacts from well removal are discussed under Section 4.1.3, Impacts Common to All Alternatives, and may include vegetation removal and mechanical damage to plants, soil compaction, erosion, changes in hydrology, and encroachment by noxious weeds and invasive plant species, as well as impacts from fugitive dust.

After reclamation, existing disturbance areas would be seeded with native plant species. Eventual return to a native plant community would be anticipated, following an interim period of time where the sites

would be vulnerable to noxious weeds and other non-native invasive species. Due to the cancellation of the leases, there would be no anticipated new disturbance to vegetation from new oil and gas development. As part of well abandonment and road reclamation activities, direct disturbance to special status species and significant plant communities would be restricted in compliance with federal regulations under the ESA.

4.6.5.6 Summary of Impacts

Alternative 1 (the No Action Alternative) and Alternative 2 would apply almost no resource-related NSO stipulations and the level of NSO coverage afforded to vegetation resources by other NSO stipulations would be minimal. Alternative 3 would apply resource-related NSO and CSU stipulations to the leases and the level of NSO coverage afforded to vegetation resources by other NSO stipulations would be greater than Alternatives 1 and 2. Alternative 4 offers the same resource-related NSO and CSU stipulations and a similar level of coverage to vegetation resources from other NSO stipulations, but in Zone 3, a portion of that coverage would be provided through lease cancellation rather than NSO stipulations. There are no leasing stipulations associated with Alternative 5, which would cancel all leases, plug and abandon 75 wells, and reclaim associated facilities and roads. The level of proposed new surface disturbance associated with the RFDS would be very similar under Alternative 1 (the No Action Alternative), Alternative 2, and Alternative 3. Proposed new surface disturbance under Alternative 4 would be slightly lower than under Alternatives 1, 2, and 3. Alternative 5 would have the lowest level of surface disturbance, which would not be associated with any new development, but rather would result from the reclamation activities. Impacts to general vegetation, riparian areas, noxious weeds, and special status plant species habitat are summarized by alternative below.

<u>General Vegetation</u>

Under the No Action Alternative, and Alternative 2, outside of Zone 1 (which would be fully precluded from surface disturbance), the RFDS could occur in any vegetation type. Under Alternative 3, surface disturbance would be fully precluded in Zone 1 and there would be NSO stipulations in the majority of all vegetation cover in Zones 2, 3, and 4. While there would still be potential for the RFDS to occur in portions not covered by NSO stipulations, most areas would be covered by one or more CSU stipulations that could require surveys or special development techniques to minimize disturbance. Alternative 4 would have the same impacts as Alternative 3 except in Zone 3, where surface disturbance would be precluded on almost 10 percent more vegetation cover. Additionally, proposed lease cancellations would remove the potential for exceptions, modifications, or waivers of NSO stipulations in over 66 percent of the zone. Alternative 5 would minimize impact to vegetation cover to the greatest extent possible, since all surface disturbance would be associated with reclamation of vegetation cover.

<u>Riparian/Wetland Areas</u>

Alternatives 1 through 5, in general, progressively provide increased coverage to riparian and wetland areas inside the lease boundaries through stipulations, lease modifications, and lease cancellations. Alternatives 1 and 2 propose no resource-specific stipulations (however, an existing Riparian/Wetland GMUGNF would be applied to 2.9 acres under all alternatives). Alternatives 3 and 4 apply several resource-specific CSU and NSO stipulations. While Alternatives 3 and 4 apply the same stipulations, Alternative 4 also cancels 25 leases in Zone 3 (which equates to more than 45 percent of the riparian and wetland areas in Zone 3).

However, the increased coverage to the lease areas may have the opposite impact to the areas outside the leases by causing the disturbance to occur off-lease. Therefore, Alternatives 1 through 4 may increase the risk of impacts to riparian and wetland areas immediately adjoining the leases (with the exception of the 25 cancelled lease areas of Alternative 4, which would not be developed).

Alternative 5 would minimize the risk of impacts to riparian and wetland areas to the greatest extent possible, since oil and gas development of the 65 leases would not occur on-lease or off-lease.

Noxious Weeds

The potential for the introduction of noxious weeds through surface-disturbing activities would be similar under Alternative 1 (the No Action Alternative), Alternative 2, and Alternative 3 since they have a very similar level of proposed development. Alternative 4 would have a lower potential due to a lower level of proposed development. Alternative 5 would have the lowest potential for noxious weed introduction.

While development in near proximity to existing noxious weed populations may increase the potential for weed proliferation, it offers an additional possibility beyond Forest Service weed treatments for noxious weed control. Under Alternatives 1 and 2, most known noxious weed populations are located in areas that would be open to surface disturbance. Under Alternatives 3 and 4 most known noxious weed populations are in areas that would be precluded from surface disturbance. Alternative 5 would minimize the potential for the spread of noxious weeds to the greatest extent, since all surface disturbance would be associated with reclamation.

Under all alternatives, the BLM would retain the ability to relocate operations to some degree and require BMPs or conditions of approval to minimize the potential for noxious weeds to become established or proliferate.

Special Status Plant Species

Oil and gas development under Alternatives 1 and 2 would have the greatest potential for impacts to Special Status Plant Species due to the least amount of potential protection from associated stipulations. Under Alternatives 1 and 2, with the exception of Zone 1 (which would be fully precluded from surface disturbance), any or all of the RFDS could occur in suitable habitat for most special status species. While Zone 1 contains the most suitable habitat for federally listed species, there is potential for RFDS to occur in Ute ladies'-tresses suitable habitat in Zone 2, as well as special status species suitable fen habitat, suitable forested habitat, suitable non-forested habitat, and significant plant community habitat in Zones 2, 3, and 4. The degree to which these habitats could be affected by the RFDS would generally depend on the relative abundance of habitat. Assuming the RFDS occurs in each special status habitat to the maximum allowed by NSO stipulations (and available acreage, since in some cases the habitat is not present in sufficient acreage to accommodate a full RFD), the RFDS would have the potential to occur in 92 percent of Ute Ladies'-Tresses suitable habitat (present only in Zone 2); 100 percent of suitable fen habitat in Zones 3 and 4; and between 1 to 6 percent of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat present in each lease zone, except in Zone 2 where it would have the potential to occur in 100 percent of the significant plant community habitat present in that zone. Under Alternatives 1 and 2, there would be no resource-specific CSU that could minimize disturbance if any NSO stipulations were exempted.

Under Alternatives 3 and 4, Zone 1 also would be fully precluded from surface disturbance and more special status species suitable habitat would be precluded from surface disturbance in Zones 2, 3, and 4. Assuming the RFDS occurs in each special status habitat to the maximum allowed by NSO stipulations and habitat availability, there is no potential for the RFDS to occur in Ute Ladies'-tresses suitable habitat, or in suitable fen habitat. The full RFDS would have the potential to occur in about 1 to 6 percent of suitable forested habitat, suitable non-forested habitat, and significant plant community habitat present in each lease zone (including Zone 2). Additionally, under Alternatives 3 and 4, many of the NSO stipulations covering these habitats are resource-specific and much of the habitat also is covered by one or more resource-specific CSU that would minimize disturbance if NSO stipulations were exempted. While both Alternatives 3 and 4 preclude surface disturbance within special status species habitat to a similar degree, Alternative 4 would offer an advantage over Alternative 3 because in Zone 3, surface disturbance in over half of all special status species habits present within the zone would be precluded through lease cancellation, which cannot be exempted. However, increased surface protections within the lease areas may increase potential impacts to special status plant species and habitat on lands outside of the lease areas (with the exception of the 25 cancelled lease areas of Alternative 4, which

would not be developed). Alternative 5 would minimize the potential for the impacts to special status species habitat to the greatest extent, since all surface disturbance would be associated with reclamation.

4.6.6 Cumulative Impacts

4.6.6.1 Cumulative Impacts Analysis Area

The CIAA for general vegetation is the existing 65 leases (80,380 acres). The CIAA for special status species is the lease area plus a 300-meter extension outside of the leasing area (CIAA acreage varies depending on species).

4.6.6.2 Past and Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

The primary past and present actions affecting the vegetation resources for both cumulative impacts analysis areas analyzed in this EIS include surface-disturbing activities such as mineral development; road development and other land development such as ROWs for pipelines, telephone lines or other developments. Section 4.1 presents the total quantifiable past and present surface disturbance by CIAA. Within the vegetation resources CIAA, there are 454 acres of surface disturbance from past or present actions. This is less than 1 percent of the CIAA. Other Forest Service District or BLM FO actions such as farming, timber harvests, livestock grazing, vegetation treatments, agriculture, recreation, and land management decisions are considered when analyzing past and present actions, but do not have quantifiable surface disturbance. No additional quantifiable past and present surface disturbance was identified within the 300-meter extension outside of the leasing area, but it is assumed that activities such as farming, timber harvests, livestock grazing, vegetation treatments, agriculture, and recreation also have taken place in that area.

Reasonably Foreseeable Future Actions (RFFAs)

RFFAs are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. RFFAs are summarized in Section 4.1 and are described in detail in **Appendix B**.

Oil and Gas and Other Surface Disturbance RFFAs

Within the General Vegetation CIAA, the impacts for Alternatives 1 through 5 (discussed in Sections 4.6.4.1, 4.6.4.2, 4.6.4.3, 4.6.4.4, and 4.6.4.5) would be the only surface disturbance effects from oil and gas development. There is no other RFFA long-term surface disturbance planned for the vegetation resources CIAA.

Within the Special Status Species CIAA, there is potential for additional oil and gas development to occur outside of the leases, but within the 300-meter buffer area (the “off-lease” area), subject to leasing availability and existing NSO stipulations. Within the 300-meter buffer area, there is potential for about 590 acres of long-term disturbance to occur on BLM lands within the CRVFO and GJFO, and about 23 acres to occur on NFS lands within the GMUGNF. The portion of this development that may occur within the 300-meter buffer is reasonably assumed to be a fraction of this total, given the total acreage over which the RFFA is projected and the acreage of the 300-meter buffer.

RFFA Projects with Countervailing Impacts

Impacts under this section are those that may not have adverse impacts on vegetation resources and may have a countervailing effect on cumulative impacts. There is an estimated 6,000 acres within the vegetation resources CIAA and special status species CIAA that may have countervailing impacts on vegetation resources under the South Rifle Habitat Enhancement Project. In addition, vegetation

treatments (e.g., noxious weed control) and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact. These actions are described in greater detail in **Appendix B**.

4.6.6.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

Within the Vegetation CIAA, the Proposed Action and alternatives would contribute between 0 percent (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long-term surface-disturbing activities within the CIAA. If selected, Alternative 5 would eliminate existing and proposed surface disturbance that could affect vegetation.

As noted in the analysis, most special status species habitat in the “off-lease” area is either closed to leasing or covered by NSO stipulations. Impacts from any RFFA development within the 300-meter buffer or on haul roads associated with the RFFA would be the same as discussed in Section 3.6.3. Indirect impacts from RFFAs such as dust deposition or noxious weed spread could affect vegetation within the leases as well as off-lease areas. There are no other identified RFFAs that would occur within the vegetation resources or special status species CIAA.

4.7 Terrestrial Wildlife Including Special Status Species

4.7.1 Analysis Assumptions and Approach to Analysis

4.7.1.1 Analysis Area

The analysis areas for terrestrial wildlife, including special status species, were chosen to represent the combination of geographic areas containing contiguous habitat that may be impacted by the proposed leasing decisions and subsequent oil and gas development, as well as the management regimes for this habitat.

The analysis areas for terrestrial wildlife species are defined as follows:

- **Nongame and Small Game Terrestrial Wildlife Analysis Area:** The terrestrial wildlife analysis area for small game species and nongame species, including raptors and other migratory birds, includes suitable habitat (as determined through use of the Forest Service Region 2 vegetation data) within the lease boundaries.
- **Special Status Species Wildlife Analysis Area:** The analysis area for special status species, including Federally Listed, Proposed, or Candidate Wildlife Species, Forest Service and BLM Sensitive Wildlife Species, and Forest Service Management Indicator Species (MIS) comprises of suitable, historic, or occupied, habitat within the 65 leases based on Region 2 vegetation data. The exception is elk, which is a MIS but is analyzed under the analysis area.
- **Big Game Analysis Area:** The big game analysis area consists of the GMUs that are crossed by the lease boundaries. Sensitive habitat is typically considered the limiting factor for big game populations, therefore additional focus will be given on these areas (e.g., winter range, transition range, migratory corridors, fawning and calving areas and summer range) within the GMUs. GMUs included in the analysis area are 12, 23, 42, 43, 421, and 521.
- **Canada Lynx Analysis Area:** The Canada lynx analysis area includes the LAUs crossed by the lease boundaries.
- **Greater Sage-grouse Analysis Area:** The greater sage-grouse analysis area includes Priority Habitat Management Areas and General Habitat Management Areas (GHMAs) as classified by Colorado Parks and Wildlife (CPW), crossed by the lease boundaries.

4.7.1.2 Scoping Issues

The public scoping issues related to terrestrial wildlife are listed below. While many of the scoping issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analysis of many of these issues in detail. All issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

- How would reasonably foreseeable habitat disturbance, vehicle use, and other elements of oil and gas development such as noise affect wildlife, special status species, and their habitat?
- How will the Proposed Action and alternatives affect big game, including effects on habitat fragmentation and connectivity and the potential for additional human disturbance or poaching from roads? How would these impacts affect big game hunting?
- What stipulations or BMPs, mitigation measures, or conditions of approval can be incorporated into the Proposed Action and alternatives to reduce risk to wildlife and special status species? (As noted in Chapter 2.0 and Section 4.1, because the locations of future oil and gas development are unknown, mitigation measures have not been identified for this leasing analysis. Onsite evaluations and site-specific NEPA analysis will be performed at the APD stage

and BMPs, mitigation measures, or COAs would be developed to address site-specific conditions as part of the permit process.)

- How will the cumulative impacts from oil and gas and other regional development affect air quality, visibility, water resources, greater sage-grouse, and other wildlife?

4.7.1.3 Assumptions

Assumptions were made concerning the impacts of making lands available to lease for oil and gas exploration and development as they relate to terrestrial wildlife and special status species.

- Species will be considered as having the potential to occur within the analysis area if:
  - Occurrence has been documented for the species;
  - The current species range exists within the study area and suitable habitat is present; and
  - Historical range for species that have the potential to be reintroduced and suitable habitat is present.
- Management direction and guidance for special status species are provided through implementation of recovery plans, conservation agreements, management plans, and state wildlife plans (e.g., Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan).
- Leasing is a commitment of the oil and gas resources for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions. As a result of leasing, future exploration and development proposals would be subject to specific state and federal regulatory and permitting requirements and to additional site-specific environmental analysis under NEPA at the APD stage of permitting. These subsequent analyses would address site-specific wildlife conditions and effects to them, and serve as the basis for any project-level design features or best management practice requirements.
- The proposed management actions in each alternative would include the proposed stipulations (e.g., NSO, CSU, or TL stipulations) to reduce impacts on wildlife. Direct and indirect impacts of land uses on terrestrial wildlife are generally best mitigated by avoiding or minimizing the impact on the degree practicable with stipulations. The various management actions and allowable use decisions outlined in this document emphasize this approach for maintaining or conserving terrestrial wildlife and their habitat. Impacts that cannot be avoided would at least be minimized by the application of COAs or BMPs.
- Impacts on wildlife populations and habitat are not discrete since actions may benefit one species while having an adverse or beneficial impact on another.
- Significant modifications to habitat suitability can impact the survivability and viability of populations (e.g., higher winter mortality or reduced reproductive success).
- Impacts on terrestrial wildlife from displacement depend on the location, extent, timing, or intensity of the disruptive activity. Impacts from displacement of wildlife would be greater for wildlife species that have limited habitat or a low tolerance for disturbance.
- The quality and quantity of winter ranges are generally considered to be the limiting factors on big game populations. The ability of these areas to support wintering populations is a major factor in determining yearlong population levels.
- The CPW would continue to manage wildlife populations, and the BLM would continue to manage wildlife habitat in coordination with the CPW. Big game habitat would be managed in coordination with CPW herd objectives and species-specific plans. Sufficient habitat currently exists to maintain current CPW Data Analysis Unit objectives for big game.

- In the context of this analysis, avoidance means reduced use and does not imply zero use or an absence of use by wildlife. When making a decision regarding discrete surface–disturbing activities following site-specific environmental review, BLM has the authority to impose reasonable measures to minimize impacts on other resource values, including restricting the siting or timing of lease activities (43 CFR 3100; 43 CFR 3160; Yates Petroleum Corp., 176 IBLA 144 [2008] a; Interior Board of Land Appeals 2010-25).
- Impacts on special status species can occur from actions that result in direct mortality of special status species, loss of habitat or modifications to habitat suitability, and in the case of special status wildlife, actions that displace individuals or disrupt behavior. Because special status species have specific habitat requirements, and their habitats are often diminishing, disturbance to the species or their habitat could result in population declines, which could adversely affect viability of local populations.
- Since special status species populations are, by their nature, generally small and localized, the total area affected by other activities or restrictions is less important than where the activities or restrictions occur in relation to special status species and their habitat.
- The health of special status species populations is directly related to the overall health and functional capabilities of upland, aquatic, riparian and wetland resources, which in turn are a reflection of overall watershed health.
- Special status species health, population levels, and habitat conditions fluctuate in response to natural factors. Periods of drought or excessive moisture and outbreaks of diseases that affect special status species directly or alter habitat (e.g., mountain pine beetle) would likely affect special status species population levels.
- Implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area.
- All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level. The BLM would implement measures to conserve BLM sensitive species and their habitats to reduce the likelihood and need for these species to become listed. Success of mitigation depends on the specific protective measures employed and the assumption that proper implementation of these measures would take place. Adaptive management would be used (i.e., changing techniques, as necessary) until success is achieved.

4.7.1.4 Impact Indicators Used for Analysis

The following indicators have been identified to analyze the effects of the alternatives on terrestrial wildlife and special status habitat and populations.

- Acres of surface disturbance within each lease zone and habitat.
- Acres of surface disturbance by suitable habitat type (big game winter range, production areas, etc., as well as special status species and migratory birds), by alternative and zone.
- Acres of special status species habitat subject to NSO stipulations, by alternative and zone.

4.7.1.5 Methods of Analysis

Methods of analysis for terrestrial wildlife and special status species include the following for each alternative:

- Identify and estimate the acres of terrestrial habitats (vegetation communities) located within the analysis areas using data provided in Section 3.6, Vegetation, and published information.
- Identify and estimate acres of designated big game ranges that occur within the analysis areas using Forest Service, BLM, and CPW data.
- Identify special status terrestrial species (federally threatened, endangered, candidate, and proposed species under the ESA; Forest Service Sensitive Species and MIS) that occur within the analysis areas using Geographic Information System data and CPW and BLM occurrence information.
- Determine the extent of lease stipulations under each alternative that would provide some level of protection from disturbance of wildlife and habitats, and where those populations and habitats would potentially be at risk due to the lack of lease stipulations.

4.7.2 Stipulations Providing Coverage to Terrestrial Wildlife Resources

In order for future oil and gas leasing within the analysis area to be consistent with environmental laws and regulations, this analysis includes proposed lease stipulations to reduce potential impacts of oil and gas development on terrestrial wildlife including special status species. It is important to note that a one-time exemption from a stipulation can be applied that is determined on a case-by-case basis. The exception suspends the restrictions of a stipulation for a specified period of time, activity, or portion of the area where applied but remains in effect relative to other periods of time, activities, or areas where applied. As detailed in Section 2.7, the 2014 WRNF Oil and Gas Leasing EIS is a programmatic environmental analysis that considers conceptual or planning-level alternatives. For this EIS analyzing potential changes to the 65 previously issued leases, the RFDS (USFS 2010a), described briefly in Chapter 1.0, Section 1.1.4 and included as Appendix F of the WRNF Oil and Gas Leasing Draft EIS (USFS 2012) was used to determine the amount of conceptual future development in order to compare potential impacts of the proposed leasing stipulations under each alternative.

Stipulations are the same under Alternatives 1 and 2 and include CSU, NSO, and TL stipulations associated with big game species only. There are no stipulations identified for special status species. Under Alternative 3, the Proposed Action, modifications of the 65 leases would be made to match the stipulations for future leasing in the Forest Service's Proposed Action from the WRNF Final EIS (USFS 2014a). Under Alternative 3, the BLM would modify the existing leases to apply stipulations that match those identified by the Forest Service for future leasing in its Proposed Action. Under this alternative, the BLM would offer the lessee the option of either accepting the new lease terms or having the lease cancelled. Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all or part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

Standard Lease Terms (SLTs) also offer some level of protection of terrestrial wildlife species and habitat through modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measure, including the relocation of proposed operations up to 200 meters and a delay for new surface-disturbing operations for up to 60 days annually. SLTs identify the independent requirement for ESA compliance.

4.7.2.1 Wildlife-specific Stipulations

Tables 4.7-1 and **4.7-2** identify stipulations specific to terrestrial wildlife for all Alternatives. The methodology in developing stipulations is discussed in Section 1.4.6, "Lease Stipulations," and the rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS (USFS 2014a). The definition of the resource and purpose (need for protection) for WRNF resources is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS. The definition of the resource and purpose for GMUGNF resources is identified on each stipulation form in Appendix C of the 1993 GMUGNF Oil and Gas Leasing Plan Amendment.

Table 4.7-1 Stipulations Associated with Terrestrial Wildlife Under Alternatives 1 and 2

CSU
Elk Production Area—GMUGNF
NSO
Big Game Winter Range
Critical Bighorn Sheep Habitats
Federal and State TEPC Species
TL
Big Game Winter Range (December 1 through April 30, applies to elk and mule deer)
Big Game Winter Range—GMUGNF
Elk Production Area (May 1 through June 30)

Table 4.7-2 Stipulations Associated with Terrestrial Wildlife Under Alternatives 3 and 4

CSU
Big Game Migration Corridors
Big Game Production Areas
Big Game Summer Concentration
Big Game Winter Ranges
Elk Production Area—GMUGNF
Sensitive Terrestrial/Avian/ Invertebrate Species
NSO
Bighorn Sheep Migration Corridors and Water Sources
Bighorn Sheep Production
Bighorn Sheep Summer Concentration
Raptor Species Breeding Territories
TEPC Raptor Species
TEPC Wildlife Species\Wallace Creek Wildlife Seclusion Area
TL
Big Game Summer Concentration (June 16 through October 14; applies to deer, elk, moose, and black bear)
Big Game Winter Range (December 1 through April 14 applies to deer, elk, and moose and includes winter ranges, winter concentration areas, and severe winter ranges)
Raptor Species Breeding Territories (NSO buffers and dates vary by species)

NSO Stipulations

NSO stipulations are designed to provide the maximum coverage by prohibiting surface use or occupancy. Under Alternatives 1 and 2, there are NSO stipulations for Big Game Winter Range, Critical Bighorn Sheep Habitats, and Federal and State TEPC species. Under Alternatives 3 and 4, the NSO stipulation for Big Game Winter Range has been eliminated but there are NSO stipulations for, Bighorn Sheep Migration Corridors and Water Sources, Bighorn Sheep Production Areas, and Bighorn Sheep Summer Concentration Areas; Raptor Species Breeding Territories; TEPC Raptor Species; and TEPC Wildlife Species.

Controlled Surface Use Stipulations

CSU stipulations provide special operational constraints beyond SLT but do not prohibit all activities. Under Alternatives 1 and 2, there is one CSU stipulation for Elk Production Area on the GMUGNF. Under Alternatives 3 and 4, there are CSU stipulations for Big Game Migration Corridors, Production Areas, and Winter Ranges (applicable to deer, elk and moose); Big Game Summer Concentration Areas (applicable to deer, elk, moose, and back bear); Elk Production Areas (within the GMUGNF only); and Sensitive Terrestrial/Avian /Invertebrate Species. These CSU stipulations allow for special design, construction, operation, mitigation, implementation, reclamation, and monitoring measures, including the relocation of operations by more than 200 meters to protect terrestrial wildlife habitats.

Timing Limitations

TL stipulations are designed to limit use of key habitat during periods in which disturbance may result in mortality, reduced animal fitness, reduced reproductive success or poor survivorship of young. TL stipulations do not apply to operation and maintenance of existing facilities.

Under Alternatives 1 and 2, there is a TL stipulation that prohibits exploration, drilling and development activities in elk and mule deer winter range from December 1 through April 30. There also is a TL stipulation for elk production areas that prohibit exploration, drilling and development activities from May 1 through June 30 to protect habitats used for rearing young and concentrated feeding sites. Both TL stipulations also prescribe year-round closures of new oil and gas roads to the public in these areas.

- Under Alternatives 3 and 4, the Big Game TL stipulation precludes construction, drilling, and completion activities from December 1 to April 15 in elk, mule deer, and moose winter ranges as mapped by CPW. In addition, a new TL stipulation prohibiting surface use in deer, elk, moose, or black bear summer concentration areas (used for rearing young and providing high value foraging sites) between June 16 through October 14, was added to reduce behavioral disturbances that can result in abandonment of critical habitats, reduced animal fitness, or reduction of reproductive success, recruitment, and survival. Under these alternatives the elk production TL was not brought forward based on the decision made in the 2014 WRNF Oil and Gas Leasing EIS. Though the stipulation will not be included on any of the leases under Alternatives 3 and 4, there is still an opportunity to apply a 60-day TL as a COA under the BLM SLTs during site-specific NEPA analyses at the implementation level. However, implementing the TL stipulation for big game summer concentration areas (June 16 through October 14) and not including the elk production TL under Alternatives 3 and 4, would result in a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection.
- In addition to a new TL stipulation for big game summer concentration areas, a TL stipulation for raptor species breeding territories was added under Alternatives 3 and 4. This stipulation prohibits surface use within species-specific buffers and time periods and also prohibits any activity or disturbance that would result in active raptor nests not being used, or which would lead to raptor nest failure, abandonment, or mortality of fledglings.

4.7.2.2 Other Stipulations Offering Additional Coverage to Terrestrial Wildlife

There are other NSO stipulations that overlay with terrestrial wildlife habitat that may offer some coverage through prohibition of surface disturbance, but are not designed to specifically cover terrestrial wildlife habitat. These stipulations include, but are not limited to the following:

- NSO—Alpine
- NSO—Fen Wetlands
- NSO—Roadless Areas
- NSO—Slopes Greater than 60 percent
- NSO—Slopes Greater than 50 percent
- NSO—USFS Administrative Sites
- NSO—High Geologic Hazard—GMUGNF
- NSO—Riparian/ Wetland—GMUGNF
- NSO—Severe or High Landscape Stability Hazards
- NSO—TEPC Aquatic Species
- NSO—TEPC Plant Species
- NSO—Water Influence Zones
- NSO—Authorized Sites And Facilities
- NSO—High Scenic Integrity Objective
- NSO—RNAs

If all other NSO stipulations are implemented, these could potentially provide additional protection to some terrestrial wildlife resources from future surface-disturbing impacts in the areas where there is overlap with suitable habitat. However, should the resource being covered not occur within an area designated for a specific stipulation, the operator may obtain a waiver or exception, resulting in a lack of coverage to terrestrial wildlife species and associated habitat. The level of coverage from the implementation of these NSO stipulations would therefore be overestimated if not all stipulations were implemented.

4.7.3 Impacts Common to All Alternatives

Within the WRNF Final EIS (USFS 2014a), impacts identified for terrestrial wildlife species were considered indirect based on the action of making lands available for future oil and gas leasing. These impacts were disclosed in terms of two key indicators:

1. Behavioral disturbance (i.e., changes in use of habitats, use of movement corridors, and in behavior; and reactions to stress as a result of human disturbance including vehicle use, noise, and lighting); and
2. Physical impacts (i.e., habitat loss, habitat degradation, habitat fragmentation and isolation, interruption of wildlife movement corridors, wildlife mortality resulting from vehicle collisions, entrapment, drowning, and poisoning) (USFS 2014a, p. 192).

Impacts under each alternative were compared based on stipulations covering wildlife habitat available to lease for future oil and gas development (USFS 2014a, p. 201-211). Physical impacts were measured by evaluating the percent habitat lost or substantially degraded by habitat group within the analysis area. Estimated physical impacts are shown as a percentage of the lands available for oil and gas leasing without NSO stipulations (USFS 2014a, Tables 49, 51, 52, 54, and 55). Behavioral disturbance impacts were measured by evaluating road density and terrestrial wildlife habitat effectiveness within the analysis area for each alternative. Habitat effectiveness objectives are detailed in Section 3.3.2.2 of the WRNF Final EIS (USFS 2014a, p. 190-200).

Within this EIS, and similar to the WRNF Final EIS (USFS 2014a), leasing, by itself, would not directly impact terrestrial wildlife resources but, given that the development of the leases is a reasonably foreseeable result of the granted lease right, the impact analysis considers the potential impacts of reasonably foreseeable future development (see Section 4.1.1).

The primary issues related to terrestrial wildlife resources include the loss or alteration of associated habitats; mortality to individuals or loss of breeding sites, nests, eggs, and young; disturbance to wildlife species due to human presence, noise and lighting effects on wildlife; increased access to sensitive wildlife habitats; and potential impacts to threatened and endangered species. The degree to which

these effects affect wildlife species depends on a variety of factors including the species, time of year, duration of effect, and intensity of effect. Impacts common to all terrestrial wildlife species, including special status, as a result of oil and gas development are detailed in the 2014 Final EIS for Leasing on the WRNF (USFS 2014a, p 192-198).

4.7.4 Impacts by Alternative

4.7.4.1 Alternative 1 (No Action Alternative)

As shown in **Table 2-8**, Alternative 1 would result in 892 acres of initial disturbance and 387 acres of long-term disturbance across all zones. The majority of the disturbance would occur in Lease Zone 2, with an estimated 684 acres of initial disturbance and 296 acres of long-term disturbance. This would represent an estimated 76 percent of the overall disturbance under Alternative 1. Development in Lease Zone 3 would be 111 acres of the initial disturbance and 48 acres of long-term disturbance, which comprises an estimated 12 percent of the overall disturbance. Development in Lease Zones 1 and 4 result in less than 10 percent of the total disturbance. Development in Lease Zones 1 would be 77 acres of the initial disturbance and 33 acres of long-term disturbance. Development in Lease Zone 4 would be 21 acres of the initial disturbance and 9 acres of long-term disturbance.

Stipulation Coverage

Under Alternative 1, the BLM would continue to administer the leases with their current stipulations. Those leases that are currently under suspension would be reaffirmed and allowed to be developed at the discretion of the lessee. Should a suspension be lifted and lease reaffirmed, the process for management of exploration, development, and reclamation would continue to follow the process described in Section 1.1.3. Due to the limited number of lease stipulations and number of acres available to development, Alternative 1 would have the most potential to impact terrestrial wildlife species. Impacts from Projected Future Oil and Gas Development

Section 4.6.4.1 (Vegetation, Alternative 1) details impacts to vegetation communities that represent the associated terrestrial wildlife habitats. **Table 4.6-2** displays the amount of associated terrestrial wildlife habitats that would be covered by resource-specific stipulations under this alternative. Terrestrial wildlife habitat, with the exception of riparian/wetland habitats would not be subject to any resource-specific NSO stipulations. This stipulation would cover less than one percent of Zone 2 for both vegetation communities and riparian/wetland habitat. Greater than 99 percent of Zone 2 would be open for oil and gas development with respect to vegetative resource-specific NSOs. No resource-specific NSO stipulations apply to Zones 1, 3, or 4.

Non-resource related NSO stipulations (Section 4.7.2.2) that overlay with terrestrial wildlife habitat that would offer additional protection against surface disturbance, but are not designed to specifically cover these habitats. With consideration of all NSO stipulations, there is no area (0 percent) open for oil and gas development (surface occupancy) in Zone1; 61 percent of Zone 2, 92 percent of Zone 3, and 98 percent of Zone 4 would be available for oil and gas development; however, it should be clarified that one or more of these other NSO stipulations could be waived during site-specific NEPA analysis.

The stipulations providing coverage to terrestrial wildlife species under Alternative 1 are listed in **Table 4.7-1**. This includes a variety of stipulations specifically designated for big game ungulate species:

- CSU—Elk Production Area for the GMUGNF
- NSO—Big Game Winter Range and Critical Bighorn Sheep Habitats
- TL—Big Game Winter Range
- TL—Elk Production Areas

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, depending on habitat, all present terrestrial wildlife species would have the potential to be impacted directly and indirectly by oil and gas development as was described and referenced in Section 4.7.3, Impacts Common to All Alternatives. Reduction of impacts from surface-disturbing activities would be in place for terrestrial wildlife habitat through NSO stipulations for big game as well as non-wildlife related NSO stipulations. Limited protection from surface-disturbing activities to all terrestrial wildlife species would be potentially applied as a CSU in this Alternative. Potential protection from behavioral disturbance during winter months would be applied as a TL.

Under this alternative, the NSO stipulation for Big Game Winter Range was only applied to 26 percent of lease 066695 in Zone 3. However, as discussed in Section 4.7.2.3, there are non-wildlife related stipulations that overlay with big game wildlife habitat that do offer some level of protection to, but are not designed to specifically cover big game wildlife habitat. With consideration of these non-wildlife-related NSO stipulations that overlay big game sensitive ranges within the analysis area, the entirety of Zone 1 is closed to surface-disturbing activities due to a variety of NSOs. Therefore, all bighorn sheep sensitive ranges, mule deer winter concentration areas and winter range, elk winter range, black bear fall concentration areas, and all greater sage-grouse habitat would potentially be covered within the lease boundaries. However, with no exceptions granted to the NSOs, the development scenario under Alternative 1 would imply that the development would occur on the adjacent lands surrounding the leases. It is understood that there could be impact to sensitive wildlife habitats on adjacent lands with similar impacts to those addressed in Section 4.7.3, Impacts Common to All Alternatives. The percentage of big game ranges within the lease boundaries covered by wildlife-specific and non-wildlife-specific NSOs are included in tables below.

Mule Deer

Sensitive mule deer ranges within the analysis area include severe winter range, winter concentration areas and winter range. A Big Game Winter Range NSO stipulation exists under Alternative 1 that would afford these areas some protection, however, this stipulation does not overlay with any of these sensitive ranges under Alternative 1. As detailed in **Table 4.7-3** below, 100 percent of the mule deer sensitive ranges identified as occurring within the analysis area in Zone 1 would be covered by other non-resource NSO stipulations. Due to the generally higher elevation, Lease Zones 2 and 3 only contain 65 acres of mule deer winter range, 62 and 3 acres, respectively.

These acres would not be covered by any NSO stipulations and would be at risk for surface disturbance during lease development. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Alternative 1 also includes a TL stipulation for Big Game Winter Range, which is applied to mule deer. The TL would provide seasonal coverage to 2 percent (93 acres) of Mule Deer Winter Range in Zone 1, 58 percent (36 acres) of the 62 acres of mule deer winter range in Zone 2, and no acreage in Zone 3. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day Big Game Winter Range TL as a COA at the implementation level.

Table 4.7-3 Mule Deer Habitats with NSO Under Alternative 1

Zone	Mule Deer Severe Winter Range			Mule Deer Winter Concentration Areas			Mule Deer Winter Range		
	Acres within Analysis Area	NSO Coverage (% of habitat)		Acres within Analysis Area)	NSO Coverage (% of habitat)		Acres within Analysis Area	NSO Coverage (% of habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	184,360	0	13	278,273	0	16	615,817	0	15
1	0	0	0	19	0	100	6,160	0	100
2	0	0	0	0	0	0	62	0	0
3	0	0	0	0	0	0	3	0	0
4	0	0	0	0	0	0	0	0	0

0 = Outside the lease zones, but within the Analysis area. These areas would not be affected by the alternative, but are included for cumulative impact analyses.

Elk

The following sensitive elk ranges occur within the analysis area: production areas; severe winter range, winter concentration areas, and winter range; and summer concentration areas. Impacts are disclosed below.

Production Areas: Elk production areas within the analysis area would not be covered by any resource-specific NSO stipulations under Alternative 1. As detailed in **Table 4.7-4** by zone, between 1 percent (in Zone 4) and 41 percent (in Zone 2) of elk production areas within the analysis area would potentially be covered by non-resource NSO stipulations. The remaining acreages (over 19,000 acres within Zones 2, 3, and 4) could potentially be developed. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Under Alternative 1, a TL stipulation for elk production areas would be applied to areas within Zones 2 and 3. This stipulation would prohibit exploration, drilling and development activities from May 1 through June 30, and would prohibit the use of any new oil and gas roads by the public year-round. The percentage of coverage to elk production areas afforded by this stipulation is disclosed in **Table 4.7-4**. The TL stipulation would cover 25 percent of elk production areas in Zone 2 and 39 percent of elk production areas in Zone 3, but would not cover any of the 1,709 acres of elk production areas in Zone 4. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day elk production TL as a COA at the implementation level.

Table 4.7-4 Elk Production Areas Subject to NSO and TL Stipulations Under Alternative 1

Zone	Acres within Analysis Area	NSO Stipulations		TL Stipulations within Elk Production Areas (% of Habitat)
		Resource-specific NSO (% of Habitat)	Any NSO (% of Habitat)	
0[1]	207,158	0	29	NA
1	0	0	0	0
2	8,581	0	41	25
3	13,523	0	4	39
4	1,709	0	1	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas would not be affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Winter Range: As showing **Table 4.7-5**, the NSO stipulation for Big Game Winter Range included under Alternative 1 would cover 8 percent of the 2,112 acres of Elk Winter Range in Zone 3. Coverage would only occur on lease number 066695. The NSO stipulation would not cover any winter range in the other zones, nor would it cover any elk severe winter range or elk winter concentration areas. Coverage afforded to Elk Severe Winter Range, Elk Winter Concentration Areas, and Elk Winter Range from other NSO stipulations also are disclosed in **Table 4.7-5**. Within the lease area, the level of coverage for Winter Range habitat afforded by other NSO stipulations under Alternative would range from 1 percent (in Zone 4) to 100 percent (in Zone 2). Coverage afforded to Elk Severe Winter Range and Elk Winter Concentration Areas would range from 0 (in Zone 3, which contains 100 acres of Elk Severe Winter Range) to 6 percent (in Zone 2, which contains 454 acres of Elk Winter Concentration Areas). Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Alternative 1 also would include a TL stipulation for Big Game Winter Range. **Table 4.7-6** discloses the level of coverage afforded to Elk Severe Winter Range, Elk Winter Concentration Areas, and Elk Winter

Table 4.7-5 Elk Winter Ranges Covered by NSO Stipulations Under Alternative 1

Zone	Elk Severe Winter Range			Elk Winter Concentration Areas			Elk Winter Range		
	Acres Within Analysis Area	NSO Coverage (% of habitat)		Acres Within Analysis Area	NSO Coverage (% of habitat)		Acres Within Analysis Area	NSO Coverage (% of habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	302,343	0	12	302,821	0	14	1,067,300	0	17
1	0	0	0	0	0	0	5,038	0	100
2	455	0	3	454	0	6	11,625	0	21
3	100	0	0	0	0	0	2,112	8	23
4	0	0	0	0	0	0	317	0	1

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative but are included for cumulative impact analyses.

Table 4.7-6 Elk Winter Ranges Covered by TL Stipulations Under Alternative 1

Zone	Elk Severe Winter Range		Elk Winter Concentration Area		Elk Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	302,343	NA[1]	302,821	NA[1]	1,067,300	NA[1]
1	0	0	0	0	5,038	2
2	455	14	454	23	11,625	76
3	100	0	0	0	2,112	13
4	0	0	0	0	317	93

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Range through application of this seasonal stipulation. The TL stipulation would cover between 2 percent (Zone 1) and 93 percent (Zone 4) of all Elk Winter Range. The TL stipulation also would offer coverage to Elk Severe Winter Range and Elk Winter Concentration Areas within Zone 2 (14 and 23 percent, respectively) but would not cover any of the 100 acres of Elk Severe Winter Range within Zone 3. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day winter Big Game TL as a COA at the implementation level.

Summer Concentration Areas: There are no stipulations that provide seasonal protections for elk summer concentration areas. As detailed in **Table 4.7-7**, within the analysis area, about 50 percent of the summer concentration areas within Zone 2 and about 5 percent of summer concentration areas within Zone 3 would be covered by other non-resource NSO stipulations. The remaining acreages (over 18,500 acres within Zones 2 and 3) would be at risk for surface disturbance during lease development. Impacts would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. There are no TL stipulations related to protection of summer concentration areas under Alternative 1.

Table 4.7-7 Elk Summer Concentration Areas Covered by NSO Stipulations Under Alternative 1

Zone	Elk Summer Concentration Areas within the Analysis Area (acres)	NSO Coverage within Elk Summer Concentration Areas (% habitat)	
		Resource-specific NSO	Any NSO
0[1]	223,723	0	42
1	0	0	0
2	7,714	0	51
3	18,063	0	5
4	0	0	0

[1] 0= Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Moose

Under Alternative 1, there are no stipulations specifically designated for the protection of moose within the analysis area. As detailed in **Table 4.7-8**, NSO stipulations unrelated to moose would provide minimal coverage to moose concentration areas within the leases (0 to 2 percent, by zone). Under Alternative 1, NSO stipulations would cover about 12 percent of all moose summer range within the leases. There are no TL stipulations related to seasonal protection of moose concentration areas or moose summer range under Alternative 1. Impacts to habitat not covered by any stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-8 Sensitive Moose Habitat Covered by NSO Stipulations Under Alternative 1

Zone	Moose Concentration Areas			Moose Summer Range		
	Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)		Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	124,086	0	22	334,837	0	9
1	0	0	0	0	0	0
2	8,861	0	2	0	0	0
3	2,584	0	<1	128	0	12
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Rocky Mountain Bighorn Sheep

An NSO stipulation for Critical Bighorn Sheep Habitats would be applied under Alternative 1. Only Zone 1 contains sensitive bighorn sheep ranges. Therefore, impacts would be specified to the Battlement herd only as the range of the Avalanche herd overlaps with Zone 3. As detailed in **Table 4.7-9**, 43 percent of overall range and summer range would be covered by the Critical Bighorn Sheep Habitats NSO and all designated bighorn sheep ranges within Zone 1 would be covered by NSO stipulations.

As described above, with consideration of all NSO stipulations, Zone1 could potentially be closed to surface occupancy related to oil and gas development. Therefore, all bighorn sheep ranges within the lease boundaries would be covered under Alternative 1. Outside the lease boundaries, but within the analysis area, 24 percent of overall range, 84 percent of production areas, 7 percent of severe winter range, 53 percent of summer concentration areas, 26 percent of summer range, 57 percent of water sources, and 61 percent of winter concentration areas would be covered by an NSO. These areas are not affected by Alternative 1, but are included for cumulative impact analyses.

Carnivores

Black Bear

Under Alternative 1, there are no stipulations specifically designated for the protection of black bear concentration areas within the analysis area. As detailed in **Table 4.7-10**, NSO stipulations unrelated to black bear would provide NSO coverage to between 43 percent (in Zone 2) and 100 percent (in Zone 1) of fall concentration areas, and 18 percent of all fall concentration areas outside of the leases (but within the analysis area). NSO stipulations would cover about 12 percent of all summer concentration areas within the leases and 13 percent of all summer concentration areas outside of the leases (but within the analysis area). Impacts to habitat not subject to stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-9 Bighorn Sheep Habitat with NSO Coverage

Zone	Overall Range			Production Areas			Summer Concentration Areas			Summer Range			Winter Concentration			Water Sources		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	164,545	0	24	30,034	0	84	8,744	0	53	149,229	0	26	5,484	0	61	12,224	0	57
1	9,361	43	100	935	0	100	404	0	100	9,361	43	100	404	0	100	5,227	0	100
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

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Table 4.7-10 Black Bear Fall and Summer Concentration Areas with NSO Coverage

Zone	Fall Concentration Areas			Summer Concentration Areas		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0	482,403	0	18	435,685	0	13
1	993	0	100	0	0	0
2	14,857	0	43	0	0	0
3	285	0	67	128	0	12
4	0	0	0	2	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Special Status Species

Federally Listed and Candidate Species

Under Alternative 1, there would be an NSO stipulation for all known locations of federally listed TEPC species. The stipulation specifies the need for surveys during the site-specific NEPA stages, and development of appropriate mitigation. The stipulation does not extend to suitable or potential habitat. However, as stated in Section 4.7.1, Analysis Assumptions, implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area. All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level.

Federally Threatened

Canada Lynx

Impacts to the Canada lynx would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Under Alternative 1, there would be no stipulations specifically designated for the protection of Canada lynx habitat within the Canada Lynx Analysis Area that consists of LAUs crossed by the lease boundaries. Lynx denning habitat was located in Zones 2 and 3 within the Canada lynx analysis area. Other non-resource-specific NSO stipulations would provide coverage to less than 1 percent of the designated habitat within Zones 2 and 3 (**Table 4.7-11**).

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Table 4.7-11 Canada Lynx Habitat with NSO Coverage

Zone	Denning Habitat			Denning/Winter Habitat			Winter Habitat			Winter Forage Habitat			Other Habitat		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	8,009	0	2	344	0	<1	1022	0	<1	732	0	<1	18	0	<1
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2,043	0	<1	0	0	0	0	0	0	0	0	0	0	0	0
3	365	0	<1	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

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Western Yellow-Billed Cuckoo

Impacts to the yellow-billed cuckoo would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Under Alternative 1, within the GMUGNF, an NSO stipulation for riparian and wetland communities would afford coverage of yellow-billed cuckoo potential habitat within the Terrestrial Wildlife Analysis Area. Impacts to wetland habitat were analyzed in Section 4.6.4.1 (Vegetation, Alternative 1).

Mexican Spotted Owl

Impacts to the Mexican spotted owl would be the same as those described above as in Section 4.7.3, Impacts Common to All Alternatives for raptor species. Under Alternative 1, there would be no stipulations specifically designated for the protection of Mexican spotted owl suitable habitat within the analysis area.

Forest Service Sensitive and Management Indicator Species

Under Alternative 1, there are no stipulations specifically designated for the protection of Forest Service Sensitive and MIS species, with the exception of elk and bighorn sheep, which are analyzed above under big game ungulates. Section 4.6.4.1 (Vegetation, Alternative 1) details impacts to associated vegetation communities that represent the habitats associated with these species within the terrestrial wildlife analysis area. There are non-resource related stipulations that overlay with Forest Service Sensitive and MIS habitat that do offer some level of coverage, but are not designed to specifically protect them.

As detailed in **Table 3.7-11**, there are 255 acres of GHMA habitat for the greater sage-grouse that overlap with leases located in Zone 1. Under Alternative 1, known greater sage-grouse locations would be protected during site-specific development as described within the Northwest Colorado Greater Sage-grouse Proposed Land Use Plan Amendment and Final EIS (BLM and USFS 2015), but there would be no stipulations specifically designated for the protection of greater sage-grouse or designated GHMA habitat. However, an NSO non-resource related stipulation, slopes greater than 60 percent, overlays with all designated GHMA, potentially affording some coverage to this habitat from future oil and gas development. Additionally with consideration of all NSO stipulations, Zone 1 is precluded from development. Should a waiver to this stipulation be granted under a separate NEPA process, impacts to greater sage-grouse would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Therefore, Impacts to Forest Service Sensitive and MIS would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives. Impacts to associated Forest Service Sensitive and MIS habitat would be the same as those described above under nongame species.

4.7.4.2 Alternative 2 (Proposed Action)

Alternative 2 addresses inconsistencies between the 1993 WRNF ROD (USFS 1993a) and the lease stipulations as they were subsequently issued. In cases where the leases did not include the stipulations as stated in the Forest Service decision document; leases would be modified to include those stipulations (**Table 4.7-1**) under this alternative.

As shown in **Table 2-8**, oil and gas development under Alternative 2 would result in the same amount of initial and long-term disturbance as Alternative 1 (892 acres of initial disturbance and 387 acres of long-term disturbance). The distribution of disturbance between zones also would be the same as Alternative 1.

Stipulation Coverage

The level of coverage afforded to terrestrial wildlife and special status species under Alternative 2 would be similar to Alternative 1 (**Table 4.7-1**) except for minor changes to 8 of the 65 leases. No additional NSO stipulations specifically designated for terrestrial wildlife species would be added as a result of Alternative 2, but TL stipulations for 85 acres of big game winter range and 1,725 acres of elk production areas would be added. In addition, non-resource-specific stipulations added under Alternative 2 provide additional coverage to terrestrial wildlife resources.

Impacts from Projected Future Oil and Gas Development

Impacts to all terrestrial wildlife species, including special status species, and associated habitat would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives and as discussed under Alternative 1, with the exception of additional non-wildlife resource specific NSO coverage to the following species habitats.

1. Sensitive elk ranges:

- **Elk Production Area:** Under Alternative 2, an additional 340 acres of non-resource-specific NSO coverage occurred within Zone 3 increasing the coverage of elk production areas from 4 percent to 7 percent (**Table 4.7-12**). TL stipulation coverage would be increased by an additional 351 acres in Zone 3, increasing seasonal protections from 39 percent to 41 percent.
- **Elk Winter Range:** Impacts would be the same as under Alternative 1 except coverage of Elk Winter Range by TL stipulations in Zone 1 (which currently cover 2 percent of the total elk winter range in that zone) would be increased by 5 acres, maintaining 2 percent coverage of the total elk winter range in Zone 1.

Table 4.7-12 Elk Production Areas with NSO and TL Coverage Under Alternative 2

Zone	Acres within Analysis Area	NSO Coverage		TL Coverage for Elk Production Areas (% of Habitat)
		Resource-specific NSO (% of Habitat)	Any NSO (% of Habitat)	
0[1]	207,158	0	29	NA
1	0	0	0	0
2	8,581	0	41	25
3	13,863	0	7	41
4	1,709	0	1	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

2. Special Status Species:

- An additional 129 acres of Canada lynx denning habitat would be covered by a NSO for slopes greater than 60 percent on Lease No. 066687 in Zone 3 under Alternative 2. The additional acres would still result in less than 1 percent coverage of denning habitat within Zone 3.

4.7.4.3 Alternative 3

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in the Proposed Action from the 2014 WRNF Final EIS (**Table 4.7-2**).

As shown in **Table 2-8**, oil and gas development under Alternative 3 would result in 886 acres of initial disturbance and 383 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2, with 684 acres of initial disturbance and 296 acres of long-term disturbance (76 percent of the overall disturbance and the same as Alternatives 1 and 2). Development in Lease Zone 3 would be 104 acres of the initial disturbance and 45 acres of long-term disturbance, which comprises approximately 12 percent of the overall disturbance. Development in Lease Zones 1 and 4 result in less than 10 percent of the total disturbance. Development in Lease Zones 1 would be 77 acres of the initial disturbance and 33 acres of long-term disturbance. Development in Lease Zone 4 would be 21 acres of the initial disturbance and 9 acres of long-term disturbance.

<u>Stipulation Coverage</u>

Under Alternative 3, the NSO stipulation for Big Game Winter Range included under Alternatives 1 and 2 would be eliminated. Additional NSO stipulations specific to wildlife resources based on the 2014 WRNF Final EIS include:

- Bighorn Sheep Migration Corridors and Water Sources, Bighorn Sheep Production Areas, and Bighorn Sheep Summer Concentration Areas
- Raptor Species Breeding Territories
- TEPC Raptor Species
- TEPC Wildlife Species

Alternative 3 also would apply CSU stipulations to:

- Big Game Migration Corridors, Big Game Production Areas, Big Game Summer Concentration, Big Game Winter Ranges
- Elk Production Area (within the GMUGNF)
- Sensitive Terrestrial/Avian/Invertebrate Species

The big game winter range TL stipulation would be extended to moose, but would not include a year-round road closure for new oil and gas roads on public lands for the general public. Alternative 3 also would apply a TL stipulation prohibiting surface use in deer, elk, moose, or black bear summer concentration areas (used for rearing young and providing high value foraging sites) between June 16 through October 14, to reduce behavioral disturbances that can result in abandonment of critical habitats, reduced animal fitness, or reduction of reproductive success, recruitment, and survival.

- Under Alternative 3, the TL stipulation for elk production areas included under Alternatives 1 and 2 was eliminated to be consistent with decision made in the WRNF EIS. Portions (June 16 through June 30) of the sensitive time period (May 1 to June 30) can be covered through SLTs, under which operations may be delayed up to 60 days during site specific NEPA analyses at the implementation level. However, implementing the TL stipulation for big game summer concentration areas (June 16 through October 14) and not including the elk production TL under Alternatives 3 and 4, would result in a 45-day window (May 1 through June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection.

- To cover raptor species breeding territories that prohibits surface use within species-specific buffers and time periods and to prohibit any activity or disturbance that would result in active raptor nest failure, abandonment, or the mortality of fledglings.

Impacts from Projected Future Oil and Gas Development

Section 4.6.4.3 (Vegetation, Alternative 3) details impacts to associated vegetation communities that represent the habitats associated with terrestrial wildlife. As shown in **Table 4.6-8**, an estimated 89 percent of associated terrestrial wildlife habitat in Zone 1 would be covered by resource-specific NSOs. For Zone 2, 11 percent of habitat and 15 percent in Zone 3 would be covered by resource-specific NSOs. For Zone 4, an estimated 16 percent of vegetation cover would be covered by resource-specific NSOs. It is estimated that 11 percent of vegetation community cover in Zone 1 would be at risk from oil and gas development. An estimated 89 percent in Zone 2, 85 percent in Zone 3, and 84 percent in Zone 4 would be at risk from oil and gas development activities prior to site-specific surveys and ESA consultation at the APD stage of permitting.

An estimated 100 percent of vegetation community cover would be covered by resource-specific CSUs for Zone 1 and Zone 2. For Zones 3 and 4, 79 percent and 94 percent, respectively, would be covered by resource-specific CSUs. No portions of Zone 1 and 2 would be at risk. Approximately 21 percent and 6 percent would be at risk from oil and gas development for Zones 3 and 4, respectively.

Mule Deer

Under Alternative 3, there would be no NSO stipulations for coverage of mule deer; however, as shown in **Table 4.7-13**, with consideration of unrelated NSO stipulations, all sensitive mule deer winter habitat within lease Zones 1 and 3 would be fully covered. Within Zone 2, 31 percent of the mule deer winter range (19 acres) would not be covered by other NSO stipulations and thus at risk for surface disturbance during lease development. TL stipulations designated for the protection of big game winter range would preclude surface use seasonally from December 1 to April 14 within deer winter range, winter concentration areas, and severe winter range. Acreages covered by stipulations are disclosed in **Table 1.4-14**. Within the lease zones, all mule deer winter habitats would be fully covered by TL stipulations except for Zone 1, in which only 71 percent of the mule deer winter range would be covered. The remaining 29 percent can be covered with a 60-day TL through BLM SLTs at the implementation level. With consideration of all NSO stipulations and resource-specific TL stipulations, all mule deer sensitive habitats would be covered during key time periods.

Elk

Production Areas: Elk production areas within the analysis area would not be covered by any resource-specific NSO or TL stipulations; however there are CSU stipulations for big game production areas as well as the option to apply a 60-day TL through BLM SLTs at the implementation level. As a result, under Alternatives 3 and 4, there is a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection. Additionally, as shown in in **Table 4.7-15**, with consideration of all NSO stipulations, most elk production areas in in the lease area also are covered by NSO stipulations unrelated to elk.

Table 4.7-13 Mule Deer Winter Ranges Covered by NSO Stipulations Under Alternative 3

Zone	Mule Deer Severe Winter Range			Mule Deer Winter Concentration Areas			Mule Deer Winter Range		
	Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Resource-specific NSO		Resource-specific NSO	Resource-specific NSO
0[1]	184,360	0	13	278,273	0	16	615,882	0	15
1	0	0	0	19	0	100	6,160	0	100
2	0	0	0	0	0	0	62	0	69
3	0	0	0	0	0	0	3	0	100
4	0	0	0	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-14 Mule Deer Winter Ranges Covered by TL Stipulations Under Alternative 3

Zone	Mule Deer Severe Winter Range		Mule Deer Winter Concentration Area		Mule Deer Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	184,360	19[1]	278,273	NA[1]	615,882	NA[1]
1	0	0	19	100	6,160	71
2	0	0	0	0	62	100
3	0	0	0	0	3	100
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-15 Elk Production Areas Covered by NSO Stipulations Under Alternative 3

Zone	Acres within Analysis Area	NSO Coverage	
		Resource- specific NSO (% of Habitat)	Any NSO (% of Habitat)
0[1]	207,158	0	29
1	0	0	0
2	8,581	0	95
3	13,523	0	83
4	1,709	0	96

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Winter Range: There are no resource-specific NSO stipulations designated for the protection of elk winter habitats, but with consideration of all NSO stipulations, the majority of elk winter habitat within the leases would be covered by an NSO stipulation (**Table 4.7-16**). As disclosed in **Table 4.7-17**, all elk winter habitat within the leases would be covered by a TL stipulation precluding surface use within elk winter ranges, winter concentration areas, and severe winter ranges from December 1 through April 14.

Summer Concentration Areas: There are no resource-specific NSO stipulations designated for the protection of elk summer concentration areas, but a CSU stipulation would be applied to all summer concentration area acreage within the lease area. Additionally, almost all elk summer concentration areas within the leases would be covered by other unrelated NSO stipulations (**Table 4.7-18**). TL stipulations precluding surface use in elk summer concentration areas from June 16 through October 14 also would be applied to all acreage (see **Table 4.7-18**).

Moose

Under Alternative 3, there are no NSO stipulations specifically designated for the protection of moose habitat. As detailed in **Table 4.7-19**, NSO stipulations unrelated to moose would provide coverage to 91 and 83 percent of moose concentration areas within Zones 2 and 3, respectively. NSO stipulations also would cover almost 100 percent of moose summer range within the leases. There also is a TL stipulation related to the protection of big game summer concentration areas under Alternative 3, which would cover almost 100 percent of moose summer range within the lease area. Impacts to habitat not covered by stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Table 4.7-16 Elk Winter Ranges Covered by NSO Stipulations Under Alternative 3

Zone	Elk Severe Winter Range			Elk Winter Concentration Areas			Elk Winter Range		
	Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)		Acres Within Analysis Area	NSO Coverage (% habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	302,343	0	12	302,821	0	14	1,067,300	0	17
1	0	0	0	0	0	0	5,038	0	100
2	455	0	89	454	0	90	11,625	0	78
3	100	0	72	0	0	0	2,112	8	72
4	0	0	0	0	0	0	317	0	91

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-17 Elk Winter Ranges Covered by TL Stipulations Under Alternative 3

Zone	Elk Severe Winter Range		Elk Winter Concentration Area		Elk Winter Range	
	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)	Acres within Analysis Area	TL Coverage (%)
0[1]	302,343		302,821		1,067,300	
1	0	0	0	0	5,038	100
2	455	100	454	100	11,625	100
3	100	100	0	0	2,112	100
4	0	0	0	0	317	100

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses. Analysis of areas outside the zone is limited to NSO stipulations.

Table 4.7-18 Elk Summer Concentration Areas Covered by NSO and TL Stipulations Under Alternative 3

Zone	Elk Summer Concentration Areas within the Analysis Area (acres)	NSO Coverage within Elk Summer Concentration Areas (% habitat)		TL for Summer Concentration Areas
		Resource-specific NSO	Any NSO	
0[1]	223,723	0	42	0
1	0	0	0	0
2	7,714	0	97	100
3	18,063	0	93	100
4	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Table 4.7-19 Sensitive Moose Habitat Covered by NSO Stipulations Under Alternative 3

Zone	Moose Concentration Areas			Moose Summer Range		
	Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)		Acres within Analysis Area (acres)	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0[1]	124,086	0	22	334,837	0	9
1	0	0	0	0	0	0
2	8,861	0	91	0	0	0
3	2,584	0	83	128	0	99
4	0	0	0	0	0	0

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Rocky Mountain Bighorn Sheep

Several NSO stipulations for Bighorn Sheep would be applied to under Alternative 3. Only Zone 1 contains sensitive bighorn sheep ranges. Therefore, impacts would be specified to the Battlement herd only as the range of the Avalanche herd overlaps with Zone 3. **Table 4.7-20** identifies the potential level of coverage afforded to bighorn sheep range from these stipulations. All production areas, summer and winter concentration areas and water resource areas would be covered and 70 percent of all overall range and summer range would be covered through NSO stipulations.

With consideration of all NSO stipulations, Zone 1 would potentially be closed for oil and gas development (surface occupancy). Therefore, all bighorn sheep ranges within the lease boundaries would be covered under Alternative 3. All NSO coverage to bighorn sheep ranges within the analysis area, but outside the lease boundaries would be the same as Alternative 1.

Table 4.7-20 Bighorn Ranges Covered by Bighorn Sheep NSOs Under Alternative 3

Zone 1	Lease No.	Bighorn Range NSO Coverage (% of Habitat)					
		Overall Range	Production Areas	Summer Concentration Areas	Summer Range	Winter Concentration Areas	Water Source
	COC 058677	100	-	-	100	-	100
	COC 059630	79	-	-	79	-	100
	COC 066727	81	-	-	81	-	100
	COC 066728	100	-	-	100	-	100
	COC 066729	41	-	-	41	-	100
	COC 066730	56	-	-	56	-	100
	COC 066731	19	-	-	19	-	100
	COC 066732	54	-	-	54	-	100
	COC 066733	63	-	-	63	-	100
	COC 066926	57	100	100	57	100	100
	Total Coverage	**71**	**100**	**100**	**71**	**100**	**100**

Table 4.7-21 Black Bear Fall and Summer Concentration Areas Covered by NSO Stipulations

Zone	Fall Concentration Areas			Summer Concentration Areas		
	Acres Within Analysis Area	NSO Coverage (% of Habitat)		Acres Within Analysis Area	NSO Coverage (% of Habitat)	
		Resource-specific NSO	Any NSO		Resource-specific NSO	Any NSO
0	482,403	0	18	435,685	0	13
1	993	0	100	0	0	0
2	14,857	0	86	0	0	0
3	285	0	57	128	0	98
4	0	0	0	2	0	50

[1] 0 = Outside the lease zones, but within the analysis area. These areas are not affected by the alternative, but are included for cumulative impact analyses.

Carnivores

Black Bear

Under Alternative 3, there are no stipulations specifically designated for the protection of black bear concentration areas within the analysis area. As detailed in **Table 4.7-21**, NSO stipulations unrelated to black bear would provide coverage to between 57 percent (in Zone 3) and 100 percent (in Zone 1) of black bear fall concentration areas and would cover almost all of the back bear summer concentration acreage within the leases. Application of the TL stipulation related to protection of big game summer concentration areas under Alternative 3 also would cover almost 100 percent of black bear summer

range within the lease area. Impacts to habitat not covered by stipulations would be the same as those described and referenced above in Section 4.7.3, Impacts Common to All Alternatives.

Special Status Species

Federally Listed and Candidate Species

Under Alternative 3, there would be an NSO stipulation for all known locations of federally listed TEPC species. The stipulation extends to occupied and potential habitats necessary for the maintenance or recovery of species listed under the ESA (including proposed and candidate species) or by the State of Colorado as threatened or endangered. Therefore, under Alternative 3, the Canada lynx, Western yellow-billed cuckoo, and Mexican spotted owl would be subject to 100 percent coverage within all zones. Additionally, as stated in Section 4.7.1, Analysis Assumptions, implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether special status species could be present in the project area. All permitted activities that could affect federally threatened or endangered species would be required to undergo ESA Section 7 consultation with the USFWS, and would need to be mitigated to ensure that those species would not be adversely affected on a project-specific basis or at a cumulative level.

Forest Service Sensitive and Management Indicator Species

Under Alternative 3, there are no stipulations specifically designated for the protection of Forest Sensitive Species and MIS. Impacts to Forest Sensitive Species and MIS under Alternative 3 would be the same as those discussed for Alternative 1. Section 4.6.4.3 (Vegetation, Alternative 3) details impacts to associated vegetation communities that represent the habitats associated with these species within the terrestrial wildlife analysis area.

4.7.4.4 Alternative 4

As shown in **Table 2-8**, oil and gas development under Alternative 4 would result in 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2, with 684 acres of initial disturbance and 296 acres of long-term disturbance (76 percent of the overall disturbance and the same as Alternatives 1, 2, and 3). Development in Lease Zone 3 would be reduced to 39 acres of the initial disturbance and 17 acres of long-term disturbance, which comprises 4 percent of the overall disturbance. Development in Lease Zones 1 and 4 would be the same as under Alternative 3.

Stipulation Coverage

Alternative 4 would apply the same stipulations as Alternative 3 (**Table 4.7-2**) but also would cancel all or part of 25 leases in Zone 3.

Impacts from Projected Future Oil and Gas Development

Section 4.6.4.4 (Vegetation, Alternative 4) details impacts to associated vegetation communities that represent the habitats associated with terrestrial wildlife. An estimated 5 percent vegetation cover (15 percent of under Alternative 3) in Zone 3 would be covered by resource-specific NSO stipulations. Resource-specific CSUs would cover an estimated 25 percent (79 percent under Alternative 3) in Zone 3. In addition to the changes between area covered by resource-specific NSOs and CSUs, 67 percent vegetation cover of Zone 3 is covered due to its CTL designation under Alternative 4.

In Zone 3, an estimated 95 percent would be potentially at risk from oil and gas development where there would be no NSO stipulations; 75 percent would be at risk where there would be no CSU stipulations; and 33 percent of vegetation cover would be at risk where areas are not designated as CTL.

An estimated 37 percent riparian/wetland habitats (91 percent of under Alternative 3) in Zone 3 would be covered by resource-specific NSO stipulations. Resource-specific CSUs would cover an estimated 41 percent riparian/wetland habitats (92 percent under Alternative 3) in Zone 3. In addition to the changes between area covered by resource-specific NSOs and CSUs, 55 percent riparian/wetland habitats in Zone 3 is covered due to its CTL designation under Alternative 4.

In Zone 3, an estimated 63 percent of riparian/wetland habitat would be potentially at risk from oil and gas development where there would be no NSO stipulations; 59 percent habitat would be at risk where there would be no CSU stipulations; and, 45 percent habitat would be at risk where areas are not designated as CTL.

Impacts to all terrestrial wildlife species, including special status species, would be the same as those described under Alternative 3, with the exception of the areas closed for leasing. Additional protection afforded to certain terrestrial wildlife species by the cancellation of leases are discussed by species affected below.

Mule Deer

Coverage by stipulations to limit adverse effects to mule deer from Alternative 4 would be the same as Alternative 3 except that the 3 acres of mule deer winter range in Zone 3 that were covered with TL stipulations specific to mule deer and which also were covered with NSO stipulations not specific to mule deer would be eliminated through lease cancellation.

Elk

Production Areas: Under Alternative 4, all or part of 25 leases within Zone 3 would be cancelled. Lease cancellation would preclude surface disturbance in 9,724 of the 13,523 acres (72 percent) of elk production areas within Zone 3. Therefore, coverage of elk production areas would increase due to the cancellation of the leases. Within the remaining elk production areas (3,800 acres) that would still be open to oil and gas development, 90 percent would be covered by non-resource-specific NSO stipulations. As with Alternative 3, SLTs could be used to provide for a delay of operations for up to 60 days during calving, however, there is a 45-day window (May 1 to June 15) that leaves approximately 3,800 acres in Zone 3 without stipulation protection. CSU stipulations also would be applied to provide additional coverage.

Winter Range: Under Alternative 4, of the 100 acres of elk severe winter range located in Zone 3 without any NSO coverage, all but three would be canceled. Other resource stipulations would provide coverage to the remaining 3 acres and therefore, 100 percent of the elk severe winter range would be covered by NSO stipulations within Zone 3. Lease cancellation also would preclude development in 1,902 of the 2,112 acres of elk winter range (90 percent) within Zone 3. Impacts to severe winter range and winter range in Zones 1, 2, and 4 would be the same as Alternative 3. Impacts to elk winter concentration areas would be the same as Alternative 3.

Summer Concentration Areas: Impacts to elk summer concentration areas would be the same as Alternative 3 except that within Zone 3, 57 percent of the 18,063 acres of elk summer concentration areas within Zone 3 would be precluded from development through lease cancellation.

Moose

Impacts to moose from Alternative 4 would be the same as Alternative 3 (**Table 4.7-17**) except 1 acre of moose summer range would be precluded from development through lease closure in Zone 3.

Carnivores

Black Bear

Impacts to black bear concentration areas and moose summer range would be the same as Alternative 3 except that within Zone 3, 85 percent (241 acres) of black bear fall concentration areas and 1 percent (1 acre) of summer concentration areas would be precluded from development through lease closure. Of the remaining 44 acres of fall concentration areas within Zone 3, 86 percent would be covered through application of NSO stipulations unrelated to black bear.

Special Status Species

Federally Listed and Candidate Species

Impacts to TEPC wildlife species under Alternative 4 would be the same as those discussed for Alternative 3. Specific to the Canada lynx, 4,105 acres of lynx denning habitat would be closed to leasing. The remaining designated denning habitat (1,466 acres) would all be covered by the NSO for TEPC wildlife species.

Forest Service Sensitive and Management Indicator Species

Impacts to Forest Service Sensitive and MIS under Alternative 4 would be the same as under Alternative 3 with the exception of additional stipulation coverage associated with suitable habitat as analyzed in Section 4.6.4.4 (Vegetation, Alternative 4).

4.7.4.5 Alternative 5

Alternative 5 would cancel all 65 existing leases, which would result in plugging and abandoning wells; removing roads, wells pads, and ancillary facilities; and reclaiming all areas of disturbance. Disturbance resulting from lease cancellations would be 37 acres for pads and 39 acres for roads in Zone 2, and 1 acre from pads and 9 acres for roads in Zone 3. No surface disturbance would occur in the off-lease area, Zone 1, and Zone 4 because there are no existing wells.

After reclamation, there would be no anticipated alteration of habitat related to oil and gas development within the lease zones that could affect terrestrial wildlife resources. As part of well abandonment and road reclamation activities, direct disturbance to special status species would be restricted in compliance with federal regulations under the ESA.

Stipulation Coverage

Under this alternative, there are no stipulations providing additional coverage to terrestrial wildlife resources, as all leases would be cancelled by this action.

Impacts from Projected Future Oil and Gas Development

There would be no future development under this alternative; however, there would be impacts to wildlife resources from the surface disturbance required to plug and abandon the existing wells and reclaim any associated infrastructure (e.g., roads) as described above in Section 4.7.3, Impacts Common to All Alternatives.

4.7.4.6 Summary of Impacts

Alternative 1

Under Alternative 1, the No Action Alternative, oil and gas development would continue as operations currently exist. Under this alternative, wildlife-specific NSO stipulations would only be applied to bighorn sheep ranges and elk and mule deer game winter ranges. With consideration of all NSO stipulations, Alternative 1 offers additional coverage for all terrestrial wildlife resources beyond wildlife-specific NSO

stipulations. Stipulations may be waived during site-specific NEPA at the implementation level, reducing the level of coverage to terrestrial wildlife.

Based on the NSO for Big Game Winter Range under Alternative 1:

- 8 percent of elk winter range in Zone 3 would be covered, but no designated mule deer winter ranges within the analysis area would be covered by this NSO; and
- 43 percent of bighorn sheep overall and summer ranges would be covered by the Critical Bighorn Sheep Habitat NSO.

In addition, all known locations of special status species listed as federally threatened, endangered, and candidate species under the ESA would be covered by TEPC species NSO under Alternative 1.

With regard to combined NSO stipulations, Zone 1 would be fully covered by NSO, thus potentially protecting all terrestrial wildlife resources, including special status species within the lease areas, if those NSO stipulations were not granted exceptions. Based on wildlife-specific NSO stipulations providing coverage to wildlife species:

The Big Game Winter Range TL stipulation that would apply to mule deer and elk winter range within the analysis area would not always cover winter range as it is currently mapped. However, under Alternative 1, the TL could potentially provide seasonal protection to 2 percent (93 acres) of mule deer winter range in Zone 1, 58 percent (36 acres) of the 62 acres of mule deer winter range in Zone 2, and no acreage in Zone 3. This TL stipulation would cover between 2 percent (Zone 1) and 93 percent (Zone 4) of all Elk Winter Range. The TL stipulation also would cover Elk Severe Winter Range and Elk Winter Concentration Areas within Zone 2 (14 and 23 percent, respectively) but would not cover any of the 100 acres of Elk Severe Winter Range within Zone 3. The TL stipulation for elk production areas would cover between 25 and 39 percent of all elk production habitat by zone, but would not cover any of the 1,709 acres of elk production areas in Zone 4. In the areas that do not have a TL stipulation attached to the lease, under the BLM SLTs, it is possible to apply a 60-day Big Game Winter Range TL or an Elk Production Area TL as a COA at the implementation level.

Alternative 2

Any future oil and gas development under Alternative 2 would follow the same guidelines as the No Action alternative, with the exception of a few modifications to eight of the leases. These modifications would address inconsistencies with the 1993 WRNF Oil and Gas Leasing EIS, and add stipulations identified in the document but not attached to the leases as issued. Impacts would be the same as Alternative 1 except that the additional stipulations would:

- Increase the coverage of elk production areas from unrelated NSO stipulations from 4 to 7 percent and the coverage afforded by TL stipulations for elk production areas from 39 to 41 percent.
- Increase coverage of elk winter range afforded by TL stipulation for big game winter range in Zone 1 by 5 acres.
- Cover an additional 129 acres of Canada lynx denning habitat through application of unrelated NSOs.

Alternative 3

Alternative 3 would modify the existing leases to match stipulations for future leasing identified in the 2014 WRNF Final EIS. These modifications would add substantial stipulation coverage to terrestrial resources compared to the No Action Alternative and Alternative 2. These additional stipulations would leave much of the lease area potentially protected against future oil and gas exploration activities and it

is anticipated that under this alternative it would become more difficult for oil and gas development to occur. All of the zones gain substantial coverage from combined NSO lease stipulations under this alternative, and the majority of sensitive terrestrial wildlife habitats have the potential to be almost or completely protected from future development. The increase in stipulation coverage to applicable terrestrial wildlife species are as follows:

- Mule deer would have 100 percent NSO stipulation coverage in Zones 1 and 3, and about 70 percent NSO stipulation coverage in Zone 3.
- Elk production areas would have between 83 and 96 percent NSO stipulation coverage by zone. Elk winter range in all zones would have between 72 and 100 percent NSO stipulation coverage. Elk severe winter range and elk winter concentration areas in Zone 2 would have 89 to 90 percent NSO stipulation coverages. Severe winter range in Zone 3 would have 72 percent NSO stipulation coverages. Elk summer concentration areas would have over 90 percent NSO stipulation coverage in all zones and a new TL stipulation would cover 100 percent of all elk summer concentration areas. The TL stipulation or elk production areas contained under Alternative 1 would be eliminated, resulting in a 45-day window (May 1 to June 15) that leaves approximately 23,813 acres (10 percent of the total range within the analysis area) of elk production areas on 39 leases in Zones 2, 3, and 4 (**Table 3.7-4**) without stipulation protection. However, SLT also could be applied to delay development during calving periods and combined NSOs would cover more of the habitat than the TL stipulation.
- The TL stipulation for mule deer and elk winter range could potentially provide better seasonal protection of winter range as currently mapped compared to Alternative 1. Mule deer winter range would have 100 percent TL coverage in Zones 2 and 3, and 71 percent TL coverage in Zone 1. Elk winter range would have 100 percent TL coverage in all zones.
- Moose concentration areas would have over 80 percent NSO stipulation coverage in all zones; moose summer range would have over 99 percent NSO stipulation coverage. Moose winter habitat also would have 100 percent TL coverage (unlike Alternative 1, which only covers elk and mule deer).
- Bighorn sheep habitat would have 100 percent stipulation coverage. Black bear fall concentration areas would have 57 to 100 percent NSO stipulation coverage by zone; summer concentration areas would have almost 100 percent NSO stipulation coverage.
- Canada lynx, Western yellow-billed cuckoo, and Mexican spotted owl and associated habitat would be covered under NSO stipulations as federally listed species.

<u>Alternative 4</u>

Any future oil and gas development under Alternative 4 would follow the same guidelines as Alternative 3, with the addition of cancelling 25 leases in Zone 3. These modifications would potentially add substantial coverage for terrestrial resources compared to the Alternatives 1, 2, and 3 by precluding development in the following habitats:

- 3 acres of mule deer habitat within the leasing area;
- 9,724 (72 percent) of elk production areas within the leasing area;
- 97 acres (17 percent) of all elk severe winter range within the leasing area;
- 1,902 acres (90 percent) of all elk winter range within the leasing area;
- 10,296 acres (57 percent) of all elk summer concentration areas;

- 241 acres (85 percent) of black bear fall concentration areas and 1 acres (1 percent) of all summer concentration areas; and
- 105 acres of lynx denning habitat.

The cancellation of these leases would protect all terrestrial resources within the cancelled lease area; and unlike combined NSO stipulations, could not be granted. Stipulation coverages for other lease areas would be the same as Alternative 3, which offer greater coverage of terrestrial wildlife resources than Alternative 1.

Alternative 5

Alternative 5 would cancel all existing leases in the area, providing the maximum amount of protection to terrestrial wildlife resource. No oil and gas development would occur; however, there would be temporary impacts to terrestrial wildlife from the process of plugging and abandoning existing wells; removing roads, well pads, and ancillary facilities; and reclaiming disturbed areas.

4.7.5 Cumulative Impacts

4.7.5.1 Cumulative Impacts Analysis Area

The CIAAs for terrestrial wildlife species were chosen to represent the combination of geographic areas containing contiguous habitat that would be impacted by the proposed leasing decisions, as well as the management regimes to which this habitat is subject. The CIAAs primarily comprise NFS lands (WRNF and GMUGNF) but also include BLM lands within the CRVFO, GJFO, and WRFOs, as well as non-federal lands.

The CIAAs for terrestrial wildlife species are defined as follows:

- **Nongame, Small Game, and Special Status Terrestrial Wildlife:** The CIAA for small game species and nongame species, including raptors and other migratory birds, includes suitable habitat (as determined through use of the Forest Service Region 2 vegetation data) within the lease boundaries (80,380 acres). The CIAA for the remainder of the special status species, including Forest Service MIS and other threatened and endangered species includes suitable, historic, or occupied, habitat within the lease boundary based on Region 2 vegetation data. The exception is elk, which is an MIS but is analyzed under the analysis area described above.
- **Big Game:** The big game CIAA includes designated ranges (e.g., winter range, transition range, migratory corridors, fawning and calving areas and summer range) within the GMUs that are crossed by the lease boundaries. GMUs included in the analysis area include: 12, 23, 42, 43, 421, and 521 (2,121,890 acres).
- **Canada Lynx:** The Canada lynx CIAA includes LAUs crossed by the lease boundaries (510,805 acres). Within the LAU boundaries crossed by the lease boundaries, there is 32,809 acres of suitable lynx habitat.
- **Greater Sage-grouse:** The greater sage-grouse CIAA includes Priority Habitat Management Areas and GHMA crossed by the lease boundaries as classified by CPW. There are 255 acres of GHMA within the analysis area.

4.7.5.2 Past and Present Actions

The past and present actions impacting terrestrial wildlife resources are identified in Section 4.1. Past and present actions within the Terrestrial Wildlife CIAA include surface disturbance from energy development as well as other land development activities and other land management actions from the Forest Service and BLM. The primary past and present actions with surface disturbance affecting the resources analyzed in this EIS include mineral development; road development and other land

development such as ROWs for pipelines, telephone lines or other developments. **Table 4.1-2** presents total quantifiable past and present surface disturbance by CIAA. **Appendix B** discusses each of these actions in more detail. In total, past and present actions would disturb 8,697 acres (<1 percent) of the Big Game CIAA, 2,057 acres (<1 percent) of the Lynx CIAA, and 50 acres (<1 percent) of the Greater Sage-grouse CIAA.

The types of impacts to terrestrial wildlife and special status species would mainly consist of activities associated with surface disturbance and permanent structures that eliminate or fragment habitat, as well as human disturbance and direct mortality to terrestrial wildlife species.

4.7.5.3 Reasonably Foreseeable Future Actions

RFFAs within the terrestrial wildlife CIAAs that may result in surface disturbance are similar to those described as past and present actions and are described in detail in **Appendix B**. Some projects such as vegetation treatments may not have adverse impacts on terrestrial wildlife resources and may have a countervailing effect on cumulative impacts. This includes activities that enhance wildlife habitat, including specific wildlife habitat improvement projects, vegetation treatments (e.g., noxious weed control), and hazardous fuels reduction activities. These actions are described in greater detail in **Appendix B**.

Nongame, Small Game, and Special Status Species Terrestrial Wildlife CIAA

The surface disturbance effects from oil and gas within this CIAA would be limited to those associated with Alternatives 1 through 5 as described above. There are no other long term surface-disturbing RFFAs planned for this CIAA. There is an estimated 6,000 acres within this CIAA that may have countervailing impacts on vegetative resources under the South Rifle Habitat Enhancement Project. In addition, vegetation treatments (e.g., noxious weed control) and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Big Game CIAA

Oil and gas development RFFAs would disturb 16,391 acres (1 percent) of the Big Game CIAA. NSO stipulations would cover designated big game ranges outside of the leases to the degree detailed in Zone 0 for each species specific analysis and within **Tables 4.7-4** through **4.7-19**. Stipulation coverages range from 9 percent (moose summer concentration areas, see **Table 4.7-8** and **4.7-19**) to 84 percent (bighorn sheep overall range). Given the percentage of coverage afforded by NSO stipulations; it is reasonable to assume that development will occur in sensitive big game habitats. It also should be noted that these percentages consider all NSO stipulations. Waivers, Exceptions, or Modifications (WEMs) to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of coverage to minimize adverse effects to terrestrial wildlife resources. Surface disturbance from non-oil and gas RFFAs would result in 99 acres. This disturbance would result from reservoir enlargement, trail reroutes, and road improvement projects. Leasing stipulations would not limit location of these developments.

In total, disturbance from all surface-disturbing RFFAs would disturb 16,490 acres (less than 1 percent) in the Big Game CIAA. The alternatives would add between 821 and 892 acres, resulting in a total cumulative impact of between 17,311 and 17,382 acres (less than 1 percent of the CIAA).

As noted, there are 21,392 acres of vegetation treatments and hazardous fuels reduction RFFAs planned the Big Game CIAA (1 percent of the CIAA). Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Lynx CIAA

Oil and gas development RFFAs would disturb 687 acres (less than 1 percent) of the Lynx CIAA. NSO stipulations would cover 14,760 acres (45 percent of suitable lynx habitat within the lynx analysis area) of lynx habitat outside of the leases. Given the low percentage of coverage afforded by NSO stipulations; it is reasonable to assume that development will occur in suitable lynx habitats. It also should be noted that these percentages consider all NSO stipulations. WEMs to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of protection for terrestrial wildlife resources.

There are no other long term surface-disturbing RFFAs planned for the Lynx CIAA. There is an estimated 14,770 acres within the Lynx CIAA (3 percent of the CIAA) that may have countervailing impacts on vegetative resources due to vegetation treatments and hazardous fuel reductions. It is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Greater Sage-grouse CIAA

Oil and gas development RFFAs would disturb 71 acres (28 percent) of the Greater Sage-grouse CIAA. 100 percent coverage would be afforded by NSO stipulations to the CIAA. Under Alternatives 1 and 2, the NSO coverage would not be specific to greater sage-grouse habitat WEMs to the stipulation may be granted to the operator under specific conditions, which are identified and included in the individual stipulation, potentially resulting in a lack of coverage for terrestrial wildlife resources. Thus the amount of coverage afforded by NSO stipulations may be overstated. There are no other long-term surface-disturbing RFFAs or vegetation or fuels reduction planned for the Greater sage-grouse CIAA. It is assumed that these activities will continue in the future. Because many factors go into determining areas to be treated, there is no quantifiable countervailing impact.

Projects with Countervailing Impacts

Impacts under this section are those that may not have adverse impacts on terrestrial wildlife resources and may have a countervailing effect on cumulative impacts. This includes activities that enhance wildlife habitat, including specific wildlife habitat improvement projects, vegetation treatments (e.g., noxious weed control), and hazardous fuels reduction activities are performed throughout the CIAA and it is assumed that these activities will continue in the future. These actions are described in greater detail in **Appendix B**. As noted, there are 6,000 acres of vegetation treatments and hazardous fuels reduction RFFAs planned for the Terrestrial Wildlife CIAA (7 percent of the CIAA; 21,392 acres planned for the Big Game CIAA (1 percent of the CIAA); and 14,770 acres within the Lynx CIAA (3 percent of the CIAA). There are no vegetation or fuels reduction treatments planned within the Greater Sage-grouse CIAA.

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4.8 Aquatic Resources

4.8.1 Analysis Assumptions and Approach to Analysis

4.8.1.1 Analysis Area

The analysis area for aquatic resources coincides with the surface water resources analysis area. As shown in **Figure 3.5-1**, the geographical extent of the analysis area for aquatic species and their habitats includes the subwatersheds (HUC-12) and perennial waterbodies located within the oil and gas lease boundaries. Additional downstream reaches are included to evaluate potential offsite indirect effects from upstream leased lands, as well as the effects from water depletions. The downstream analysis area is defined as the perimeter of the subwatersheds that extend downstream of the lease boundaries. For federally listed fish species in the Colorado River, the downstream analysis area relates to the closest occurrence of the fish species including their critical habitat.

4.8.1.2 Scoping Issues

The following issues were identified for aquatic biological resources during public scoping. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development. Those issues that cannot be addressed in this leasing analysis are followed by a statement in parentheses explaining the reason for not addressing them.

- What is the potential for the Proposed Action and alternatives to affect the Colorado River System fish through consumptive use or impacts to water quality?
- How will the cumulative impacts from oil and gas and other regional development affect air quality, visibility, water resources, greater sage-grouse, and other wildlife?
- What acute or chronic impacts could result from reasonably foreseeable development that would affect aquatic species, including special status native and/or game species? How would these impacts affect hatchery operations and fishing activities? (Specific impacts to fisheries, such as chronic impacts, cannot be addressed without site-specific knowledge of the chemicals to be used and the precise locations in relation to aquatic habitat. Without knowledge of the site-specific locations for future oil and gas development, the high-level analysis in this EIS is not able to relate potential effects on fish populations to hatchery or stocking operations. Fishing activities are a recreation activity and are discussed in Section 4.13, Recreation.)
- What stipulations or BMPs, mitigation measures, or conditions of approval can be incorporated into the Proposed Action and alternatives to reduce risk to wildlife and special status species? (As noted in Chapter 2.0 and Section 4.1, BMPs, mitigation measures, and COAs will be addressed at the site-specific APD stage of oil and gas development. They are not included in this EIS.)

4.8.1.3 Assumptions

The following assumptions were used in analysis of impacts to aquatic biological resources.

- Species were considered as having the potential to occur within the analysis area if:
  - Occurrence has been documented for the species;
  - The current species range exists within the study area and suitable habitat is present; and
  - Historical range for species that have the potential to be reintroduced and suitable habitat is present.

- Important aquatic habitats are defined as perennial waterbodies such as ponds, reservoirs, lakes, streams, and rivers that provide habitat on a consistent basis throughout the year. The 100-year floodplains of rivers such as the Colorado and White represent critical habitat for the Colorado River federally listed fish species.
- Analysis for aquatic species includes select game fish (i.e., trout) and special status aquatic species.
- Effects on habitat for federal or state listed species could adversely affect population viability.
- The analysis for special status aquatic species assumes that the BLM and the Forest Service would continue to manage special aquatic status species' habitats on their lands in coordination with CPW and the Forest Service.
- The USFWS would have regulatory oversight regarding the management of federally listed species.
- The green lineage for cutthroat trout (GB) is treated the same as the federally threatened greenback cutthroat trout (GBCT).
- Management direction and guidance for special status species are provided through implementation of recovery plans, conservation agreements, management plans, and state wildlife plans (e.g., Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan), BLM policies (BLM 6840 Manual), and Forest Service policies (Forest Service Manual 2600, Rocky Mountain Region – Wildlife, Fish, and Sensitive Plant Habitat Management).
- Leasing is a commitment of the oil and gas resources for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions in support of the exploration or development of a lease. As a result of leasing, future exploration and development proposals could be brought forward that would be subject to specific state and federal regulatory and permitting requirements and to additional site-specific environmental analysis under NEPA. These subsequent analyses would address site-specific wildlife conditions and effects to them, and serve as the basis for any project-level design features or best management practice requirements.
- The leasing analysis relies on a RFDS that projects future potential surface-disturbing activities to provide a development scenario that has been determined to be reasonable on the proposed available lands. The RFD or alternatives will contain assumptions regarding well distribution within leases.
- It is conservatively assumed at this leasing stage that all water use for oil and gas drilling would be considered a water depletion. The source of water for future development could include municipal supplies, which have already been through previous Section 7 consultation. This water use would not result in further depletions.
- Additional mitigation measures are not identified as part of this programmatic analysis, but they will be identified and implemented as part of the APD stage.

4.8.1.4 Impact Indicators Used for Analysis

The following impact indicators are used in the impact analysis for aquatic resources:

- Amount of perennial stream miles subject/not subject to stipulations, by alternative and by lease zone.
- Length of perennial stream miles containing Colorado River cutthroat trout (CRCT), by alternative and by zone.

- Percentage of stream miles subject to stipulations compared to total perennial stream miles within each lease zone by alternative.
- Number and names of CRCT streams covered/not covered by stipulations, by alternative and by zone.
- Acres covered/not covered for boreal toad and northern leopard frog by stipulations, by alternative and by zone.

4.8.1.5 Methods of Analysis

Impacts were evaluated for each alternative using the following methods:

- Aquatic habitat for game fish and special status aquatic species was identified as perennial waterbodies (i.e., rivers, streams, lakes, and reservoirs) located within the Lease Zone areas and leases using Geographic Information Systems and USGS hydrology data.
- Information regarding aquatic species occurrence within the analysis area was obtained from a review of existing published sources, BLM RMPs, Forest Service LRMPs (forest plans), and file information from BLM, Forest Service, CPW, and USFWS.
- As part of the impact analysis, impact indicators were used to provide comparison among alternatives.
- There is considerable overlap of NSO and CSU stipulations for the same stream segments. In situations where there is overlap between multiple stipulations for the same stream segment, the longest stream length in miles was used in the analysis.
- Protection measures for Alternative 5 would include federal and state regulations related to the plugging and abandoning of producing wells, removal of roads, well pads, and ancillary facilities, and reclamation of all disturbed areas.

4.8.2 Stipulations Providing Coverage to Aquatic Resources

Six stipulations directly apply to aquatic habitat and species in the analysis area. The definition of these stipulations and applicability to Alternatives 1 through 4 are provided in **Table 4.8-1**. It is noted that these stipulations would not apply to Alternative 5.

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
NSO	Native Cutthroat Trout Habitat	No surface occupancy or use is allowed on the specified lands within 350 feet of occupied trout habitat. A modification may be granted if an environmental analysis demonstrates that a new road or pipeline added within the 350-foot buffer of an occupied native cutthroat trout stream has less impact to the cutthroat trout than an alternative route that avoids the buffer entirely.	X	X		

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
NSO	TEPC Populations and Habitats	No surface occupancy or use allowed on described lands for habitat areas used by aquatic species listed by the federal or state government as endangered or threatened, and federally proposed or candidate species. Habitat areas include occupied habitat or habitat necessary for the maintenance or recovery of the species. A modification may be granted, in consultation with the USFWS, if an environmental analysis demonstrates that the Proposed Action can be sited, conducted, or conditioned to remain compatible with the habitat protection and species recovery objectives.			X	X
NSO	Roadless Areas	No surface occupancy or use on the Battlement Mesa, Assignation Ridge, White River, and Pagoda Peak roadless areas for the purpose of protecting the roadless character of the areas.	X	X	X	X
CSU	Watersheds with CRCT and GBCT[2] Conservation Populations	Net density of roads cannot be increased in 6th level watersheds containing a conservation population of CRCT and GBCT. In cases where new roads are necessary for operations, an equivalent length of existing roads must be removed. Temporary roads (intended for less than 1 year) are excluded from this stipulation. A modification may be granted if an environmental analysis demonstrates that a new road or pipeline added within the 350-foot buffer of an occupied native cutthroat trout stream has less impact to the cutthroat trout than an alternative route that avoids the buffer entirely.			X	X
CSU	Sensitive Aquatic Species	Surface occupancy or use where aquatic species' habitats (fish and amphibians) listed as Sensitive by the Forest Service Rocky Mountain Region occur, special design, construction, mitigation, implementation, reclamation, reclamation, and monitoring measures may be required. A modification may be granted, in consultation with the USFWS, if an environmental analysis demonstrates that the Proposed Action can be sited, conducted, or conditioned to remain compatible with the habitat protection and species recovery objectives.			X	X
TL	CRCT Fisheries	No surface use is allowed during the exploration, drilling, and development activity from June 1 through October 1 in CRCT streams. This stipulation does not apply to operation and maintenance of production activities.	X	X		

Table 4.8-1 Stipulations Providing Coverage for Aquatic Habitat and Species

Type[1]	Name		Alternatives			
			1	2	3	4
TL	Boreal Western Toad	No surface use is allowed during the following time period April 15 through September 30. This stipulation does not apply to operation and maintenance of production facilities. The stipulation applies to lands within 1.5 miles of occupied western boreal toad breeding sites. A modification may be granted if an environmental analysis determines, through field surveys and data record searches and in consultation with CPW and the USFWS, that there are no known occupied or historically occupied western boreal toad breeding sites within 1.5 miles of lands proposed for activities.	X	X	X	X

[1] NSO = No Surface Occupancy; CSU = Controlled Surface Use; and TL = Timing Limitation.

[2] GBCT is not present within the Project area. However, CRCT (green lineage) is present and treated as GBCT at this time.

The following stipulations also would provide coverage for aquatic habitat although they were not designated specifically to protect that resource. The applicability to Alternatives 1 through 4 is noted in parentheses.

- NSO—Riparian/Wetland GMUGNF (Alternatives 1 and 2);
- NSO—Roadless Areas (Alternatives 1 through 4);
- NSO—Fen Wetlands (Alternatives 3 and 4); and
- NSO—Water Influence Zones (Alternatives 3 and 4).

4.8.3 Impacts Common to All Alternatives

The following types of potential impacts on aquatic species and habitat could occur from reasonably foreseeable oil and gas development:

- Loss or alteration of aquatic habitat could occur if there are no stipulations or regulations protecting aquatic habitat.
- Loss of aquatic species populations or reductions in abundance and diversity of aquatic species could occur in waterbodies where habitat is altered or removed.
- Effects of water quality changes such as increased sediment and other contaminants could affect aquatic habitat and species.
- Transfer of nuisance aquatic species could occur as a result of vehicle and equipment movement near drainages.
- Effects of flow alterations from oil and gas development on aquatic habitat and species would depend on the magnitude and duration of the flow change and the type of waterbody affected (i.e., intermittent vs. perennial stream, reservoir, or lake).
- Impingement and entrainment of game fish or special status fish species could occur due to surface water withdrawals.

The potential impacts on aquatic species and habitat listed in the first four bullets above also could result from the well plugging and abandonment and reclamation activities considered under Alternative 5.

Disturbance to Aquatic Habitat and Species

Alteration of habitat and subsequent effects on aquatic species would not occur directly in streams, rivers, or other waterbodies such as wetlands where there are stipulations requiring avoidance in buffer areas around the waterbody. There also would be protections afforded by compliance with federal and state regulations that limit disturbance to waterbodies through issuance of permits with environmental protection requirements. The relevant stipulations are discussed in the following sections as they apply to each of the alternatives.

There could be potential disturbance to aquatic habitat, if new roads or pipelines constructed to develop fluid minerals cross streams. Road or pipeline crossing locations have not been defined at this time but could occur on small- to mid-sized perennial streams. The WRNF LRMP (USFS 2002a) requires crossing techniques that would minimize adverse effects on stream habitat, as well as the restoration of disturbed areas to pre-construction conditions. The LRMP direction also provides additional protection for streams that contain pure genetic populations of CRCT and the following Conservation Agreement Species: bluehead sucker, flannelmouth sucker, and roundtail chub. New or widened stream crossings would not be allowed in streams with pure CRCT. In addition, no instream disturbance would be allowed during the spawning period (June 1 through September 1) of CRCT. Oil and gas development activities would be designed to avoid or mitigate impacts to the bluehead sucker, flannelmouth sucker, and roundtail chub that occur in the Green River.

If road or pipeline crossings are required in non-CRCT streams, construction may result in temporary disturbance to aquatic habitat by altering bottom substrates and possibly removing riparian vegetation. Vegetative cover along streambanks provides cover and shading for fish, bank stability, and increased food and nutrient supply as a result of deposition of insect and vegetative matter into the watercourse. Disturbance to streambank areas at stream crossing would represent a relatively small portion of the overall vegetative cover along the stream and juvenile and adult fish would likely move from the disturbance area. Bottom disturbance would result in mortalities to macroinvertebrates and possibly early life stages of fish. However, macroinvertebrate communities would likely recover within several months after disturbance.

Waterbody crossings by vehicles and equipment pose a risk of transferring invasive aquatic species between drainages, primarily the parasite that transmits whirling disease.

Water Quality Effects on Habitat and Species

Aquatic habitat for game and special status fish species could be negatively affected by water quality changes due to surface disturbance activities and potential fuel spills or leaks. Perennial streams with game and special status fish species are present in all of the lease zones. Accelerated erosion from surface disturbance may adversely impact aquatic habitats by increasing sedimentation in waterbodies. Actions including ground disturbance, vegetation removal, pipeline construction, and construction and use of access roads are the primary causes of erosion that can result in increased sedimentation and turbidity in streams. Natural events such as floods, fire, and drought conditions also can contribute to increased erosion. Changes in water quality resulting from surface disturbance within or near waterbodies would include increases in suspended sediment concentrations and turbidity. Sediment that is suspended or enters the waterbody from adjacent areas would be redeposited in areas in downstream areas. The extent of the sedimentation effect would depend on the flow conditions, substrate composition, stream configuration, and types of aquatic communities located within the affected areas. Refer to Section 4.5.1.3 in Water Resources for a detailed discussion of sedimentation effects on subwatersheds and surface water. Sedimentation also can affect water quality conditions by reducing dissolved oxygen, increase water temperature (Waters 1995). Fish species could be affected by

sedimentation in many of the perennial streams within the lease zones. Zones 2 and 3 contain most of the perennial stream habitat and game and special status fish species.

The effects of sedimentation on aquatic species would range from adverse effects on species behavior and physiological functions or important activities such as spawning and reproduction (Waters 1995). Excessive sedimentation also can alter important habitats by reducing depths in pools and covering spawning and rearing areas that are used by early stage development of fish. Over a long-term period, increased sediment loading also can reduce primary production and macroinvertebrate productivity (Waters 1995). The duration of sediment effects could range from short-term to long-term, depending on the duration of the surface disturbance activities and timeframe for stabilization.

Vehicle and equipment use, pipeline leaks, and failed well casings, or fuel and lubricant storage near waterbodies would pose a potential risk to aquatic biota. If fuel or other contaminants reached a waterbody, aquatic species could be exposed to toxic conditions from chemical residues within or on substrates in waterbodies. Impacts to aquatic species could range from lethal to sublethal effects and result in direct mortalities or reduced health. The magnitude of impacts would depend on the volume of spilled fuel, flow conditions, channel configuration, timing of cleanup and remediation, and species present in the affected area.

Implementation of a SPCC Plan would reduce the potential occurrence of or damage from spills.

Water Quantity Changes and Effects on Habitat and Species

Water use for drilling and completion activities, hydrostatic testing, and dust control could affect stream flows, if water sources are derived from or connected to surface water. As part of subsequent NEPA analyses at the APD stage of permitting, the water sources and connections to surface water would be evaluated for each site-specific oil and gas development project. If the water sources are connected to surface water, flow reductions could occur and affect the amount of available habitat for aquatic species. Negative effects on fish species could occur if the magnitude of the flow change alters a substantial portion of habitat needed for the various life stages of development.

In October 2008, the BLM completed a Programmatic Biological Assessment (PBA) for water depletion activities associated with BLM's fluid minerals program (including Forest Service leases) in the Colorado River basin in Colorado (BLM 2008b). In response to BLM's PBA, the USFWS issued a Programmatic Biological Opinion (PBO) (ES/GJ-6-CO-08-F-0006) on December 19, 2008, which concurred with BLM's determination that water depletions are "Likely to Adversely Affect" the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker (USFWS 2008a). Likewise, reasonably foreseeable oil and gas development also is likely to adversely affect designated critical habitats for these endangered fish along the Yampa, White, Colorado, and Gunnison rivers. However, the USFWS determined that water depletions from the Colorado River basin are not likely to jeopardize the continued existence of the Colorado pikeminnow, humpback chub, bonytail, or razorback sucker, and are not likely to destroy or adversely modify designated critical habitat. The PBA and PBO were written to remain in effect for up to 15 years or as long as an average annual depletion of 4,046 acre-feet per year is not exceeded. In the event this amount is exceeded, the BLM would reinitiate Section 7 consultation on a new depletion amount. Water use associated with federal fluid mineral development is tracked and reported annually. Because water use for reasonably foreseeable oil and gas development considered under this EIS has been through previous Section 7 consultation, there would be no new depletions counted from any of the alternatives.

As part of the Recovery Program for the Upper Colorado River fish species, a one-time payment is required for the average annual depletion volume in acre-feet that exceeds 100 acre-feet. The depletion fee is established each fiscal year after it has been determined that the Recovery Program is making sufficient progress toward recovery of the federally endangered fish species regarding ESA compliance for water withdrawals. The BLM has committed to offset the impacts of reasonable foreseeable future

development by soliciting a one-time payment from an industry group (USFWS 2008a). Based on average annual depletions of 4,046 acre-feet per year over a 15-year period (2009-2024) and the Fiscal Year 2009 depletion fee of $18.29 per acre-foot, a one-time payment of $74,001.34 was made to the Recovery Program.

Entrainment and Impingement Effects from Surface Water Withdrawals

The withdrawal of water from the permitted streams could result in the entrainment and impingement of early life stages of fish. The extent of the potential impact would depend on the timing and location of water withdrawals in the streams. Entrainment of young fish could occur in portions of the stream that are used as nursery areas that consist of shallow areas along the margin of streams, side channels, or backwaters.

Conservation measures identified in the PBO would be required to be implemented for any water withdrawals for oil and gas development in the analysis area. Water withdrawals taken directly from the Colorado, White, Yampa, and Gunnison rivers, which contain occupied and critical habitat for the four federally endangered fish species, must be implemented by individual oil companies, as listed below.

- Avoid entrainment by pumping from off-channel locations that are not connected to the mainstem portion of the river.
- If the pump head must be located in the river channel where larval fish are known to occur, additional measures must be applied. These measures prescribe the location of the pump, the amount of pumping between June 1 and August 15, and the timing of pumping.
- Screen all intake pumps with 0.25-inch or finer mesh.
- Report any fish impinged on screens to the USFWS.

Impacts Identified in the WRNF Final EIS

Impact issues that were identified for aquatic systems in the WRNF Final EIS (USFS 2014a) include the potential effects of future oil and gas development on aquatic habitat and species from road crossings; increased sedimentation from road and well pad surfaces; increased stream flow magnitude due to compacted surface run-off; and chemical pollutants such as fuels and industrial chemicals (USFS 2014a, p. 220). Impact indicators for the analysis consisted of the projected number of wells; projected number of well pads; acres of long-term disturbance watershed sensitivity; and acres available for leasing not covered by NSO stipulations (USFS 2014a, p. 220). The analysis identified the acres of surface occupancy by alternative and the relative sensitivity of three groups of subwatersheds to oil and gas development: 1) CRCT subwatersheds; 2) bluehead sucker/flannelmouth sucker/roundtail chub subwatersheds; and 3) mountain sucker subwaterseds (pp. 226 and 227). Seven subwatersheds (Thompson Creek, Middle Riffle Creek, Beaver Creek-Colorado River, Cache Creek-Colorado River, Wallace Creek, Morapos Creek, and Outlet North Fork White River) were considered high sensitivity for CRCT (p. 226). Two subwatersheds (West Divide Creek and Rifle Creek) were considered high sensitivity for bluehead sucker/flannelmouth sucker/roundtail chub (USFS 2014a, p. 227). In addition, four subwatersheds (West Rifle Creek, Morapos Creek, and Coal Creek) were high sensitivity for mountain sucker (USFS 2014a, p. 227). The acres of surface occupancy for CRCT subwatersheds ranged from 2,770 to 27,309 acres (USFS 2014a, p. 226). The No Action Alternative had the highest potential to affect sensitive fish and amphibians, federally listed fish species, and management indicator species.

4.8.3.1 Alternative 1 (No Action Alternative)

Under Alternative 1, stipulations would be applied as they were issued in the 1993 EIS/ROD (USFS 1993a). Two NSO stipulations would apply to aquatic habitat and species: riparian/wetland and CRCT habitat. Information related to the RFD zone, lease, and area protected in terms of acres and

linear stream miles is provided in **Table 4.8-2**. Aquatic habitat and species would be protected to a limited extent in Lease Zones 2 and 3. In Lease Zone 2, the riparian and wetland stipulation would apply to aquatic habitat in 3 acres in the headwaters of Middleton Creek. No fish are known to occur in this stream. This stipulation would be less than 1 percent of the lease where it would be applicable. In Lease Zone 3, the NSO Cutthroat Trout stipulation would be applied in seven leases. This stipulation would apply to a total of 599 acres in Lease Zone 3 or approximately 7 percent of the total combined area in the seven leases. In terms of stream miles, approximately 4.3 miles of CRCT habitat would apply to this stipulation. Five of the leases in **Table 4.8-1** show that no stream miles would be directly covered by stipulations. This means that the cutthroat trout stream does not pass through the lease, but upland areas adjacent to the stream are part of the buffer protection area. A portion of the drainage area would be covered by the NSO stipulation. Streams that would be affected by the NSO Cutthroat Trout stipulation would include North Thompson, Middle Thompson, and the South Branch Middle Thompson creeks. The CRCT populations in these streams consist of blue lineage in Middle Thompson Creek and a mixture of blue and green lineage in North Thompson Creek. It is suspected that the green lineage also is present in the South Branch Middle Thompson Creek. The Middle Thompson Creek also is considered a core conservation population.

Table 4.8-2 Stipulations for Aquatic Habitat and Species under Alternative 1

Zone	Lease No.	Stipulation Type	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	070013	NSO	Riparian/Wetland—GMUGNF	Middleton Creek	<0.1	<1
3	066691	NSO	Cutthroat Trout	North Thompson Creek	0.5	30
3	066694	NSO	Cutthroat Trout	North Thompson Creek	<0.1	<5
3	066696	NSO	Cutthroat Trout	Middle Thompson Creek	1.6	56
3	066697	NSO	Cutthroat Trout	Middle Thompson Creek	1.2	42
3	066701	NSO	Cutthroat Trout	South Branch Middle Thompson Creek	0.5	29
3	066712	NSO	Cutthroat Trout	North Thompson Creek	0.4	24
3	066909	NSO	Cutthroat Trout	North Thompson Creek	0.1	6
				Total NSO	**4.3**	**56[1]**
3	066701	TL	Cutthroat Trout	South Branch Middle Thompson Creek	1.1	64
3	066711	TL	Cutthroat Trout	Park Creek	0.3	NA[2]
3	066908	TL	Cutthroat Trout	Yank Creek	1.0	71
3	066909	TL	Cutthroat Trout	Yank Creek	0.2	14
				Total TL	**2.6**	**8[1]**

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

The TL stipulation for CRCT would apply to three streams, Park Creek, Yank Creek, and South Branch Middle Thompson Creek, in Zone 3. The stipulation would restrict surface disturbance from June 1 through October 1 in 2.6 stream miles. No streams within the zones would apply to boreal toad habitat.

The NSO stipulation for roadless areas would provide coverage to minimize adverse impacts to aquatic habitat and species, although it was not designed for aquatic resources. The NSO roadless stipulation would apply to 1.6 miles of CRCT (green lineage) habitat in Cache Creek (Zone 2).

A CTL stipulation on future oil and gas development would be applicable to Middle Thompson, West Divide, Park, Camp, and Cache creeks.

There are no stipulations that would apply to aquatic habitat and species in Zones 1 and 4 and some of the perennial streams are not subject to stipulations in Zones 2 and 3. Compliance with existing federal and state regulations and permits (e.g., CWA Section 404/401 permits) related to protection of streams and waterbodies would be required, depending on the site-specific location. Due to the lack of lease stipulations along some of the perennial streams, there could be negative effects on aquatic habitat and species. The extent of potential impacts on aquatic habitat and species would vary depending on the lease zone and whether stipulations would be in effect to minimize impacts (**Table 4.8-3**). There would be limited or no negative impacts on aquatic habitat and species in Zones 1 and 4 due to a lack of perennial streams and important aquatic species. The highest risk of potential impacts would be in Zone 3 where 28 miles of perennial stream habitat and 4 streams with game fish or special status species would not be subject to lease stipulations. Potential impacts also could occur in 6 perennial stream miles and 3 streams with game or special status species in Zone 2.

Table 4.8-3 Streams Not Subject to Stipulations under Alternative 1

Lease Zone	Miles of Perennial Streams[1]	Streams with Game Fish Species	Streams with Special Status Species	Streams with CRCT – Conservation Population (Yes or No)
1	0	None	None	None
2	6	West Divide Creek Beaver Creek Owens Creek	West Divide Creek Beaver Creek Owens Creek	West Divide Creek (Y) Beaver Creek Y) Owens Creek (N)
3	28	Fourmile Creek Little Rock Creek West Divide Creek East Divide Creek	Little Rock Creek West Divide Creek East Divide Creek	Little Rock Creek (Y) West Divide Creek (Y) East Divide Creek (N)
4	<1	None	None	None

[1] Miles of perennial streams within lease zone with no stipulations for protecting aquatic habitat and species.

Special status species that could be affected by projected future oil and gas development include CRCT and bluehead sucker in Zone 2 and CRCT, bluehead sucker, flannelmouth sucker, roundtail chub, and northern leopard frog in Zone 3. Streams containing CRCT are listed in **Table 3.8-2**. Potential habitat for the northern leopard frog occurs in East Divide Creek.

Portions of the subwatersheds that extend beyond the lease zone boundaries and their perennial stream habitat and associated game and special status species also could be affected by future oil and gas development, if there are no stipulations covering aquatic habitat and species. **Appendix A, Tables A-2** through **A-5** identifies these streams and species by lease zone.

The majority of the disturbance under Alternative 1 would occur in Zone 2, representing approximately 76 percent of the overall disturbance from future oil and gas development. Development in Zone 3 would be approximately 12 percent of the overall disturbance. Development in Zones 1 and 4 would be less than 10 percent of the total disturbance. For context, the estimated area of disturbance from projected

future oil and gas development would be less than 0.1 percent of the HUC-12 analysis area. Surface disturbance could result in alteration of aquatic habitat and water quality changes involving increased sediment and potential spills or leaks into streams with no stipulations. In total, development activities could adversely affect up to approximately 34 miles of perennial streams that contain game or special status fish species (**Table 4.8-3**). There would be no negative effects from oil and gas development under Alternative 1 on North Thompson, Middle Thompson, and the South Branch Middle Thompson creeks in Zone 3, as a result of implementation of NSO and TL stipulations for cutthroat trout.

The total water use for well drilling under Alternative 1 would be approximately 366 acre-feet over the 20-year period of development (annual average of 18.3 acre-feet per year). The total completion water use would be approximately 3,959 acre-feet (198 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 39.6 acre-feet per year could be from groundwater or surface water sources that are not recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM. Drilling water would be used in all four lease zones, with the largest quantity in Zone 2 (total of 211 acre-feet or annual average of 10.5 acre-feet per year).

4.8.3.2 Alternative 2

The effects of developing reasonably foreseeable future oil and gas within the lease zones under Alternative 2 on aquatic habitat and species would be the same as that discussed for Alternative 1. No additional stipulations would provide coverage to minimize adverse effects to aquatic habitat and species in the 8 leases with modifications to address inconsistencies with the 1993 WRNF Oil and Gas Leasing ROD (USFS 1993a).

4.8.3.3 Alternative 3

Under Alternative 3, additional stipulations would be applied to leases compared to Alternative 1. Two NSO stipulations would apply to aquatic habitat and species (Native Cutthroat Trout Habitat and TEPC Aquatic Species). By implementing these two NSO stipulations, aquatic habitat and CRCT would apply to 3.4 miles in Zone 2, 25.0 miles in Zone 3, and 0.4 mile in Zone 4 (see **Table 4.8-4**). No aquatic habitat would be subject to resource-specific NSO stipulations in Zone 1. Protection to aquatic habitat would be provided to the following streams:

- Zone 2—West Divide, Owens, Beaver, and Cache creeks
- Zone 3—East Willow, Little Beaver, Little Rock, West Divide, Fourmile, North Thompson, Freeman, South Branch Thompson, Middle Thompson, Porcupine, Park, Beaver Dam, Camp, Lava Boulder, Park, and Yank creeks
- Zone 4—Milk Creek

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	066915	Native Cutthroat Trout Habitat	West Divide Creek	0.4	71
	066916	Native Cutthroat Trout Habitat	West Divide Creek	0.1	19
	066917	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Owens Creek	<0.1	100
	066920	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Creek	0.6	NA[1]

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	067544	Native Cutthroat Trout Habitat	Cache Creek	0.6	27
	070014	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	1.3	59
	070015	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**3.4**	**44[2]**
3	058835	TEPC Aquatic Species	East Willow Creek	0.1	3
	05836	TEPC Aquatic Species	East Willow Creek	0.7	23
			Little Beaver Creek	0.6	40
	058837	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Little Rock Creek	0.1	100
			West Divide Creek	2.0	33
			Unnamed	1.0	20
		TEPC Aquatic Species	Little Beaver Creek	0.3	20
			West Divide Creek	0.8	13
	058838	TEPC Aquatic Species	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Native Cutthroat Trout Habitat	West Divide Creek	2.3	38
			Willow Creek	0.1	14
	058840	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	0.9	18
	058841	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	1.2	24
	066687	TEPC Aquatic Species	Fourmile Creek	0.2	10
	066691	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.5	30
	066693	TEPC Aquatic Species	Freeman Creek	0.1	14
	066694	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	<0.1	<6
	066695	TEPC Aquatic Species	South Branch Thompson Creek	<0.1	<6
	066696	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Middle Thompson Creek	1.6	56
	066697	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Middle Thompson Creek	1.2	42
	066701	TEPC Aquatic Species	South Branch Thompson Creek	1.7	100
	066702	TEPC Aquatic Species	Porcupine Creek	1.5	100
	066707	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Park Creek	0.4	30

Table 4.8-4 NSO Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	066708	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.1	20
	066710	TEPC Aquatic Species	Fourmile Creek	1.4	67
			Unnamed	0.1	NA[1]
	066711	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Park Creek	0.9	68
	066712	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.4	24
	066908	TEPC Aquatic Species	Yank Creek	0.6	43
	066909	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.7	42
			Total Zone 3	**25.0**	**70**[2]
4	066948	TEPC Aquatic Species	Martin Creek	0.4	80

[1] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

[2] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

Approximately 44 percent of the total miles of named perennial streams in Zone 2 would apply to NSO stipulations, 70 percent in Zone 3, and 80 percent in Zone 4. No perennial streams in Zone 1 contain game or special status species.

Applying the GMUGNF NSO stipulation for riparian/wetlands would result in a 0.1-mile section of Middleton Creek in Lease Zone 2 being restricted from surface disturbance. This stream is not occupied by CRCT or other special status aquatic species.

Two CSU stipulations would be applied to streams in Zones 2, 3, and 4 that contain sensitive aquatic species and watersheds with Colorado and greenback cutthroat conservation populations (**Table 4.8-5**). In total, the CSU stipulations would apply to 6 miles in Zone 2, 34 miles in Zone 3, and 0.5 mile in Zone 4. The CSU stipulations would apply to the same streams as listed for the NSO stipulations except that the stream lengths would be longer for the CSU stipulations, affording less restrictive constraints on surface disturbance that would still reduce the potential risk to the resource. One timing limitation stipulation for boreal toad breeding sites would be applied to Park Creek (0.5 mile).

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	061121	CSU-Sensitive Aquatic Species	West Mamm Creek	0.8	27
			Unnamed	0.1	42
	066915	CSU-Sensitive Aquatic Species	West Divide Creek	0.4	71
	066916	CSU-Sensitive Aquatic Species	West Divide Creek	0.1	6
	066917	CSU-Sensitive Aquatic Species	Owens Creek	<0.1	100
	066920	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Creek	0.6	100
	067147	CSU-Sensitive Aquatic Species	Middle Mamm Creek	1.2	100
	067543	CSU-Watersheds with CRCT/GBCT Conservation Populations	Unnamed	0.5	100
	067544	CSU-Sensitive Aquatic Species	Cache Creek	0.6	27
	070014	CSU-Sensitive Aquatic Species	Cache Creek	1.3	59
	070015	CSU-Sensitive Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**6.0**	**78[1]**
3	058835	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	1.5	50
	058836	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	CSU-Sensitive Aquatic Species	Little Beaver Creek	0.4	27
			Little Rock Creek	0.1	100
			West Divide Creek	3.2	53
			Unnamed	2.5	50
	058838	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.8	26
			West Divide Creek	1.3	43
			Willow Creek	0.7	100
			West Divide Creek	0.9	15
	058840	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	1.0	20

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	058841	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	1.2	24
	066687	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Fourmile Creek	0.2	9
	066691	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	0.5	30
	066693	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Freeman Creek	0.7	100
	066694	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	<0.1	<6
	066695	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	South Branch Middle Thompson Creek	<0.1	<6
	066696	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Middle Thompson Creek	1.6	56
	066697	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Middle Thompson Creek	1.2	42
	066701	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	South Branch Middle Thompson Creek	1.7	100
	066702	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Porcupine Creek	1.5	100
	066707	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Park Creek	0.4	30
			Beaver Dam Creek	0.4	25
	066708	CSU-Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Dam Creek	1.2	75
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.5	100
	066710	CSU-Sensitive Aquatic Species	Fourmile Creek	0.2	9
			Unnamed	0.2	100
		CSU-Watersheds with CRCT and GBCT Conservation Populations	Unnamed	1.5	NA[2]

Table 4.8-5 CSU and TL Stipulations for Aquatic Habitat and Species under Alternative 3

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
	066711	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	Park Creek	0.9	68
		TL-Western Boreal Toad Breeding Sites	Park Creek	0.4	30
	066712	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	North Thompson Creek	0.4	24
		TL-Western Boreal Toad Breeding Sites	North Thompson Creek	0.3	18
	066908	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	Yank Creek	1.2	86
	066909	CSU-Sensitive Aquatic Species and GBCT Conservation Populations	North Thompson Creek	0.7	42
			Yank Creek	0.2	14
	066913	CSU-Watersheds with CRCT and GBCT Conservation Populations	Unnamed	0.2	100
			Total Zone 3	**34.4**	**100[1]**
4	066948	Sensitive Aquatic Species and GBCT Conservation Populations	Martin Creek	0.5	100

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

Areas within the HUCs but outside of the lease zones would be protected by the CTL designation under Alternative 3. The CTL designation would close designated areas to future oil and gas leasing and development along approximately 44 miles of perennial stream habitat located outside of Zone 3. Habitat for game fish and special status aquatic species would be applied in Middle Thompson, North Thompson, South Branch Thompson, Park, West Divide, and Fourmile creeks and the Crystal River.

The NSO stipulation, TEPC Aquatic Species, would apply to boreal toad habitat and would avoid disturbance to the following boreal toad habitat: 43 acres in Zone 2; 541 acres in Zone 3; and 6 acres in Zone 4. This same NSO stipulation also is presented for boreal toad current range, which applies to 715 acres in Lease Zone 2. Incorporation of the GMUGNF NSO stipulations for high geological hazards, riparian/wetlands, and 60 percent steep slopes would result in an additional 73 acres being applicable to boreal toad current range. CSU and TL stipulations also would apply to boreal toad habitat in similar areas and acres.

Leopard frog habitat would be subject to NSO and CSU stipulations in the following areas: 595 acres in Zone 2, 4,255 acres in Zone 3, and 63 acres in Zone 4. Northern leopard frog habitat also would be

subject to the CSU stipulation for 929 acres in Zone 1, 3,434 acres in Zone 2, 8,373 acres in Zone 3, and 111 acres in Zone 4.

The aquatic resource-specific stipulations associated with Alternative 3 would apply to all perennial stream habitat in the lease zones that contain game fish and special status aquatic species. Habitat alteration or loss could occur in some streams that they do not contain game fish or special status aquatic species, such as West Mamm, Middle Mamm, and Cottonwood creeks in Zone 2 and portions of streams within Zones 2 and 3 where special status aquatic species are not present. It is estimated that 56 percent of perennial stream miles in Zone 2 and 22 percent in Zone 3 would not be subject to stipulations related to aquatic resources.

Additional NSO stipulations related to roadless areas, water influence zones, and wetland or fen areas would restrict development along streams, although they were not designed to protect aquatic resources. These additional NSO and CSU stipulations could provide coverage for most of the stream segments that would not be subject to the aquatic resource-specific stipulations. For context, the estimated area of potential disturbance would be less than 0.1 percent of the total HUC-12 analysis area associated with each of the zones. Surface disturbance could result in adverse impacts to aquatic habitat and water quality due to increased sedimentation and risks of spills or leaks into streams not covered by stipulations. In total, development activities could negatively affect up to 18 miles of perennial streams that contain game or special status fish species.

The total water use for well drilling under Alternative 3 would be approximately 364 acre-feet over the 20-year period of development (annual average of 18.2 acre-feet per year). The total water use for completions would be approximately 3,940 acre-feet (197 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 39.3 acre-feet per year could be derived from groundwater or surface water sources that would not be recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM.

4.8.3.4 Alternative 4 (Proposed Action)

Under Alternative 4, the same 2 NSO stipulations designated to cover aquatic habitat and species described for Alternative 3 would apply to aquatic habitat. Similarly, the GMUGNF stipulations would be applicable to the same aquatic resources and species, as discussed for Alternative 3. By implementing these two NSO stipulations, aquatic habitat and CRCT would be protected in 3.4 miles in Zone 2, 13.8 miles in Zone 3, and 0.4 mile in Zone 4 (**Table 4.8-6**). No habitat would be covered by NSO stipulations in Zone 1. Coverage of aquatic habitat from NSO stipulations would be the same as that listed for Alternative 3. Approximately 44 percent of the total miles of named perennial streams in Zone 2 would be protected by NSO stipulations, 43 percent in Zone 3, and 100 percent in Zone 4. No perennial streams in Zone 1 contain game or special status species.

Table 4.8-6 NSO Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	066915	Native Cutthroat Trout Habitat	West Divide Creek	0.4	72
	066916	Native Cutthroat Trout Habitat	West Divide Creek	0.1	18
	066917	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Owens Creek	<0.1	100
	066920	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Creek	0.6	100

Table 4.8-6 NSO Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	067544	Native Cutthroat Trout Habitat	Cache Creek	0.6	27
	070014	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	1.3	59
	070015	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Cache Creek	0.3	14
			Total Zone 2	**3.4**	**44**[1]
3	058835	TEPC Aquatic Species	East Willow Creek	0.1	3
	058836	TEPC Aquatic Species	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Little Rock Creek	0.1	100
			West Divide Creek	2.0	33
			Unnamed	1.0	20
		TEPC Aquatic Species	Little Beaver Creek	0.3	20
			West Divide Creek	0.8	13
	058838	TEPC Aquatic Species	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Native Cutthroat Trout Habitat	West Divide Creek	2.3	38
			Willow Creek	0.1	14
	058840	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	0.9	62
	058841	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Unnamed	1.2	NA[2]
	066691	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	<0.1	<6
	066693	TEPC Aquatic Species	Freeman Creek	<0.1	<14
	066708	Native Cutthroat Trout Habitat and TEPC Aquatic Species	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.1	20
	066908	TEPC Aquatic Species	Yank Creek	<0.1	<7
	066909	Native Cutthroat Trout Habitat and TEPC Aquatic Species	North Thompson Creek	0.1	6
			Total Zone 3	**13.8**	**39**[1]
4	066948	TEPC Aquatic Species	Martin Creek	0.4	80

[1] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

[2] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

Approximately 15 miles of perennial stream habitat within the HUC-12 analysis area but outside the leases within Zone 3 also would be protected by being closed to leasing.

Because all or part of 25 leases would be closed to leasing within Zone 3 under Alternative 4, there would be no disturbance due to oil and gas development on approximately 44 miles of perennial stream habitat within this zone along Middle Thompson, North Thompson, South Branch Thompson, Park, West Divide, and Fourmile creeks and the Crystal River.

The two CSU stipulations applicable to sensitive aquatic species and watersheds with Colorado and greenback cutthroat conservation populations would be the same as that listed under Alternative 3, with the exception of Zone 3 in which more stringent limitations on impacts to aquatic habitat would result from the leases that would be cancelled (see **Table 4.8-7**).

Table 4.8-7 CSU Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
2	061121	Sensitive Aquatic Species	West Mamm Creek	0.8	45
			Unnamed	0.1	42
	066915	Sensitive Aquatic Species	West Divide Creek	0.4	71
	066916	Sensitive Aquatic Species	West Divide Creek	0.1	29
	066917	Sensitive Aquatic Species	Owens Creek	0.1	100
	066920	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Creek	0.6	100
	067147	Sensitive Aquatic Species	Middle Mamm Creek	1.2	100
	067543	CRCT/GBCT Conservation Populations	Unnamed	0.5	100
	067544	Sensitive Aquatic Species	Cache Creek	0.6	NA[1]
	070014	Sensitive Aquatic Species	Cache Creek	1.3	NA[1]
	070015	Sensitive Aquatic Species	Cache Creek	0.4	NA[1]
			Total Zone 2	**6.0**	**78[2]**
3	058835	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	1.5	50
	058836	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.7	23
			Little Beaver Creek	0.7	47
	058837	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			Little Rock Creek	0.1	100
			West Divide Creek	3.2	53
			Unnamed	1.3	NA[1]

Table 4.8-7 CSU Stipulations for Aquatic Habitat and Species under Alternative 4

Zone	Lease No.	Stipulation Name	Stream Name	Stream Miles Covered	Percent Stream Miles Subject to Stipulation
3	058838	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Little Beaver Creek	0.4	27
			West Divide Creek	0.6	10
	058839	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	East Willow Creek	0.8	13
			West Divide Creek	2.3	38
			Willow Creek	0.7	100
	058840	Headwaters West Divide Creek	Unnamed	1.0	20
	058841	Headwaters West Divide Creek	Unnamed	1.2	24
	066691	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	North Thompson Creek	<0.1	<6
		Thompson Creek	North Thompson Creek	<0.1	<6
	066693	Fourmile Creek	Freeman Creek	<0.1	<14
	066707	CRCT/GBCT Conservation Populations	Beaver Dam Creek	0.4	25
	066708	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Beaver Dam Creek	0.1	6
			Camp Creek	0.2	100
			East Divide Creek	2.0	100
			Lava Boulder Creek	0.5	100
	066908	Thompson Creek	Yank Creek	<0.1	<7
	066909	Thompson Creek	North Thompson Creek	0.1	6
			Yank Creek	<0.1	<7
	066913	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Unnamed	0.2	14
			Total Zone 3	**18.5**	**58[2]**
4	066948	Sensitive Aquatic Species and CRCT/GBCT Conservation Populations	Martin Creek	0.5	100

[1] NA = Not applicable because the mainstem portion of the stream is not located within the lease, but a stream buffer does occur within the lease.

[2] Stream miles subject to the stipulations for the total zone percentage are not additive of individual stream miles.

The NSO stipulation, TEPC Aquatic Species, would apply to boreal toad habitat under Alternative 4 and avoid disturbance to the boreal toad habitat in the following amounts by zone: 2,118 acres in Zone 1; 3,813 acres in Zone 2; 1,159 acres in Lease Zone 3; and 48 acres in Lease Zone 4. CSU and TL stipulations also would provide protection to boreal toad habitat for similar areas and acres.

Leopard frog habitat would be subject to the resource-specific NSO and CSU stipulations by avoiding disturbance to the same acres of habitat in Zones 2 and 4 as described for Alternative 3. The NSO stipulation would apply to less leopard frog habitat (1,842 acres) compared to Alternative 3 (4,255 acres) because more area would be closed to leasing, resulting in more stringent limitations where leases are cancelled. The CSU stipulation under Alternative 4 would apply to the same acres of leopard frog habitat as described under Alternative 3 for Zones 1, 2, and 4, and less under the CSU stipulation because a large portion of Zone 3 would be closed to leasing.

The aquatic resource-specific stipulations associated with Alternative 4 would apply to all perennial stream habitat in the lease zones that contain game fish and special status aquatic species. The addition of the areas to be closed to leasing under Alternative 4 in combination with the NSO stipulation would minimize adverse effects to streams due to surface disturbance impacts. Habitat alteration or loss could occur in a limited number of streams that do not contain game fish or special status aquatic species, such as West Mamm, Middle Mamm, and Cottonwood creeks in Zone 2.

Similar to Alternative 3, additional NSO stipulations such as those designated to protect roadless areas, water influence zones, and wetland or fen areas would restrict development along streams, although they were not designed to protect aquatic resources. These additional NSO and CSU stipulations could provide coverage for most of the stream segments that would not be subject to the aquatic resource-specific stipulations. For context, the estimated area of potential disturbance would be less than 0.1 percent of the total HUC-12 analysis area associated with each of the zones. The impacts from reasonably foreseeable future oil and gas development would be similar to but less than that described for Alternative 3.

The total water use for well drilling under Alternative 4 would be approximately 339 acre-feet over the 20-year period of development (annual average of 16.9 acre-feet per year). The total water use for completions would be approximately 3,699 acre-feet (185 acre-feet per year), but approximately 80 percent of this water would be recycled. It is assumed that 20 percent of the completion water or 36.9 acre-feet per year could be derived from groundwater or surface water sources that would not be recycled. The actual water use and associated depletions would be tracked and reported annually to the USFWS by the BLM

4.8.3.5 Alternative 5

Under Alternative 5, all leases would be cancelled, and producing wells would be plugged and abandoned. Existing wells, access roads, and ancillary facilities would be removed, and all disturbed areas would be reclaimed. Disturbance resulting from lease cancellations would be approximately 37 acres for pads and 39 acres for roads in Zone 2, and 1 acre from pads and 9 acres for roads in Zone 3. No surface disturbance would occur in Zones 1 and 4 because there are no existing wells.

After reclamation, there would be no potential alteration of aquatic habitat from disturbance related to oil and gas development within the lease zones that could affect aquatic resources and habitat. As part of well abandonment and road reclamation activities, direct disturbance to aquatic habitat in the two streams, Beaver and West Divide creeks, containing CRCT would be restricted in compliance with federal regulations under the ESA.

There would be no water use or depletions under Alternative 5 related to well drilling or completion within the lease zones. There could be a small amount of water used for dust control during reclamation activities in Zones 2 and 3.

4.8.3.6 Summary of Impacts

In summary, the highest level of potential impacts to aquatic habitat and species would occur under Alternatives 1 and 2, as indicated by the percentage of perennial streams not subject to resource

stipulations (i.e., 100 percent in lease Zones 1 and 4; 44 percent for lease Zone 2; and 92 percent for lease Zone 3). Potential impacts would include habitat loss or alteration and negative changes in water quality. It is noted that there is very limited perennial stream habitat in lease Zones 1 and 4. In contrast, there would be no impacts to game fish and special status aquatic species under Alternatives 3 and 4, since streams that contain these species are subject to aquatic-focused stipulations. There could be impacts to a limited number of perennial streams that do not contain game fish or special status species under Alternatives 3 and 4. Potential water use from drilling and completion would negatively affect aquatic species if there are new depletions. The estimated volume of potential water use is similar for Alternatives 1 through 4, although Alternative 4 would be slightly higher than the other alternatives.

4.8.4 Cumulative Impacts

4.8.4.1 Cumulative Impacts Analysis Area

The cumulative impacts analysis area for aquatic resources is the same as the HUC-12 analysis area. The downstream analysis area is defined as the perimeter of the subwatersheds that extend downstream of the lease boundaries.

4.8.4.2 Past Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

The impacts of Alternatives 1 through 5 on aquatic resources in the HUC-12 subwatersheds would vary, with the lowest level of contribution resulting from oil and gas development under Alternatives 3, 4, and 5. The disturbance projected under each alternative would combine with past and present actions to total approximately 5,226 acres in the HUC-12 subwatersheds (less than 1 percent of the CIAA). Details on the cumulative actions are described in the Cumulative Impacts Scenario, **Appendix B**. The types of impacts would consist of alteration or loss of perennial stream habitat, water quality changes from sediment input or contaminant spills into streams, and potential habitat reductions due to water use if water sources are linked to surface water.

Reasonably Foreseeable Future Actions

Oil and gas RFFAs would disturb approximately 14,854 acres in the HUC-12 subwatersheds in and around Zones 1, 2, and 3. Future disturbance from oil and gas development in or near Zone 4 is estimated to be 43 acres. In total, these RFFAs would affect 2.5 percent of the CIAA. Estimated water use for oil and gas RFFAs is 22,304 acre-feet for drilling and 431,291 acre-feet for completions. Details on the cumulative actions are described in the Cumulative Impacts Scenario, **Appendix B**. Surface disturbance from non-oil and gas RFFAs would result in approximately 11,992 acres in the HUC-12 subwatersheds (2 percent of the CIAA). This disturbance would result from vegetation treatments and hazardous fuels reduction projects. The types of cumulative impacts to aquatic habitat and species would be the same as listed for past and present actions.

4.8.4.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The impacts of Proposed Action and alternatives would combine with surface disturbance effects from past and present actions and oil and gas development RFFAs to affect between 3 and 6 percent of the CIAA. The alternative's contribution to surface disturbance to total cumulative impacts would range between 0 percent (Alternative 5) to 3 percent (Alternatives 1 and 2). Additional portions of the CIAA (up to 2 percent) could be affected by vegetation treatments and hazardous fuels reduction projects. The types of cumulative impacts to aquatic habitat and species would be the same as listed for past and present actions.

Total water use for drilling and completion under Alternatives 1 through 4 would range from approximately 339 to 366 acre-feet for drilling and 3,699 to 3,959 acre-feet for completion over the 20-year timeframe of development. This water use would combine with the estimated water use for oil and gas RFFAs for an average total water use over a 20-year period of approximately 5,428 acre-feet per year, using the same assumptions for water recycling and drilling water used to project the water usage under the alternatives. The contribution of water use from oil and gas development under Alternatives 1 through 4 with oil and gas RFFAs would be tracked and reported annually to the USFWS by the BLM.

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4.9 Cultural Resources

4.9.1 Analysis Assumptions and Approach to Analysis

4.9.1.1 Analysis Area

The analysis area encompasses the maximum extent of the lease boundaries.

4.9.1.2 Scoping Issues

Issues and concerns relevant to cultural resources that were raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development. Those issues not specifically addressed in this analysis include an explanation for excluding the discussion in parentheses following the issue.

- The Thompson Divide area was identified as a Traditional Cultural Property (TCP) during public scoping. Concerns were expressed over the cultural and health violations that will occur if the suspended oil and gas leases are not voided. (This area is not a recognized TCP so was not specifically discussed as a cultural resource. The health impacts in the analysis area are considered in other sections, such as Section 4.16.2, Human Health and Safety.)
- Commenters reminded the BLM that EO 13007 charges management of federal lands to accommodate access to, and ceremonial use of, sacred sites and to avoid adversely affecting the physical integrity of such sacred sites. (Compliance is assumed for all federal actions.)
- Concerns for heritage tourism, particularly related to the Redstone, the Coke Ovens, Elk Park, and the Thompson House in Carbondale. (All of these are located outside of the analysis area so are not addressed in this section.)
- Cultural resource sites are non-renewable resources, and they would lose integrity, heritage value, and potentially important information if they are developed.

4.9.1.3 Assumptions

The following assumptions were made for the analysis of cultural resources.

- Oil and gas leasing decisions do not authorize specific actions or ground disturbance and would have no direct impact on cultural resources. The surface disturbance that would occur under reasonably foreseeable development has the potential to affect cultural resources, but are only measurable at the time of development of the lease.
- Prior to development, preconstruction surveys would be conducted to identify any heritage resources that may be affected by a project, to identify which of those heritage resources are eligible for the National Register of Historic Places (NRHP), and to minimize unanticipated discoveries of unknown sites. These surveys would be required during the APD stage that would involve subsequent site-specific NEPA analysis before a permit to drill is issued. If eligible cultural resources (archaeological sites or TCPs are identified that require protection, the proposed locations of wells, access roads, or other facilities may be moved or mitigated according to federal requirements to avoid or minimize adverse direct or indirect impacts.
- Under all of the alternatives, the preferred management strategy for eligible cultural resources would be avoidance and protection of these sites from adverse effects. Eligible sites are non-renewable resources, and they would lose integrity, heritage value, and potentially important information if they were destroyed or altered without appropriate mitigation. It is assumed that all future oil and gas development in the analysis area would comply with all federal and state regulations, such as the National Historic Preservation Act; Archaeological Resources Protection

Act of 1979, as amended; EO 13007 (Indian Sacred Sites); and any terms and conditions associated with permits to drill.

- Measures would continue to be implemented in order to avoid the impacts to all eligible sites under federal jurisdiction. Treatments designed to minimize or mitigate adverse direct or indirect effects to eligible properties may include project relocation, redesign or modification, physical protection measures (including fencing or padding), stabilization, restoration, rehabilitation, documentation, monitoring, repair, and data recovery. Other measures may be required to protect or minimize adverse impacts to TCPs.
- The numbers of cultural resources covered by stipulations or affected assumes an even distribution of sites and density for each zone, based on the numbers presented in Section 3.9.3.

4.9.1.4 Impact Indicators Used for Analysis

Impact indicators for this analysis are based on acres of NSO stipulations that would protect cultural resources and the number of sites that may be affected by surface disturbance in relation to known cultural resources sites and site density.

4.9.1.5 Methods of Analysis

There are no stipulations that have been developed specifically to protect cultural resources. However, beneficial impacts would result from implementation of any NSO stipulations because that would minimize or prevent surface disturbance and result in avoidance of cultural resources. As a result, the NSO stipulation is the primary constraint on development considered in regards to minimizing impacts to cultural resources in Zones 1 through 4. The area of NSO stipulations is compared to the anticipated total sites in each zone based on the acreage and site densities that was presented in Section 3.9.

4.9.2 Stipulations Providing Protections to Cultural Resources

There are no resource-specific stipulations designed to protect cultural resources within the existing leases (the 1993 EIS does contain an NSO stipulation for Historic Sites, Open Lithic Scatters and Paleontological Sites; however it was not applied within the 65 existing leases). NSO stipulations implemented to protect other resources would serve to exclude ground-disturbing activities that have the potential to affect cultural resources should they be implemented. Therefore, implementing NSO stipulations would avoid adverse impacts to cultural resources.

4.9.3 Impacts Common to All Alternatives

Impacts from the development of oil and gas would consist of physical disturbance to cultural resources through such activities as ground disturbance, construction, demolition, erosion, and sedimentation. Indirect effects to cultural resources, such as visual impacts, noise, or other impacts to the setting of the cultural resources, also may occur. Under Alternative 5, leases would be canceled requiring disturbance of previously disturbed areas to plug and abandon wells, decommission roads, remove equipment and infrastructure, and reclaim disturbed areas. Following reclamation, impacts would be primarily beneficial because further surface disturbance for oil and gas development would not occur unless areas are leased in the future. The primary difference in the potential impacts under each alternative is the extent of reasonably foreseeable future development that would result in surface disturbance in Zone 3 and the effects of lease cancellation, which would exclude all oil and gas surface disturbance.

The preferred management strategy for eligible sites under all the alternatives would be to avoid and protect these sites from direct, indirect, and cumulative effects. Under all of the alternatives, federal guidelines under Section 106 of the National Historic Preservation Act require inventory, documentation, analysis, mitigation, avoidance, and monitoring when necessary.

Vandalism, inadvertent damage, or illegal artifact collection could occur as a result of increased access via newly constructed roads. New road construction would make cultural resources more accessible and studies have shown most vandalism occurs within close proximity to roads.

Impacts Identified in the WRNF Final EIS

According to the WRNF Final EIS (USFS 2014a), identifying land as open to oil and gas leasing has no direct effects on cultural resources, and any effects of leasing and potential future development would be measureable at the time of development of the lease. Adverse impacts may result from ground-disturbing activities that damage archaeological sites or disrupt cultural landscapes, while beneficial impacts may result from minimizing or preventing surface disturbance, and avoidance of archaeological sites, as well as from measures used to protect sites (USFS 2014a, p. 370). The impacts to cultural resources cannot be quantified without knowing the location of potential future surface-disturbing activities and the cultural resources that might be present. Some irreversible loss of sites may occur as a result of inadvertently damaged, destroyed, vandalized, or looted sites, once the roads are constructed and the earthmoving begins. Sites also may experience damage due to natural processes (USFS 2014a, p. 370).

4.9.4 Impacts by Alternative

4.9.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Alternative 1, the No Action Alternative, reaffirms the lease stipulations on the 65 leases as they were originally issued. Under this alternative, there are currently a total of 23,443 acres of NSO stipulations. Based on the predicted density of cultural resources sites (including TCPs) presented in Section 3.9.3 by zone, 276 cultural resources sites are anticipated to occur in these areas that would be subject to stipulations (see **Table 4.9-1**).

Table 4.9-1 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 1

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,110	202
2	9,820	39
3	3,448	34
4	65	0
Total	**23,443**	**276**

Of the 117 previously recorded cultural resources sites, 18 (13 in Zone 1 and 5 in Zone 2) would be covered by NSO stipulations. Of these 18 previously recorded sites, 2 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 416 new wells on 60 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (319 wells). The estimated total initial surface disturbance under Alternative 1 would be 892 acres, with the majority of disturbance occurring in Zones 2 and 3. Based on projected site densities by zone, it is possible that 6 sites could be affected by this development-related surface disturbance (see **Table 4.9-2**). In

compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-2 Comparison of Initial Surface Disturbance and Projected Cultural Resources Affected under Alternative 1

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	76	2
2	684	3
3	111	1
4	21	0
Total	**892**	**6**

4.9.4.2 Alternative 2

Stipulation Coverage

Alternative 2 would update 8 leases with 513 additional acres of NSO stipulations, and would serve to protect these areas that may otherwise be open to surface disturbance (**Table 4.9-3**). Based on the predicted density of cultural resources sites presented in Section 3.9.3 by zone, 281 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-2**).

Table 4.9-3 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 2

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,106	202
2	9,820	39
3	3,965	40
4	65	0
Total	**23,956**	**281**

Of the 117 previously recorded cultural resources sites, 18 (13 in Zone 1 and 5 in Zone 2) would be covered by NSO stipulations. Of these 18 previously recorded sites, 2 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

The projections for future oil and gas development and estimated associated surface disturbance are the same as that described for Alternative 1. The potential number of sites that could be affected also would be the same as stated for Alternative 1 and displayed in **Table 4.9-2**.

4.9.4.3 Alternative 3

Stipulation Protections

Under Alternative 3, there would be an increase in the extent of NSO stipulations. Under this alternative, there would be a total of 71,046 acres of NSO stipulations. Based on the predicted density of cultural

resources sites presented in Section 3.9.3 by zone, 670 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-4**).

Table 4.9-4 Comparison of NSO Acreage and Anticipated Sites Covered by Stipulations under Alternative 3

Zone	NSO Area (acres)	Anticipated Number of Sites Potentially Covered by Stipulations
1	10,114	202
2	21,606	86
3	36,974	370
4	2,352	12
Total	**71,046**	**670**

Of the 117 previously recorded cultural resources sites, 80 (13 in Zone 1, 10 in Zone 2, 55 in Zone 3, and 2 in Zone 4) would be covered by NSO stipulations. Of these 80 sites, 10 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 413 new wells on 59 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (318 wells). The estimated total initial surface disturbance under Alternative 3 would be 886 acres, with the majority of disturbance occurring in Zones 1 and 2. Based on projected site densities by zone, it is possible that six sites could be affected by this development-related surface disturbance (see **Table 4.9-5**). In compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-5 Comparison of Initial Surface Disturbance and Cultural Resources Covered by Stipulations Affected under Alternative 3

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	77	2
2	684	3
3	39	1
4	21	0
Total	**886**	**6**

4.9.4.4 Alternative 4 (Proposed Action)

Stipulation Protections

Under Alternative 4, the extent of NSO stipulations would be less but there would be additional protection from surface disturbance from oil and gas development through the cancellation of all or part of 25 leases in a portion of Zone 3 that would be closed to leasing. The areas closed to leasing would exclude the possibility of surface disturbance for oil and gas development, so the acreage is combined with NSO acres for purposes of this analysis. Under this alternative, there would be a total of

74,743 acres of NSO stipulations combined with areas closed to leasing. Based on the predicted density of cultural resources sites presented in Section 3.9.3 by zone, 707 cultural resources sites are anticipated to occur in these areas that are subject to stipulations (see **Table 4.9-6**).

Table 4.9-6 Comparison of NSO/CTL Acreage and Anticipated sites Covered by Stipulations under Alternative 4

Zone	NSO/CTL Area (acres)	Anticipated Number of Sites
1	10,114	202
2	21,606	86
3	40,671	407
4	2,352	12
Total	**74,743**	**707**

CTL = Closed to Leasing.

Of the 117 previously recorded cultural resources sites, 81 (13 in Zone 1, 10 in Zone 2, 56 in Zone 3, and 2 in Zone 4) would be covered by NSO stipulations or in the area closed to leasing. Of these 81 sites, 10 are eligible for NRHP listing and 1 is listed.

Impacts from Projected Future Oil and Gas Development

It is estimated that there would be approximately 383 new wells on 55 pads across Zones 1 through 4. The majority of the new wells, and the most new surface disturbance, would occur in Zone 2 (319 wells). The estimated total initial surface disturbance under Alternative 1 would be 821 acres, with the majority of disturbance occurring in Zones 2 and 1. Based on projected site densities by zone, it is possible that 5 sites could be affected by this development-related surface disturbance (see **Table 4.9-7**). In compliance with federal regulations, sites eligible for the NRHP would be avoided or mitigated so impacts to important sites would be minimal.

Table 4.9-7 Comparison of Initial Surface Disturbance and Cultural Resources Covered by Stipulations Affected under Alternative 4

Zone	Initial Surface Disturbance (acres)	Potential Number of Sites Affected
1	77	2
2	684	3
3	39	0
4	21	0
Total	**821**	**5**

4.9.4.5 Alternative 5

All of the previously issued 65 leases would be cancelled under Alternative 5, and would include well closures and abandonment, reclamation of well pads, removal/burial of pipeline, and removal and reclamation of roads. While some disturbance would be associated with these activities, most, if not all, surface disturbance would occur in areas that were previously disturbed so it is unlikely that cultural resources would be disturbed. Prior to any surface disturbance, however, cultural resources surveys would be required to minimize the potential to adversely affect sites. Over the long term, the setting

would return to undisturbed conditions and the public access to these areas would be reduced, resulting in potentially beneficial impacts to cultural resources through the more natural settings and reduced public access that could lead to vandalism.

4.9.4.6 Summary of Impacts

The potential risks to cultural resources derive from the extent of surface disturbance and the relative protection through the limitation of surface disturbance under each alternative. For those alternatives where oil and gas development is projected (Alternatives 1 through 4), Alternative 4 would have the greatest extent of protection from surface disturbance and the fewest sites at risk from construction and development activities, while Alternative 1 would have the least protection and greatest risk. Alternative 5 would have the lowest potential adverse effects on cultural resources due to the low area of projected surface disturbance and the reclamation of existing disturbed areas. However, it is unlikely that sites that are eligible for the NRHP would be adversely affected under any alternative because federal regulations require site-specific surveys before surface-disturbing activities begin and avoidance or mitigation of eligible sites. There would be the potential for indirect effects if there is a change to the setting due to nearby surface disturbance and noise.

4.9.5 Cumulative Impacts

The CIAA for cultural resources includes the lease boundaries with a 2-mile buffer, considered as the area of potential effect (332,040 acres total).

4.9.5.1 Past, Present, and Reasonably Foreseeable Future Actions

The past and present actions that have affected cultural resources include any surface disturbance within 2 miles of the lease boundaries. There are 612 acres of quantifiable surface disturbance within the CIAA (see Section 4.1 and **Appendix B** for more details). While this includes such activities as oil and gas development, road construction, timber harvesting, livestock grazing, and vegetation treatments, compliance with federal regulations required cultural resources surveys to be conducted before these actions commenced. These surveys have contributed to the knowledge of cultural resources in the CIAA.

Section 4.1 and **Appendix B** provide a summary of the surface-disturbing RFFAs that are projected within the CIAA. The majority of the surface-disturbing activities projected within the CIAA for cultural resources are oil and gas development (7,586 acres of projected surface disturbance from RFFAs, or about 2 percent of the CIAA), especially within existing leases and established units. The CIAA also includes approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments. These treatments also would affect about 2 percent of the CIAA.

4.9.5.2 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

The disturbance under the Proposed Action and alternatives would contribute between 0 percent (Alternative 5) and 5 percent (Alternatives 1 and 2) of the total surface disturbance anticipated from surface-disturbing past and present actions and RFFA activities within the CIAA; with consideration of proposed vegetation and hazardous fuels reduction treatments, the contribution of the Proposed Action and alternatives ranges from 0 percent (Alternative 5) to 3 percent (Alternatives 1 and 2). As directed by law, cultural resources inventories are conducted for any actions involving federal lands. The surveys for cultural resources required prior to surface disturbance would add to the knowledge of recorded sites in the region but would not be likely to increase the risk of adverse effects to sites eligible for the NRHP due to the practice of avoidance or mitigation.

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4.10 Transportation

4.10.1 Analysis Assumptions and Approach to Analysis

4.10.1.1 Analysis Area

The analysis area for direct, indirect, and cumulative impacts consists of the affected oil and gas leases and any off-lease area that might be used to access development areas within the leases, plus the regional road network spanning multiple counties.

4.10.1.2 Scoping Issues

Relevant issues and concerns raised during public scoping are listed below. These are addressed in this analysis to the degree possible without knowledge of the site-specific locations of future oil and gas development.

- Transportation route development on area roads, specifically in the Thompson Divide Area, where additional semi-trailer traffic may be a detriment to recreational and tourist activities in the area.
- Impacts from improvement of local roads to accommodate heavier truck traffic, could include increased erosion, mud and rock slides, cattle and wildlife hazards, decrease recreation use, more dust and air pollution, watershed pollution, and vegetation impacts.
- Increased traffic hazards on area roads from additional oil and gas development. There were specific concerns related to East Divide Road south of Silt, Four-Mile Road southwest of Glenwood Springs, Thompson Creek Road and SH-133 near Carbondale, Coal Creek Road west of Redstone, and Midland and Grand Avenues in Glenwood Springs.
- Coordination with state and county transportation policies and regulations. (This concern is not addressed because it is not within the federal agency jurisdiction. Coordination for road use and access outside of federal land would be the responsibility of the lease operator.)

4.10.1.3 Assumptions

The following assumptions were used to facilitate the transportation analysis:

- Neither the Forest Service nor the BLM have the authority to require operators to use designated access routes not on federal lands. During the submittal, review, and approval process for an APD, the BLM and Forest Service would consider whether new ROW grants on BLM-administered land or special use permits on Forest Service-administered land are needed to cross federal land. Mitigation needed at the time of development such as avoidance of sensitive locations, road relocations, or special inventories would be analyzed at the APD stage of permitting, and mitigation measures or permits for access would be implemented through the use of COAs.
- Any new roads or improvements to existing roads or other changes to the Forest Transportation System would be in conformance with the Forest Plan, Forest Service and other applicable regulations (including the federal On-Shore Orders and WRNF Road Design standards) affecting road construction and use.
- Existing haul roads and NFS roads would be used to the extent possible for access to oil and gas leases.
- If existing roads or segments are relocated to improve access while reducing impacts, the unused portion would be fully decommissioned and reclaimed.

- During exploration, development, and production activities, roads would be managed in accordance with the current travel management plan, or as determined during site-specific environmental analyses.
- New roads could be considered single-purpose roads to be used and maintained by the operator for the production life of associated wells and closed to public motorized use. When no longer needed for oil and gas development, roads would be fully decommissioned and reclaimed.
- Additional environmental analysis would occur for future exploration and development of oil and gas resources at the APD stage of permitting when site-specific locations are known.
- Site-specific NEPA for future development on adjacent BLM lands for wells that access minerals within the leases under evaluation would be analyzed at the APD stage once locations are known.
- Operators would comply with applicable laws, regulations, and permits.
- The analysis assumes that the leasing decision would be followed by future oil and gas development.

4.10.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to transportation across the range of alternatives include the following:

- Miles of potential new roads required for oil and gas lease development.
- Estimated traffic related to drilling and production operations associated with the development of gas wells, well pads, pipelines, and access roads.

4.10.1.5 Methods of Analysis

The method of analysis incorporates the predicted miles of new road development and estimated traffic volumes under each alternative and compares that to existing values to determine the changes and level of impact.

4.10.2 Stipulations Providing Coverage for Transportation

There are no existing or proposed stipulations under any alternative that relate specifically to transportation. NSO stipulations implemented for other resources would serve to minimize traffic levels and access roads in areas with sensitive resources on the leases that need to be protected but may just move the oil and gas infrastructure (wells, pads, pipelines, and roads) and associated traffic to another location outside of the NSO or off the lease. NSO stipulations also would assist to preserve and retain the existing scenic integrity in the area, by keeping natural features intact. CSU stipulations would assist in minimizing adverse impacts to forest resources by enabling locations to be moved where there are concerns related to resource protection, but this may not be useful to manage traffic or access.

4.10.3 Impacts Common to All Alternatives

New roads would be constructed and added to the road network to access new oil and gas development, except under Alternative 5, which would cancel all leases. New roads would most likely be decommissioned and reclaimed once production is done, unless needed for other resource uses as determined by the Forest Service. Although it is a stated goal to fully reclaim roads once production is done, the potential would be present for reclamation efforts to experience varying levels of success or in some circumstances to be delayed.

Public travel can be impacted by increased traffic on roads, including temporary conflicts with normal traffic, decreased travel speeds, travel delays, and increased vehicle collision rates. The projected traffic could cause an increase in fugitive dust and noise and an increased risk of collision with wildlife.

The development phases include development (construction drilling and completion), operations/maintenance, and abandonment/reclamation. Depending on the phase of development, one could expect to encounter over-legal (overweight, over-width, or over-length) vehicles to serve oil and gas locations, in addition to other types of traffic. The construction, drilling and well completion phases would generate the most traffic and could be encountered throughout a daily 24-hour period. The total number of round-trips in addition to the anticipated average daily round-trips per well by development phase is shown in **Table 4.10-1**.

Long-term operations consist of the regular travel of employees involved in the operation and maintenance of producing wells and ancillary facilities such as compressors and pipelines. Vehicles used in maintenance and other operations activities mostly consist of pickup trucks, although heavy truck traffic could be encountered. Maintenance activities generally occur daily over the life of the anticipated well production (estimated to be 20 years).

Heavy truck traffic in oil and gas development areas can cause damage to roads and bridges. The WRNF requires operators to bring the structural section of a road to the standard necessary to accommodate operational traffic during all weather conditions. An operator must apply for and obtain an overweight permit and performance bond prior to hauling an over-legal load across a bridge structure on NFS lands.

Impacts Identified in the WRNF Final EIS

Impacts that were identified for transportation resources due to the potential effects of future oil and gas development and operations in the WRNF include increased traffic on roads that may result in temporary conflicts with normal traffic, travel delays, and increased vehicle collision rates (USFS 2014a, p. 315). Elevated oil and gas traffic could generate fugitive dust and noise as well as an increased risk of collision with wildlife. New single-purpose roads would be added to the local road network, although these roads may be closed to public motorized use. Heavy truck traffic associated with oil and gas development and operations could cause extensive damage to roads and bridges (USFS 2014a, p. 316). These impacts would be the most discernable during drilling and well completion phases when vehicle traffic could approach 50 round trips a day, per well. Transportation impacts would be less noticeable during the production and operations phase as traffic levels would decrease (USFS 2014a, p. 316).

4.10.4 Impacts by Alternative

Impacts by alternative for transportation were determined by considering the anticipated road construction as well as estimated increases in lease development traffic. Potential stipulations, such as big game TLs, also were noted, as road and pad construction could be limited to the timeframe outside the specified period of the year.

It is assumed that approximately 1 mile of new road construction would take place for each well pad. Exact placement of these roads and pads is unknown at this time; in some cases, pads may be located off the lease where minerals would be extracted through directional or horizontal wells.

The development phase consists of road and pad construction, drilling and completion activities. During this phase, average daily vehicle round-trips would be the highest and would result in the greatest level of impacts to transportation. The majority of vehicles used during this phase would be light trucks, followed by heavy truck traffic, and to a much lesser degree, over-legal vehicles.

Table 4.10-1 Estimated Traffic per Well By Development Phase

	Development			Completion		Operations and Maintenance		Abandonment and Reclamation	
	Road Pad Pipeline Construction	**Drilling Rig Up Rig Down**	**Drilling**	**Completion Mobilization**	**Completion**	**Production**	**Work-Over**	**Plug and Abandon Well**	**Reclaim Road and Pad**
Total Trips (Vertical/ Directional Wells)	114	21.7	130	137	240			25	28.6
Avg Daily Round Trips	40	19	13	48	12	5	5	5	10
Total Trips (Horizontal Wells)	114	22	780	137	360			25	29
Avg Daily Round Trips	40	19	13	48	12	5	5	5	10

Trips associated with the maintenance and operation stage of lease development would be much lower per well than during development, resulting in a corresponding decreased level of traffic. It is impossible to predict when and in what zone development would occur, and the associated concentrated traffic levels, because this is dictated by market conditions. Due to the low number of oil and gas development projected in the analysis area under each alternative, it may be that traffic levels would be concentrated on any single external access route at any one time. The total number of round-trips is presented to facilitate comparison between alternatives. Heavy truck traffic may be less noticeable on roads within the lease zones that currently experience this type of traffic because the associated impacts already are present and integrated into the transportation network.

4.10.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Traffic would be heaviest for most leases from May 1 to December 1 in order to account for Big-Game Winter TL stipulations attached to many leases. It is assumed that drilling and completion activities would not occur in winter or early spring; however, exceptions, modifications, or waivers could be granted on a case-by-case basis.

Impacts from Projected Future Oil and Gas Development

The potential impacts would be the number of new roads constructed in support of the projected number of wells that may be developed. If all leases under Alternative 1 were developed, up to 416 wells could be developed on up to 60 well pads with Zones 1 through 4. The majority of oil and gas development is projected to occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development. The impacts to the transportation system, therefore, would be the addition of up to 60 miles of road over the 20-year analysis timeframe.

The actual locations of well pads, roads, pipelines, and other associated infrastructure to be developed and the timing for development are unknown at this time. As a result, the amount of new roads constructed could be less than 60 miles because the assumption was made that there would be one access road to each well pad and did not take into account existing access roads that may be used. The length of access roads could be greater than 60 miles (or more than the average 1 mile per pad) should there be the need to reach well pads that are remote. Future proposed roads would undergo site-specific reviews and further NEPA analysis of impacts prior to approval of the road use plan and permits to drill. The road use plan may prevent duplicate roads and strive to reduce the overall length and network of new roads.

The amount of traffic generated by oil and gas development and production would be dependent on the number of wells drilled and completed in a given year. Under Alternative 1, the drilling and completion of 416 wells would occur over 20 years, resulting in an average of 21 wells drilled per year, although it is unknown what the actual pace of lease development would be.

Estimated maximum total development, operations and maintenance, and well abandonment and reclamation round-trips, as well as operations and maintenance average daily round-trips, are depicted by haul road for each zone in **Tables 4.10-2** through **4.10-5**. Estimated traffic levels for each haul road were tabulated by utilizing the RFD scenario for the potential number of wells to be developed on each lease. Increased traffic due to oil and gas activities on lands available for leasing would be more noticeable along Rio Blanco and Pitkin county roads than along western Garfield and eastern Mesa County roads because there are already high levels of existing oil and gas infrastructure and projected future development in Mesa and western Garfield counties.

Table 4.10-2 Alternative 1: Zone 1 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Mesa County Road (CR)-V[6]	Heavily utilized south from De Beque to the junction with CR T. Use is very light or nonexistent south of this junction until several miles north of Hwy 330 where oil and gas traffic increases.	17,866/894	70,080/192	1,032
Mesa CR-T[6]	Heavily utilized.	17,866/894	70,080/192	1,032
Garfield CR-306	Heavily utilized.	13,403/670	59,495/163	875

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: USFS 2010.

Table 4.10-3 Alternative 1: Zone 2 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Garfield CR-300[6]	Heavily utilized.	10,939/547	61,685/169	906
Garfield CR-302[6]	Heavily utilized to Battlement Creek.	10,939/547	61,685/169	906
Garfield CR-304/BLM 8157 and 8159	Heavily utilized.	10,939/547	61,685/169	906
Garfield CR-320[6]	Heavily utilized.	7,789/389	43,800/120	643
Garfield CR-301 and 309/USFS-845	Heavily utilized. Use on CR-309 becomes very light to nonexistent at the USFS boundary.	37,039/1,852	209,875/575	3,079
Garfield CR-317	Heavily utilized.	7,789/389	43,800/120	643
USFS-824[6]	Heavily utilized.	7,789/389	43,800/120	643
USFS-818	Heavily utilized.	23,870/1,194	134,685/369	1,978
Garfield CR-319	Heavily utilized.	23,870/1,194	134,685/369	1,978
Garfield CR-315	Heavily utilized.	33,054/1,653	187,245/513	2,747
Garfield CR-331[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Garfield CR-342[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Mesa CR-330E[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
USFS-816[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Mesa CR-330[6]	Heavily utilized.	57,746/2,887	327,040/896	4,800
Garfield CR-344[6]	Heavily utilized.	48,362/2,418	273,020/748	4,012
Mesa CR-79[6]	Heavily utilized to SGI compressor station. Use is then light.	48,362/2,418	273,020/748	4,012
USFS-814.1[6]	Nonexistent. Restricted bridge.	48,362/2,418	273,020/748	4,012

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: USFS 2010.

Table 4.10-4 Alternative 1: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,212/161	58,765/161	262
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M and USFS-321[8])	Heavily utilized.	9,572/479	53,290/146	781
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	12,977/649	72,270/198	1,059
Pitkin County CR–3D/USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	1,028/51	5,840/16	86

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: USFS 2010.

Table 4.10-5 Alternative 1: Zone 4 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Rio Blanco CR 15/Moffat County 45	Lightly utilized	6,427/321	36,500/100	536
Rio Blanco CR-48[6]	Nonexistent	6,427/321	36,500/100	536
Rio Blanco CR-51/USFS-252[6]	lightly utilized	6,427/321	36,500/100	536

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily heavy truck traffic. Non-existent is no commercial use.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: Mobley 2014; USFS 2010.

Most oil and gas development is projected for Zone 2, which would lead to a proportionately increased level of road and well construction and maintenance traffic. Zone 1 is projected to experience the next highest level of road construction, well development, and maintenance traffic, followed by Zones 3 and 4. As detailed in **Table 4.10-2** and **4.10-3**, Mesa CRs V and T would potentially incur higher traffic levels than other Zone 1 haul roads should traffic be concentrated on a single road based on RFD scenarios. Elevated use of haul roads would potentially increase traffic levels as well on SH-300 near Collbran, adding an increase in noise an increased risk of vehicle collisions or accidents, and potentially higher road maintenance costs. Within zone 2, estimated round-trips per year would range from 389 to 2,887 over a 20-year period depending on the route as depicted in **Table 4.10-3**.

Roads in Zone 3, although projected to be utilized lightly by heavy truck traffic for oil and gas development and production, serves mostly recreation users and homeowners, so impacts from additional oil and gas development along sensitive potential haul routes, such as Four-Mile Road (CR-117) and Jerome Park/Thompson Creek Road (CR-108), may be more noticeable than on more heavily traveled roads. Impacts could include temporary conflicts with normal traffic, travel delays, decreased travel speeds, and increased vehicle collision rates with other vehicles or with wildlife and livestock. Increased heavy truck traffic may reduce recreational and tourist activities in recreation-intensive areas, such as the Thompson Divide area. These impacts would be more noticeable during development phases when industrial traffic would be heavier. **Table 4.10-4** portrays estimated traffic levels for Zone 3 roads, based on RFD scenarios. Well development activities could potentially result in total estimated 9,572 round-trips on Four-Mile Road (CR-117), and then subsequently through the city of Glenwood Springs over 20 years. There is no available existing traffic data for Four-Mile Road (CR-117) to evaluate the estimated percent increase in average daily traffic; however, it assumed during the lease development phase that a maximum of potentially 50 average daily round-trips per well and a total of 146 average daily round-trips for all wells during operations and maintenance would be added to existing traffic levels.

Municipal concerns from the cities of Glenwood Springs and Carbondale have been cited related to where potential haul roads intersect with the municipal road networks in and near town. These concerns are centered on whether the existing level of service, road capacity, and structural road and bridge limitations are adequate to accommodate increased industrial traffic and whether this new traffic would cause safety issues in the use of Midland Avenue, the 27th Street roundabout, the 27th Street (Sunlight) Bridge, and the SH-82 bridge in Glenwood Springs. Concerns for Midland Avenue also include poor road surface condition, high rockfall probability, pedestrian and biker safety, and the incompatibility of heavy truck traffic with school traffic and student crossing areas. Concerns surrounding Four-Mile Road (CR-117) outside of Glenwood Springs include the incompatibility of heavy truck traffic on a road that services mostly residential and recreational users within the Four Mile-Thompson Divide area, as well as the potential cost of increased maintenance resulting from increased heavy truck traffic.

Along Thompson Creek Road (CR-108) well development activities also would potentially result in 50 average daily round-trips per well and a total of 198 average daily round-trips for all wells during operations and maintenance would be added to existing traffic levels over the 20-year development period. This would result in an increase of average daily traffic along Thompson Creek Road (CR-108) of 52 percent during lease development (assumes one well is developed a year) and an increase 204 percent of average daily traffic when operations and maintenance traffic for all wells to be developed is incorporated and compared to existing traffic levels portrayed in Section 3.10.

Coal Creek Road (USFS 307) also could potentially see traffic level increases associated with lease development, and operations and maintenance of 81 percent and 26 percent, respectively, as compared to the existing levels detailed in Section 3.10. Traffic on Thompson Creek Road (CR-108) and Coal Creek Road (USFS 307) would then pass through the Carbondale.

Additionally, within Zone 3, East Divide Road (CR-313/USFS 801/812) may be considered an alternative haul route. This route is unsuitable for industrial heavy traffic and is not considered a viable access route by the Forest Service.

Within Carbondale, concerns were centered on road degradation of city streets such as Main Street and SH-133, as well as safety concerns for some haul roads such as Thompson Creek Road (CR-108) that pass through school zones and sensitive watersheds. Sensitive watersheds could be susceptible to contamination in the event of spills and accidents. Furthermore, there are safety concerns regarding the structural capability of local bridges and their ability of handling large truck traffic, such as the Thompson Creek Road (CR-108) bridge over the Crystal River. Road structural concerns also exist with the potential for road damage from spring thaw periods. Road limits are at times imposed by local authorities to attempt to reduce damages. Pitkin County identified concerns regarding the potential use of Coal Creek Road, such as whether it has the capacity to enable use by heavy trucks in its current condition and the potential damage to extensive road reclamation that has been done in the area.

There are three Rio Blanco County roads serving Zone 4 which could be expected to handle the maximum total development round-trips shown in **Table 4.10-5**. Oil and gas development traffic would increase along SH-13, SH-133, and SH-82, as well as US-6 and possibly I-70. At the highest level of per well average daily vehicle round-trips associated with lease development (50), this increase in traffic levels would be negligible on these highways when compared to current traffic levels portrayed in **Table 3.10-1**.

These levels would fluctuate depending on the timing of development and would occur over a period of 20 years. Spreading new road construction and development associated traffic over a 20-year timeframe would result in an incremental increase in traffic levels and a more modest elevation in corresponding impacts. Consultation and coordination by operators with state, county, and local governments and agencies would serve to further lessen impacts to area roads and resources.

4.10.4.2 Alternative 2

Stipulation Coverage

Under Alternative 2, 8 leases would be affected by minor changes to stipulations, but these changes would not affect transportation more than described for Alternative 1 because the projected amount of new development would be the same.

Impacts from Projected Future Oil and Gas Development

Should leases be developed under Alternative 2, the estimated number of potential well pads and wells would be the same as under Alternative 1. This would result in similar impacts to transportation resources from an increase in the number of new roads and increased traffic levels as under Alternative 1.

Sensitive local roads and areas, including but not limited to Four-Mile Road (CR-117), Midland Ave in Glenwood Springs, Thompson Creek Road (CR-108), Coal Creek Road (USFS-307), and SH-133 in Carbondale, would experience the same level of lease development and production-related truck traffic as detailed under Alternative 1. Estimated traffic levels by haul road and zone are detailed in **Tables 4.10-2** through **4.10-5**.

4.10.4.3 Alternative 3

Stipulation Coverage

Under Alternative 3, the acreage under NSO, CSU, and TL stipulations would greatly increase when compared to Alternatives 1 and 2. The increase in stipulations would more greatly affect where and when roads could be constructed.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, approximately 413 wells are projected to be developed on 59 pads. Should leases be developed under Alternative 3, the estimated number of potential well pads would be the same as under Alternatives 1 and 2, except in Zone 3, where the projected number is lower. This would result in slightly less impacts to transportation resources in Zone 3, which is the location of the roads of concern identified by residents and municipalities. Estimated traffic levels under Alternative 3 by haul road are shown in **Table 4.10-6**.

With the additional stipulations being described under this alternative, specific sensitive local roads and areas, such as Thompson Creek Road (CR-108) and SH-133 in Carbondale, would potentially experience a slightly lower level of development and production related traffic than under Alternatives 1 and 2. Under Alternative 3, it is estimated projected traffic levels across all phases of lease development on Thompson Creek Road (CR-108) would decrease by approximately 15 percent when compared to Alternatives 1 and 2. These levels, shown in **Table 4.10-6**, would fluctuate depending on the timing of development and would occur over a period of 20 years, resulting in an incremental increase in traffic levels and types of traffic. Traffic levels on sensitive roads Four-Mile Road (CR-117) and Coal Creek Road (USFS 307) are anticipated to stay the same as under Alternatives 1 and 2.

Table 4.10-6 Alternative 3: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,212/161	58,765/161	262
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	9,572/479	53,290/146	781
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	10,985/549	60,955/167	893
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	1,028/51	5,840/16	86

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on F**igure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

4.10.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Under Alternative 4, the acreage of NSO, CSU, and TL stipulations would be the same in Zones 1, 2, and 4, compared to Alternatives 1 and 2. Due to the cancellation of all or part of 25 leases and the designation as closed to leasing surrounding them in Zone 3, Alternative 4 would more greatly limit where and when roads could be constructed in Zone 3.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, approximately 383 wells would potentially be developed on 55 well pads. Should leases be developed under Alternative 4, the estimated number of well pads would be less than Alternatives 1, 2, and 3 in Zone 3. This would result in fewer impacts to transportation resources and a decrease in traffic levels and new roads relative to Alternatives 1, 2, and 3, as is reflected by the reduction in round-trips and average daily vehicle round-trips, shown in **Table 4.10-7**.

Table 4.10-7 Alternative 4: Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	3,405/170	18,980/52	278
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	4,012
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	1,456/73	8,030/22	120
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/ N Thompson Creek Road)	Lightly utilized.	0/0	0/0	0/0
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	0/0	0/0	0/0

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

Sensitive local roads and areas, including but not limited to Four-Mile Road (CR-117) and Midland Ave in Glenwood Springs would experience substantially lower levels of truck traffic, when compared to Alternatives 1, 2, and 3, resulting from the majority of Zone 3 under Alternative 4 due to the cancellation of leases. The few leases in Zone 3 that would be open to leasing would be accessed either by Zone 2 haul roads or Zone 3 haul roads, such as Four-Mile Road (CR-117). Estimated traffic levels on Four-Mile Road (CR-117) would decrease by 85 percent during all phases of leasing development under Alternative 4, when compared to Alternatives 1, 2, and 3. Thompson Creek Road (CR-108), Coal Creek Road (USFS 307), and SH-133 in Carbondale would not experience any lease development truck traffic under Alternative 4. **Figure 2-13** shows areas that would be closed to leasing in Zone 3 under Alternative 4.

4.10.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Under Alternative 5, there would be no potential for future development within the 65 leases because all leases would be cancelled. Leases currently in production would be plugged and abandoned and well pads and roads would be decommissioned and reclaimed. As noted in **Table 4.10-1**, traffic associated with these activities would result in approximately 5 average daily round-trips over a 5-day period for plugging and abandoning activities, and 10 average daily round-trips over a 20-day period for reclamation activities, per reclaimed well (if they are all performed in the same year), resulting in minor short-term impacts to area roads similar to those of operations and maintenance. As shown in **Tables 4.10-8** and **4.10-9**, no truck traffic associated with plugging and abandoning and reclaiming existing wells and pads would pass along roads of concern within the Thompson Divide area or the cities of Glenwood Springs and Carbondale.

4.10.4.6 Summary of Impacts

In summary, within the analysis area the maximum estimated new road construction would take place within Zone 2 under Alternatives 1 and 2. Additionally, the highest annual vehicle round-trips and total trips would take place within Zone 2 under Alternatives 1 and 2, potentially resulting in impacts such as decreased travel speeds, travel delays, and increased vehicle collision rates. Impacts to local areas and roads of concern near the Thompson Divide area, Glenwood Springs, and Carbondale would be greatest under Alternatives 1 and 2, although impacts would be spread along a 20-year development period. Alternatives 3 and 4 would produce slightly less impacts to transportation resources as a result of the potential development of fewer wells pads and associated wells. Alternative 5 would produce the least impacts of any alternative as existing wells are plugged and abandoned and lease pads and access roads reclaimed.

Table 4.10-8 Alternative 5, Zone 2 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
Garfield CR-300[6]	Heavily utilized.	0/0	0/0	0
Garfield CR-302[6]	Heavily utilized to Battlement Creek.	0/0	0/0	0
Garfield CR 304/BLM 8157 and 8159	Heavily utilized.	0/0	0/0	0
Garfield CR-320[6]	Heavily utilized.	0/0	0/0	214
Garfield CR-301 and 309/USFS-845	Heavily utilized. Use on CR 309 becomes very light to nonexistent at the USFS boundary.	0/0	0/0	214
Garfield CR-317[6]	Heavily utilized to the USFS boundary.	0/0	0/0	54
USFS-824[6]	Heavily utilized.	0/0	0/0	54
USFS-818.1	Heavily utilized.	0/0	0/0	590
Garfield CR-319	Heavily utilized.	0/0	0/0	590
Garfield CR-315	Heavily utilized.	0/0	0/0	0
Garfield CR-331[6]	Heavily utilized.	0/0	0/0	3,055
Garfield CR-342[6]	Heavily utilized.	0/0	0/0	3,055
Mesa CR-330E[6]	Heavily utilized.	0/0	0/0	3,055
USFS-816[6]	Heavily utilized.	0/0	0/0	3,055
Mesa CR-330[6]	Heavily utilized.	0/0	0/0	0
Garfield CR-344[6]	Heavily utilized.	0/0	0/0	107
Mesa CR-79[6]	Heavily utilized to SGI compressor station. Use is then light.	0/0	0/0	107
USFS-814.1[6]	Non-existent. Restricted bridge.	0/0	0/0	107

[1] Roads are detailed from west to east.

[2] Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

[3] Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

[4] Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

[5] Includes production and work-over.

[6] Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

Source: Mobley 2014; USFS 2010.

Table 4.10-9 Alternative 5, Zone 3 Estimated Traffic Levels by Development, Operations, and Abandonment and Reclamation

Potential Haul Routes[1]	Current Route Utilization [2]	Maximum Total Development Round-Trips/Round-Trips per Year[3,4]	Operations and Maintenance Total Annual Trips/ Average Daily Trips[5]	Well Plug and Abandonment and Road and Pad Reclamation Total Round-Trips
USFS-800[6]	Lightly utilized.	48,362/2,418	273,020/748	107
Garfield CR-313[6,7]	Lightly utilized. After the Spruce Crossing Gulch drainage, utilization is very light to nonexistent.	0/0	0/0	0
USFS-808.1[6]	Lightly utilized.	48,362/2,418	273,020/748	107
USFS-300.3 and 300.4[6]	Lightly utilized.	0/0	0/0	0
Garfield CR-117 (Four-Mile Road)/USFS-300 (USFS-300.4K, USFS-300.4M, and USFS-321[8])	Heavily utilized.	0/0	0/0	0
Garfield CR-108/Pitkin CR-1 and 1A (Jerome Park/Thompson Creek/N Thompson Creek Road)	Lightly utilized.	0/0	0/0	0/0
Pitkin County CR-3D /USFS-307 (Coal Creek/Coal Basin Road)/	Lightly utilized.	0/0	0/0	0/0

1 Roads are detailed from west to east.

2 Heavily utilized is characterized by daily heavy truck traffic. Light utilization is anything less than daily.

3 Includes road pad pipeline construction, Drilling rig up rig down, drilling, completion mobilization, and completion.

4 Round trips per year are based on a 20-year drilling schedule, as all wells could be developed anytime within this development period.

5 Includes production and work-over.

6 Where multiple haul routes have been identified as potential routes servicing the same leases, it is unknown at the leasing stage the degree to which either or both routes would be used; therefore the totals presented represent the maximum amount of traffic that would occur if all lease development were to occur on each road.

7 This route as shown on **Figure 3.10-2** would be considered an alternative haul route. The route on USFS lands is currently unsuitable for use by heavy truck traffic and is not considered a viable access route by the Forest Service.

8 USFS 300.4K, 300.4M, and 321 are spur roads from USFS 300 and would not receive the same level of traffic as USFS 300/CR-117.

Source: Mobley 2014; USFS 2010.

4.10.5 Cumulative Impacts

4.10.5.1 Cumulative Impacts Analysis Area

The Cumulative Impacts Analysis Area (CIAA) for transportation is the 4 lease zones (80, 380 acres) as well as the regional road network (see **Figures 3.10-1** and **3.10-2**). This area includes multiple county roads currently serving existing oil and gas operations, as well as state and U.S. highways.

4.10.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines as well as other developments. Impacts to transportation from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent, and also would contribute to increased levels of traffic on the local and regional road network.

Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions would include oil and gas, as well as road, powerline, pipeline, reservoir, vegetation treatment, habitat improvement, and recreational trails projects. These projects also would contribute to increased levels of traffic on the local and regional road network. Impacts would be short-term ending upon project completion.

It is projected that 50,166 wells will be drilled on 6,830 pads across the WRNF and within the BLM CRVFO, GJFO, and WRFO. Development of these wells would produce approximately 4,681,210 round-trips during construction. Well development would increase road construction and further expand the regional road network. These estimates were derived from BLM and Forest Service planning documents. A more detailed breakdown of traffic estimates associated with these projected wells is located in **Table B-5** in **Appendix B**. Other surface-disturbing activities such as gravel mining in Garfield County would incrementally increase traffic levels on the regional road network contributing to slight increase in impacts to the regional road network.

Road projects, such as slated improvements to CR 5 in Rio Blanco County, would enhance travel safety and facilitate enhanced travel times for regional traffic. More information is located in **Appendix B**.

4.10.5.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

Transportation from the Proposed Action and alternatives are disclosed in Section 4.10.4. Development of the WRNF leases would contribute less than 1 percent to the cumulative oil and gas development in the region and the transportation associated with that development. If selected, Alternative 5 would remove operations traffic associated with 75 existing wells.

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4.11 Lands and Special Uses

4.11.1 Analysis Assumptions and Approach to Analysis

4.11.1.1 Analysis Area

The analysis area encompasses the four lease zones (see **Figure 1-1**).

4.11.1.2 Scoping Issues

The NEPA scoping process revealed an array of the public's concerns regarding impacts to lands and special uses. Relevant issues and concerns raised during scoping are detailed below.

- Oil and gas activities limiting or otherwise affecting existing or proposed land uses, such as private or residential property, livestock grazing, other zoned county uses, and conservation easements.
- Protection of Pitkin County property acquisitions and restoration activities, such as Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and Thompson Creek Mine, from inconsistent development and degradation.
- Consideration of Pitkin County land use code which places limits on oil and gas development in the Thompson Divide area.
- Consideration of the Mesa County Mineral and Energy Resources Plan.
- Stipulations to protect the environment from future pipeline construction and maintenance.

While these issues are addressed in general terms, the general nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing some issues in detail. Issues would be addressed in more detail at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Impacts to livestock grazing and ranching activities, as well as recreation, are addressed in Sections 4.14 and 4.13, respectively. The potential for impacts to the Jerome Park Conservation Easement and other viewsheds is discussed in Section 4.15, Scenic Resources. Section 4.17 addresses the potential for impacts to private or residential property.

4.11.1.3 Assumptions

The following assumptions were used to facilitate the lands and special uses analysis:

- Additional environmental analysis would occur for future exploration and development of oil and gas resources within the leases when site-specific proposals are submitted during the APD process.
- Site-specific NEPA for future development on adjacent BLM lands would be analyzed at the APD stage, as well as ROW applications for off lease, unit, or communitization agreement development, once locations are known.
- Lands proposed for leasing that contain communication sites, authorized under special use permits or communications use leases, have a CSU stipulation attached to the lease.
- Operators would comply with applicable laws and regulations for surface and subsurface development of resources.
- The analysis assumes implementation of the future projected oil and gas development for each lease derived from the RFDS scaled for each alternative.

4.11.1.4 Impact Indicators Used for Analysis

The following indicators used to measure potential impacts to lands and special uses:

- Lease stipulations in areas committed to other land uses.
- Amount of acreage within the analysis area that is precluded from surface disturbance from oil and gas development through lease stipulations,
- Acres in which land use may change from an existing use to oil and gas development based on the RFDS.

4.11.1.5 Methods of Analysis

The method of analysis for lands and special uses includes quantifying the extent to which, by alternative, the overall acreage committed to other land uses may potentially be impacted, identifying conflicts with land use plans or regulations, referencing potential impacts or conflicts with other land uses (grazing, recreation, etc.).

4.11.2 Stipulations Providing Coverage to Lands and Special Uses

Leased lands with NSO stipulations means infrastructure for oil and gas production associated with a leased parcel such as well pads, buildings, tanks, and drilling equipment must be placed outside of the stipulated area unless it can be proven that the resource for which the NSO was designated does not exist in that location. NSO equates to no ground disturbance for those activities within the stipulation boundaries in that particular lease. Access roads and collection pipeline corridors are not always authorized under a surface use plan but may be granted under other authorizations such as special use authorizations, ROWs, or road use permits subject to Forest Plan standards and guidelines. NSO stipulations, in some cases, would serve to preserve current land uses.

4.11.3 Impacts Common to All Alternatives

Should development occur, there would be surface-disturbing activities from construction of well pads, pipelines, and other associated activities, taking the place of current land uses.

Impact issues that were identified for land use in the WRNF Final EIS include the potential effects of existing as well as future oil and gas development and operations on potential authorizations such as utility lines, communication sites, and road use (WRNF Final EIS 2014, p. 377-378). Development of leaseholds may require special use authorizations, such as for third party pipelines, and would be subject to site-specific environmental analysis (WRNF Final EIS 2014, p. 377). Further lands and realty authorization and special use impact discussion can be found in USFS 2014, pages 377 and 378.

<u>Minerals</u>

Under all alternatives, any mineral development within the leases would be in accordance with USFS leasing and surface stipulations. There is no private mineral ownership within the leases. Should other mineral development actions be granted, oil and gas development would be required to avoid those areas. Impacts to mineral development also are discussed in Section 4.3, Geology, Minerals, and Paleontology.

<u>Rights-of-Way</u>

Under all alternatives, leasing stipulations would allow for some relocation of activities to avoid existing ROWs. Additionally, for safety reasons, all proposed ROW development would be required to observe requisite buffers between well pads and existing transmission lines. Development of leases may require special use authorizations or ROW grants for such infrastructure as roads and off-lease or off-unit pipelines transporting gas or water. The site-specific environmental analysis required when site-specific

proposals are submitted would identify mitigation measures and conditions of approval that would become part of any authorization issued. All future ROWs also would be designed to avoid any oil and gas development that occurs as a result of this leasing decision.

Valid Existing Rights

Under all alternatives, there would be no impact to any valid outstanding rights within the leases, as all rights would be honored when it is subsequently determined that the claim to such rights meet the criteria set forth in a respective statute granting such occupancy and use (USFS 2002a).

Communication Sites

There is one communication site, the Sunlight Base and Repeater, in Zone 3. Stipulations overlapping the communication site are detailed by alternative below. In all cases, leasing stipulations would allow for some relocation of activities to avoid the communication site.

County Land Use Plans and Zoning

Oil and gas development may affect existing or proposed land uses as defined by County Master Plans or other land use codes. Compatibility of reasonably foreseeable development with these land uses, while not required, is discussed by alternative below. Under all alternatives, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

The Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are outside the lease zone boundaries (see **Figure 3.11-1**). Development would not occur in these areas under any alternative.

As noted in Section 4.15, Scenic Resources, the Jerome Park Conservation Easement would be within a mile of some lease borders. The Cold Mountain Ranch, Mautz Ranch, Elk Park, and Redstone Coke Ovens conservation easements would be located about 5 miles east of the closest lease. The potential for visual impacts to the easements from reasonably foreseeable development would depend on the type of leasing stipulation present in the leases closest to the easement (discussed by alternative below), as well as site-specific conditions such as slope, aspect, terrain and vegetation in and around the site-specific location; and the amount of contrast between the natural and constructed landscape (see Section 4.15, Scenic Resources). Expected noise levels from oil and gas development and operation are discussed in Section 4.16, Human Health and Safety. Impacts to other special uses such as recreation and livestock grazing are found in Sections 4.13, and 4.14, respectively.

4.11.4 Impacts by Alternative

The identification of potential impacts to lands and special uses by alternative should leases be developed were determined by considering the acres within the leasing zones that are covered by each type of leasing stipulation. Analysis of potential impacts to lands and authorizations as well special uses are presented below by alternative.

4.11.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Under Alternative 1, approximately 24,443 acres within all the zones would be covered by NSO stipulations, limiting potential oil and gas development and impacts to current authorizations that may be affected by the construction of new infrastructure. Another 26,609 acres would be covered by TL

stipulations, 4,722 acres by CSU stipulations, and 30,960 acres by SLTs. CSU stipulations would reduce land use conflicts by allowing relocation of operations more than 200 meters. TL stipulations would be used to reduce seasonal conflicts with wildlife or other resources that may affect land use. Under SLTs, operations could be relocated up to 200 meters.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this disturbance and subsequent impacts to lands and realty authorizations and potential changes to special uses would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be under a NSO for slopes greater than 60 percent. If all stipulations were implemented, there would be no impact to the Sunlight Base and Repeater (located in Zone 3) because surface disturbance would be precluded in those areas through an NSO stipulation. If the NSO or slopes greater than 60 percent were to be exempted, there would be no constraints to development in this area beyond SLTs.

County Land Use Plans and Zoning

Zoning within Mesa County (Zone 1 and Zone 2) is intended to provide protection and continuation of agriculture and forestry protection, as well as the preservation of environmentally sensitive lands. Lease development activities may not be compatible with Mesa County zoning; however, NSO stipulations, which almost cover the entirety of Zone 1 would preclude surface disturbance in this zone, preserving the zoning intent. Approximately a third of Zone 2 would be under NSO stipulations, which would aid in compatibility with Mesa County zoning. Within Garfield County, application of NSO, CSU, and TL stipulations would complement county goals of properly regulating oil and gas activities and ensuring that effects on the natural environment are mitigated; however, increased haul road traffic on Four-Mile Road would contribute to increased noise to adjacent homes within the Oak Meadows and Springridge Reserve Planned Unit Development, potentially detracting from the residential setting. Similarly, lease development activity and associated traffic within Pitkin County zoning district RS-30 may conflict with the intent to “preserve agricultural operations and environmental resources, and preserve rural visual quality and character” (Pitkin County 2006). Application of NSO, CSU, and TL stipulations in Zone 3 would assist in reducing impacts to lands within the RS-30 zoning district, although residual impacts may still conflict with zoning intent. A Level 1 Travel Route CSU stipulation would be applied to portions of Four-Mile Road crossing two existing leases. It is anticipated that application of NSO and TL stipulations within Zone 4 would minimize adverse agricultural impacts and would be in accordance with Rio Blanco County land-use policies. Additionally, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place. Under SLTs, operations could be relocated up to 200 meters, which may help in reducing impacts to lands and aiding in compatibility with zoning requirements.

Other Special Uses

Potential impacts to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are described under Impacts Common to all Alternatives. Under Alternative 1, some portions of the leases closest to Jerome Park, Cold Mountain Ranch, Mautz Ranch, Elk Park, and the Redstone Coke Ovens easements and the Thompson Creek Mine would have NSO stipulations; potential for visual impacts would be determined during site-specific NEPA. Section 4.10, Transportation, discloses reasonably foreseeable traffic levels on Coal Creek

Road, Thompson Creek Road and SR-133. Elevated traffic levels would potentially increase noise and fugitive dust to portions of the easements that are adjacent to the roadways; however, traffic would be intermittent and would not be expected to impede the values for which the easements were designated or inhibit restoration activities within the Thompson Creek Mine site. Additionally, traffic levels near the easements would fluctuate depending on the timing of development and would occur over a period of 20 years.

4.11.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting lands and special uses under Alternative 2 would be similar to Alternative 1 with the exception of minor changes to eight leases. The types of stipulations are discussed in Section 4.11.2.

Impacts from Projected Future Oil and Gas Development

Impacts from projected future oil and gas development and the subsequent impacts to land use changes and authorizations would be the same under Alternative 2 as under Alternative 1, with the exception that stipulations within eight leases in Zone 3 would be enhanced, offering an increased level of restrictions on where lands and realty authorizations may occur.

Communication Sites

The Sunlight Base and Repeater would be under a NSO for slopes greater than 60 percent, the same as under Alternative 1. Stipulations on the adjacent lease also are NSO for slopes greater than 60 percent.

County Land Use Plans and Zoning

Potential conflicts with county land use plans and zoning would be similar to those under Alternative 1, except that a Level 1 Travel Route CSU stipulation would be added to Lease 066706, so that all portions of Four-Mile Road that cross the three existing leases would be covered by this CSU. Site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

Impacts would be the similar to Alternative 1, except that there would be slightly more NSO stipulations in leases close the Jerome Park Conservation Easement further limiting the potential of oil and gas development and subsequent potential visual impacts to areas within the viewshed of the Jerome Park Conservation Easement. Visual impacts would be determined during site-specific NEPA.

4.11.4.3 Alternative 3

Stipulation Coverage

Under Alternative 3, approximately 71,045 acres within all the leasing zones would be covered by NSO stipulations, limiting potential development. Another 54,992 acres would be covered by TL stipulations and 80,379 acres by CSU stipulations.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, the potential exists for approximately 413 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 886 acres and long-term surface disturbance of 384 acres. The majority of this disturbance and subsequent impacts to lands and realty authorizations and potential changes to special uses would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be under a CSU specific to communication sites. This stipulation would assist in minimizing conflicts between oil and gas development and communications site by allowing relocation of leasing activities by more than 200 meters when required.

County Land Use Plans and Zoning

Under Alternative 3, three less pads would be constructed in Zone 3, lessening potential conflict between lease development and Garfield and Pitkin county plans and interests. NSO acreage under Alternative 3 within Zones 2, 3, and 4 would increase substantially, and CSU and TL stipulations also would be added to additional acreage further lessening the potential for conflicts with Garfield, Pitkin, and Rio Blanco county plans and zoning. Conformance with Mesa County planning and the Mineral & Energy Resources Master Plan in Zone 1 would be the same as discussed under Alternative 1; increased NSO acreage within Zones 2 would lessen potential for conflicts. Additionally, site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in addition to county mineral development plans, if in place.

Other Special Uses

Potential impacts to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine are discussed under Section 4.11.3, Impacts Common to All Alternatives.

Some portions of the leases closest to the conservation easements would be covered by NSO stipulations. The leases in the northeastern portion of the Zone 3 (closest to the Roaring Fork Valley and Carbondale) would generally not have NSO stipulation applied to them but would be covered by CSU stipulations. The potential for visual impacts would be determined during site-specific NEPA. Section 4.10, Transportation, discloses reasonably foreseeable traffic levels on Coal Creek Road, Thompson Creek Road and SR-133. Increased haul road traffic on Coal Creek Road and Thompson Creek Road in addition to increased lease development traffic levels on SR-133, would contribute to increased noise and fugitive dust to the portions of these easements that are adjacent to the roadways, although traffic levels and subsequent noise and fugitive dust would be slightly less under this alternative. Traffic would be intermittent and would not be expected to preclude activities within these easements or inhibit restoration activities within the Thompson Creek Mine site. Additionally, traffic levels near the easements would fluctuate depending on the timing of development and would occur over a period of 20 years.

4.11.4.4 Alternative 4 (Proposed Action)

<u>Stipulation Coverage</u>

Under Alternative 4, approximately 46,283 acres within all the leasing zones would be covered by NSO stipulations, limiting potential changes to existing lands and special uses authorizations and limiting future lands and special uses authorizations. Another 51,920 acres would be covered by CSU stipulations and 40,847 by TL stipulations. An estimated 28,460 acres would be closed to leasing, which would exclude oil and gas development and associated changes to land uses.

<u>Impacts from Projected Future Oil and Gas Development</u>

Under Alternative 4, the potential exists for approximately 383 wells to be drilled from 55 well pads. These actions could potentially result in initial surface disturbance of 821 acres and long-term surface disturbance of 356 acres. The majority of this disturbance and subsequent impacts to land use changes and lands and special uses authorizations would occur in Zone 2, followed by Zones 1, 3, and 4, in order from high to low potential changes due to surface disturbance and construction of infrastructure.

Communication Sites

The Sunlight Base and Repeater would be within areas that would be closed to leasing, which would be a benefit to this authorization by negating the potential for potential oil and gas development and associated impacts to this authorization from construction of new infrastructure.

County Land Use Plans and Zoning

Should leases be developed under Alternative 4, the estimated number of potential well pads would be less than Alternatives 1, 2, and 3, with the reduction in well pads and wells occurring in Zone 3, as the majority of Zone 3 would be closed to leasing. This would completely negate the potential in Pitkin County for conflict between lease development activities and Pitkin County plans and interests. The potential for conflicts with Mesa, Garfield, and Rio Blanco county land use plans and zoning within Zones 1, 2, and 4 would be the same as under Alternative 3. Site-specific NEPA analysis for future exploration and development of leases would occur during the APD process. Site-specific analysis would take into account county easements, as well as other zoned county uses, in additional county mineral development plans, if in place.

Other Special Uses

Under Alternative 4, there would be no effect from visual impacts or haul road fugitive dust and noise to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine as leases closest to these areas would be cancelled. Lease cancellation within substantial portions of Zone 3 would result in no lease development traffic along adjacent haul roads such as Coal Creek Road and Thompson Creek Road.

4.11.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations in the analysis area because all leases would be cancelled. Existing wells, wellpads, roads, and pipelines would be removed and reclaimed, which would result in future returns to the land uses that existed before oil and gas development and the limitation on future development.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, ground-disturbing activities would take place to plug and abandon 75 existing wells and decommission roads, well pads, and other ancillary facilities, such as tanks and burners. It is projected that approximately 86 acres of surface disturbance on previously disturbed land would occur from these actions, with the majority taking place in Zone 2. This disturbance would result in short-term disturbances to existing land uses but would not preclude future lands and special uses authorizations. These lands would be available for land uses other than fluid mineral extraction.

Any visual impacts or haul road fugitive dust and noise to the Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine from reclamation activities and traffic would be temporary. Lease cancellation in all lease zones also would negate the potential conflicts with Mesa, Garfield, Pitkin, and Rio Blanco county land use plans and zoning. Decommissioning of existing facilities and subsequent reclamation of the land would return the land to a state that could be more complementary with land use plans and zoning.

4.11.4.6 Summary of Impacts

In summary, when compared to Alternative 1, Alternatives 3 and 4 contain the most stipulations, which would limit where and when lands and special uses authorizations may be modified or issued and how

land uses would change. Land use impacts could result from potential lease development conflicts with both nearby easements and reclamation areas as well as county plans and zoning.

The potential for impacts to Jerome Park Conservation Easement, Cold Mountain Ranch, Mautz Ranch, Elk Park, Redstone Coke Ovens, and the Thompson Creek Mine would be the greatest under Alternative 1 due to the greatest amount of proposed development and least amount of stipulations precluding surface disturbance. As compared to Alternative 1, Alternative 5 would have the least amount of impact, followed by Alternatives 4, 3, and 2, in that order.

Potential conflicts with county zoning would potentially be greatest under Alternative 1, as this alternative contains the lease amount of acreage under NSO, which would preclude surface disturbance and lessen potential non-conformance with county plans and zoning. As compared to Alternative 1, Alternative 5 would have the least amount of impact, followed by Alternatives 4, 3, and 2, in that order.

4.11.5 Cumulative Impacts

4.11.5.1 Cumulative Impacts Analysis Area

The Cumulative Impacts Analysis Area would be the same as the analysis area described in Section 4.11.1.1 (80,380 acres).

4.11.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines. Impacts lands and special uses authorizations from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the CIAA. There are no RFFAs which would result in surface-disturbing activities within the CIAA for lands and special uses. There are approximately 6,000 acres of vegetation treatment and hazardous fuels projects with countervailing impacts to lands and special uses within the lands and special uses CIAA. This is 7 percent of the CIAA. These projects, such as South Rifle Habitat Enhancement Project and the East Sopris Fuels Reduction Project, would reduce hazardous fuels that could threaten existing or proposed land uses.

4.11.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

The Proposed Action and alternatives would contribute between 0 (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long-term surface-disturbing activities within the CIAA. If selected, Alternative 5 would eliminate surface disturbance and traffic that could affect existing or proposed land uses.

4.12 Special Designations

4.12.1 Analysis Assumptions and Approach to Analysis

4.12.1.1 Analysis Area

The analysis area for special designations consists of any special designation area intersecting the 65 leases or any off-lease area that might be used for accessing the leases.

4.12.1.2 Scoping Issues

During the public scoping process, the following issues and concerns related to Special Designations were identified. While many of the issues are addressed in general terms, the high-level analysis in this EIS without knowledge of site-specific proposals for oil and gas development does not allow for analyzing these issues in detail. Many of these issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required. The text in parentheses following some of the scoping issues provides a rationale for those that could not be addressed in this EIS.

- Impacts to the resource values contained in RNAs or potential RNAs.
- Compliance with the 2001/2012 Roadless Rule as some leases were issued after the rule was established.
- The Colorado Roadless Rule (CRR) does not prohibit oil and gas development, and exempts leases sold before July 2012.
- Impacts to the scenic values of SH-133/West Elk Loop, a Designated Scenic and Historic Byway.
- Impacts to wilderness qualities and undisturbed/unfragmented habitat within designated roadless areas (Baldy Mountain inventoried roadless area (IRA); Clear Fork IRA; East Divide/Four Mile Park IRA; East Willow IRA; Housetop Mountain IRA; Huntsman Ridge IRA; Mamm Peak IRA; and Thompson Creek IRA). (These IRAs were designated prior to the Colorado Roadless Rule, which takes precedence. These IRAs were therefore not addressed in the analysis because they no longer apply to Forest Service management.)
- Impacts to segments of Thompson Creek and Crystal River that are eligible for Wild and Scenic River Designations. (As noted in Section 3.12.3.5, there are no Wild and Scenic Rivers or eligible sections within the Analysis Area, as the nearest eligible section is located at a distance of 1.2 miles. Impacts to Wild and Scenic River values would be determined during site-specific NEPA analysis.)

4.12.1.3 Assumptions

The following assumptions were used to facilitate the special designations analysis:

- Additional environmental analysis would occur for future site-specific exploration and development of oil and gas resources.
- Site-specific NEPA for future development on adjacent BLM lands would be analyzed at the APD stage once locations are known.
- Operators would comply with applicable laws and regulations.
- The analysis assumes that the leasing decision would be followed by future oil and gas development per the RFD scenario.

- Application of the 2001 Roadless Rule and its exceptions for surface disturbing activities is unsettled. To provide a conservative bases for assess impacts of Alternatives 1 and 2, this analysis assumes that surface disturbing activities will be allowed.

4.12.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to special designations across the range of alternatives include the following:

- Acres of projected surface disturbance from oil and gas development in special designation areas.
- Acres of areas special designation areas protected/not protected by lease stipulations.

4.12.1.5 Methods of Analysis

The method of analysis for Special Designations includes quantifying the extent overall acreage may potentially be impacted, identifying conflicts with land use plans or regulations, referencing potential impacts or conflicts with other areas (grazing, recreation, etc.), and quantifying the potential opportunity lost to manage to protect those values for which they were designated.

4.12.2 Stipulations Providing Coverage to Special Designations

Leased lands with NSO stipulations means infrastructure for oil and gas production associated with a leased parcel (well pads, buildings, tanks, and drilling equipment) must be placed outside of the areas restricted by this stipulation. NSO equates to no ground disturbance for those activities within the stipulation boundaries of that particular lease. The NSO stipulations apply only to those activities authorized under the surface use plan. Access roads and pipelines are not always authorized under a surface use plan so the locations may be granted under special use authorizations or road use permits subject to Forest Plan standards and guidelines. Access roads could not be constructed in designated roadless areas for new leases issued after the promulgation of the CRR. The CRR does not preclude development on existing leases, as is detailed in Section 3.12.2.3. NSO stipulations, in some cases, would serve to preserve current land uses and maintain the integrity of special designations.

CSU stipulations would assist in maintaining the natural setting and the integrity of special designations. CSU stipulations also serve as a moderate constraint to maintain natural resource values.

TL stipulations would assist in focused limitations for certain seasonal activities, such as hunting. This would be considered a moderate constraint that limits the time of year when development could occur.

4.12.3 Impacts Common to All Alternatives

Stipulations vary for Colorado Roadless Areas (CRAs) and the Lower Battlement Mesa RNA under each alternative. Of the lands that have a NSO stipulation associated with them, no surface effects would occur. Lands that do not have a NSO stipulation may experience some surface disturbance.

Impacts from oil and gas development would be more pronounced during construction, especially if the disturbance would occur in the interior of a CRA. CRAs where development would occur could experience a higher potential for fragmentation of plant and animal communities and habitat, and subsequent lessening of diversity, compared to those areas where mineral development would not occur. Natural appearing landscapes within CRAs and RNAs would have the potential to be compromised where development occurs, as roads, pipelines, and well pads all require vegetation manipulation with long-term impacts. If a lease is developed and roads are constructed in a CRA, the integrity of the CRA may be compromised and potentially lead to the loss of a CRA and its availability for future consideration for recommended wilderness, depending on the density of development. The

density of development is expected to be the greatest within Zone 2 with the potential development of 46 well pads. Well pad construction within the remaining zones would be substantially lower, ranging from two to seven pads depending on the zone. Activity and roads associated with lease development could produce added noise and distraction, further affecting roadless characteristics of CRAs and the naturalness of RNAs.

Impacts Identified in the WRNF Final EIS

Impacts that were identified for special designations in the WRNF Final EIS include the potential effects of future oil and gas development and operations on CRAs and RNAs. Impacts under alternatives where leases are allowed to continue under lease terms would result from increased well development that may affect roadless and natural characteristics (USFS 2014a, p. 360 – 361, 348 – 349). Alternatives where leases become available for lease with new, more restrictive, stipulations would experience greater coverage for CRAs and RNAs and would result in fewer impacts to roadless and natural characteristics (USFS 2014a, p. 360 – 361, 348 – 349).

4.12.4 Impacts by Alternative

Impacts by alternative for special designations were determined by considering where special designations may be covered by stipulations that were developed specifically for protection of the resource. The analysis takes into account the types of stipulations that were developed to cover other resources that also may minimize adverse impacts to special designations.

Tables 4.12-1 and **4.12-2** show acres of stipulations by RNA and CRA, respectively. Analysis of potential impacts to the Lower Battlement RNA as well as CRAs is presented below by alternative. The Lower Battlement RNA only occurs within Zone 1.

Table 4.12-1 Stipulations Overlapping the Lower Battlement RNA by Alternative in Zone 1

Stipulation Type	Alternative 1 (% of analysis area)	Alternative 2 (% of RNA in Leases)	Alternative 3 (% of RNA in Leases)	Alternative 4 (% of RNA in Leases)
Zone 1				
NSO	100	100	100	100
CSU	0	0	100	100
TL	1	1	52	52
SLT	0	0	0	0

Table 4.12-2 Stipulations Overlapping CRAs by Alternative in Zones 1 to 4

Stipulation Type	Alternative 1 (% of CRAs intersecting Leases)	Alternative 2 (% of CRAs intersecting Leases)	Alternative 3 (% of CRAs intersecting Leases)	Alternative 4 (% of CRAs intersecting Leases)
Zone 1				
NSO	100	100	100	100
CSU	0	0	100	100
TL	0	0	37	37
SLT	0	0	0	0

Table 4.12-2 Stipulations Overlapping CRAs by Alternative in Zones 1 to 4

Stipulation Type	Alternative 1 (% of CRAs intersecting Leases)	Alternative 2 (% of CRAs intersecting Leases)	Alternative 3 (% of CRAs intersecting Leases)	Alternative 4 (% of CRAs intersecting Leases)
Zone 2				
NSO	49	49	100	100
CSU	1	1	100	100
TL	42	42	88	88
SLT	15	15	0	0
Zone 3				
NSO	5	6	56	35
CSU	3	5	56	35
TL	15	19	39	27
SLT	79	75	0	0
CTL	0	0	0	65
Zone 4 (There are no CRAs within Zone 4)				
NSO	0	0	0	0
CSU	0	0	0	0
TL	0	0	0	0
SLT	0	0	0	0

4.12.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

As detailed in **Table 4.12-1** under Alternative 1, all of the lands leased in the Lower Battlement RNA are protected with a NSO stipulation. The majority of NSO stipulations pertain to slopes greater than 60 percent and bighorn sheep habitat. There is potential for development to occur where there is no NSO stipulation within the RNA. Because there is no resource-specific NSO stipulation designed to protect the RNA, it is possible that development could occur should the operator obtain an exception, waiver, or modification to the lease stipulation.

Under Alternative 1, leases within the CRAs would be developed under the existing terms and stipulations of the lease. Without any resource-specific NSO or CSU stipulations designed to cover roadless areas, the CRAs may be affected by future development, although leases issued after July 2012 would follow CRR and therefore development would be restricted.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 60 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance.

Stipulations for CRAs within Zones 1 through 4 are shown in **Table 4.12-2**. Depending on the density, oil and gas development within or adjacent to a CRA could lead to compromising the characteristics that for which the roadless area was designated. Depending on the extent and location of future oil and gas

development, portions of the RNA, including areas of the RNA adjacent to the leasing zone, could be compromised, altering the characteristics for which the RNA was set aside. Additionally, development within an RNA could compromise the characteristics for which it was designated. However, it should be noted that the projected future density of oil and gas development is low, so adverse effects to these Special Designations may be dispersed and minor.

SH-133/West Elk Loop, a Designated Scenic Byway, would be located nearly 3 miles east of the closest lease. Some of the portions closest to SH-133 would be covered by NSO stipulations and, in general, the leases closest to the scenic byway would be located on the opposite sides of ridgelines.

4.12.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting RNAs and CRAs under Alternative 2 are essentially the same as Alternative 1 despite the minor additional stipulations in 8 leases, as displayed in **Tables 4.12-1** and **4.12-2**.

Impacts from Projected Future Oil and Gas Development

Impacts on Special Designations from projected future oil and gas development would be the same under Alternative 2 as under Alternative 1.

4.12.4.3 Alternative 3

Stipulation Coverage

Stipulations affecting RNAs and CRAs under Alternative 3, as compared to Alternatives 1 and 2, may serve to better maintain the integrity of special designations. Under this alternative, a NSO would be applied to all RNA and CRA acreage, affording the maximum amount of coverage through stipulations. Access roads could not be constructed in designated roadless areas for leases issued after the CRR. The NSO would preclude development on leases during exploration and development. It is important to note that the NSO stipulations apply only to those activities within the leases, and access road construction off the leases may occur under special use authorizations or road use permits.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, approximately 413 wells would potentially be developed resulting in 886 acres of initial disturbance and 384 acres of long-term disturbance. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance.

As shown in **Tables 4.12-1** and **4.12-2**, there would be a NSO stipulation for all RNA and CRA acreage, minimizing adverse impacts to RNA natural characteristics and CRA roadless characteristics. Ground disturbance would be minimized to RNAs and CRAs within their respective boundaries, but some ground disturbance may occur through activities authorized under special use authorizations or road use permits. Drilling would be off-site, outside of RNAs and CRAs. Some development could occur along the boundaries and directional drilling could occur under the RNA and roadless area, but the RNAs and CRAs and their respective characteristics would be maintained as there would be no development within them. Where exterior boundary development could potentially occur along RNAs and roadless areas, edge effect may occur in these instances where noise and traffic would be associated with this type of development. Impacts to the SH-133/West Elk Loop Designated Scenic Byway would be similar to Alternatives 1 and 2.

4.12.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Stipulations affecting CRAs and RNAs under Alternative 4 may serve to preserve current land uses and maintain the integrity of special designations. Stipulations under Alternative 4 would be similar to those under Alternative 3, except where leases would be designated as CTL and cancelled within Zone 3. The lease cancellation would eliminate development within the CRAs in Zone 3.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, approximately 383 wells would potentially be developed resulting in 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of this disturbance would occur in Zone 2, followed by Zones 1, 3, and 4, in order from high to low disturbance area.

Impacts from future oil and gas development would be similar to Alternative 3 except in Zone 3 where some leases would be cancelled. As shown in **Tables 4.12-1** and **4.12-2**, there would be a NSO stipulation for all RNAs and CRAs, minimizing adverse impacts to RNA natural characteristics and CRA roadless characteristics. **Table 4.12-2** also shows the substantial increase in NSO and CTL acreage within Zone 3. Cancellation of Zone 3 leases would further remove the SH-133/West Elk Loop Designated Scenic Byway from closest lease.

4.12.4.5 Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled.

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, as all leases would be cancelled, ground-disturbing activities would take place to plug and abandon the existing wells and reclaim roads and other infrastructure. It is projected that approximately 86 acres of initial surface disturbance would occur from these actions, with the majority taking place in Zone 2. None of this disturbance would occur within the RNA or CRAs, or the SH-133/West Elk Loop Scenic Byway viewshed.

4.12.4.6 Summary of Impacts

In summary, the maximum net long-term disturbance due to oil and gas development across all alternatives, estimated based on the RFDS, would be less than 1 percent of the analysis area. Within the analysis area, the maximum potential adverse impacts to RNAs and CRAs would occur under Alternatives 1 and 2. Alternatives 3 and 4 would further increase stipulations offering enhanced levels of protection to RNAs and CRAs. Alternative 5 would produce fewer adverse impacts to Special Designations than all other alternatives existing wells would be plugged and abandoned, lease pads and access roads reclaimed, and future development would not occur. Impacts to the SH-133/West Elk Loop Designated Scenic Byway, would be similar under Alternatives 1 through 3, and greatly reduced under Alternatives 4 and 5.

4.12.5 Cumulative Impacts

4.12.5.1 Cumulative Impacts Analysis Area

The CIAA for special designations is the CRAs on the project leases in addition to the entire extent of RNA intersecting the 4 leases zones (64,864 acres).

4.12.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions are broken into three surface-disturbing activities: mineral development, transportation corridors, and other development. Other development includes ROWs for pipelines and telephone lines as well as other developments. Impacts to special designations from past and present surface-disturbing activities are similar to those described in Section 4.12.3. There are 4 acres of quantifiable disturbance within the special designations CIAA. These actions also would contribute to increased levels of traffic on the local and regional road network.

There are no reasonably foreseeable future actions which would result in surface-disturbing activities within the CIAA for special designations. Approximately 3,000 acres within the special designations CIAA area would be a part of the South Rifle Habitat Enhancement Project. This would result in beneficial impacts to special designations within the CIAA as habitat improvements would foster a more natural setting.

4.12.5.3 Contribution of Proposed Acton and Alternatives to Cumulative Impacts

Aside from the RFDS analyzed for the 65 leases in Zones 1 through 4, there are no reasonably foreseeable future actions pertaining to oil and gas activities within the special designation CIAA.

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance within the leases. This is less than 1 percent of the 64,864 acre-CIAA but comprises most of the cumulative long-term surface disturbance within the CIAA.

As previously noted, the South Rifle Habitat Enhancement Project is projected to occur on 3,000 acres (5 percent) of the CIAA. If selected, Alternative 5 also would remove 75 existing wells within the leases (affecting less than 1 percent of the CIAA). These projects would have countervailing affects to special designations by retuning the area in and around special designations to a more natural setting.

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4.13 Recreation

4.13.1 Analysis Assumptions and Approach to Analysis

4.13.1.1 Analysis Area

The analysis area encompasses the WRNF and a small portion of the GMUGNF with an emphasis on the four lease zones (see **Figure 1-1**). The majority of the recreation that occurs within the lease zones is dispersed recreation, consisting mostly but not exclusively of hunting and hiking.

4.13.1.2 Scoping Issues

The NEPA scoping process revealed an array of the public's concerns with impacts to recreation. Relevant issues and concerns raised during scoping are detailed below:

- Effects to hunting, angling, and other recreational uses in the areas being analyzed, specifically, the sustainability of hunting and fishing opportunities.
- Downstream water uses, including the fishery on the Crystal River and the Gold Medal fishery on the Roaring Fork River.
- Potential effects to the number of recreationists that historically use all allowed or permitted areas.
- Effects of sound associated with potential oil and gas development on areas managed for quiet recreation and wildlife.

While many of the above issues are addressed in general terms, the high-level of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. All issues listed above would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required. Impacts to downstream water uses are discussed in Section 4.8, Aquatics. Impacts from noise also are discussed in Section 1.16, Human Health and Safety.

4.13.1.3 Assumptions

The following assumptions were used to facilitate the recreation analysis:

- Leasing is a commitment of the resource for potential future exploration and development activities, but leasing does not compel or authorize any ground-disturbing actions in support of the exploration or development of a lease. As a result of leasing, future exploration and development proposals could be brought forward that would be subject to additional site-specific environmental study and permitting requirements.
- Developed and on-the-ground recreation resources would be preserved on lands with NSO stipulations regardless of resource emphasis. Therefore, analysis and all subsequent tables in this section display the total of all NSO stipulations regardless of resource emphasis. CSU stipulations are identified to preserve recreation resources and serve as a moderate constraint to preserve those values if they are resource-specific stipulations. TL stipulations are generally not considered to provide direct benefit to recreational resources, but may result in a more natural setting and also may preserve the viability of big game herds or fish populations utilized in recreation activities.
- The standards for the Forest Plan Management Areas 1.31, 1.32, 3.31, 3.32, 4.3, and 4.32 would be met when approving future site-specific development proposals.

- Future increases in population in surrounding communities will increase the demand for recreation on NFS lands.
- Changes to recreation settings could occur from potential exploration, development, production, and reclamation activities in areas without NSO stipulations.
- In site-specific areas, there is potential for adverse effects to some Recreation Opportunity Spectrum (ROS) class objectives because those objectives may not be retained over the short or long term. This could result in an overall reduction in acres in the more primitive end of the spectrum and an increase of acres in the more developed end of the ROS.
- Operators would comply with applicable laws and regulations.
- The analysis assumes implementation of projected future oil and gas development based on scaling the RFDS to account for proposed lease stipulations under each alternative.

4.13.1.4 Impact Indicators Used for Analysis

The indicators used to measure potential impacts to recreation resources across the range of alternatives include the following:

- Acres of surface disturbance, based on the RFDS, within each Management Area, by alternative and by lease.
- Acres of surface disturbance, based on the RFDS, within existing recreation opportunities as defined by winter and summer ROS Class objectives by alternative and by lease.
- Percent of Management Area and winter and summer ROS Class objectives under NSO by alternative and zone.

4.13.1.5 Methods of Analysis

Analysis focuses on the potential for future development of oil and gas leases to change the quantity and quality of recreation settings and opportunities. The analysis is done by analyzing the acres of existing recreation opportunities that may be affected and potential impacts to dispersed and developed recreation resources. The analysis also includes a qualitative discussion of potential impacts to dispersed and developed recreation resources and recreation special uses.

4.13.2 Stipulations Covering Recreation Resources

The rationale for stipulations is shown in Appendix B of the WRNF Oil and Gas Leasing Final EIS. The definition and purpose of the stipulations is identified on each stipulation form in Appendix A of the 2014 WRNF Oil and Gas Leasing Final EIS (USFS 2014a) and in Appendix B of the 1993 Final EIS (USFS 1993). Within the WRNF forest, there are four NSOs, one CSU, and one TL stipulation specific to recreation resources, but only three apply within the analysis area:

- NSO – Authorized Sites and Facilities – 0.25 mile and CSU Authorized Sites and Facilities – 0.5 mile: All alternatives
- NSO – Summer Non-motorized Recreation: Alternatives 3 and 4 only
- TL – Snowmobile Corridor: Alternatives 1 and 2. Under Alternatives 3 and 4, this is revised to a CSU for Designated Winter Groomed Routes under Special Use Permit

NSO stipulations would preclude surface disturbance in the area in which they are applied, thus preserving the recreation experience, scenic integrity, safety of forest users, and the natural environment that initially made the area desirable for recreational use. CSU stipulations assist in preserving the recreational experience by requiring special design, construction, operation, mitigation, reclamation

measures, and monitoring. CSUs also allow the relocation surface-disturbing activities beyond 200 meters (656 feet) to preserve recreation values. TL stipulations provide focused coverage only during the time of year when recreational activities occur.

There are other resource-related stipulations that would minimize the potential impacts of oil and gas development on areas with high recreation value, even though they were not developed for that purpose. Resources closely correlated with recreation include, but are not limited to, the following:

- Big Game Habitat (NSO, CSU, and TLs under all alternatives but revised under Alternatives 3 and 4 to include additional habitat);
- Roadless Areas (NSO under all Alternatives, but revised under Alternatives 3 and 4 to address the 2012 CRR);
- RNAs (NSO under all alternatives but revised under Alternatives 3 and 4 to include the Lower Battlement Mesa RNA, which is in Lease Zone 1); and
- Sensitive Level 1 Travel Routes (CSU under Alternatives 1 and 2 and revised to CSU – High Concern Travel Ways or Use Areas under Alternatives 3 and 4).

There are additional NSOs that could overlay areas of high recreation value. However, if the resources these stipulations are designed to address are not found to occur on the leases, the stipulations would not be implemented.

4.13.3 Impacts Common to All Alternatives

4.13.3.1 Impacts Summarized in the WRNF Final EIS

Impact issues that were identified for recreation resources in the WRNF Final EIS include the potential effects of future oil and gas development and operations on the recreation settings, quality of visitor's experiences, and the quantity of recreation opportunities (WRNF Final EIS 2014, p. 292). The EIS also recognizes that changes related to the related intrinsic values to adjacent communities would be dependent on the level of development. Although opportunities to pursue a variety of recreation activities would remain, in some site-specific locations the quality and quantity of the recreation opportunities would likely change or diminish proportionately to the level of oil and gas development (WRNF Final EIS 2014, p 292). Types of recreation opportunities also could change, as post-leasing activities and physical disturbances could impair recreational experiences and adjacent community's sense of place (WRNF Final EIS 2014, p. 292-293). Furthermore, future oil and gas development may impair desired recreational conditions within forest management areas, as well as create long-term negative effects in terms of compatibility with Semi-primitive Non-motorized (SPNM) and Semi-primitive Motorized (SPM) ROS classes (WRNF Final EIS 2014, p 293). These impacts are described in further detail below.

4.13.3.2 Impacts to the Recreational Experience

Changes may result to recreational setting and quality of recreation experiences due to post-lease oil and gas development including construction, drilling, completion operations, and reclamation. The level of change to recreation settings, quality of visitor's experiences, quantity of recreation opportunities, and the related intrinsic values to adjacent communities would be dependent on the level of development in each zone. Stipulations, mitigation measures, conditions of approval, and best management practices developed during site-specific NEPA analysis and APD processing set the conditions under which the RFDS or connected actions may occur on lands available for lease.

Opportunities to pursue a variety of recreation activities across most of the leasing areas would remain after development occurs. However, in some site-specific locations, the quality and quantity of developed and dispersed recreation opportunities would likely change or diminish proportionately to the level of oil and gas development. This could result in shifts in patterns of recreational use as the type of recreation

opportunities sought by recreationists are affected by development activities, such as traffic, lights, and noise, causing recreational opportunities to be sought elsewhere during the most intensive stages of post-leasing oil and gas development. Post-leasing activities and physical disturbance within the landscape could impair visitor's recreational experiences and the adjacent community's sense of place.

For lands that are subsequently developed, adverse impacts to recreation resources would be greatest during the initial construction phases when vehicle traffic, human activity, and noise are the greatest. Adverse impacts may result from changes to the existing landscapes through introduction of new industrial features such as access roads, well pads, facilities, pipelines, and utility corridors. Associated impacts from initial disturbances could include noise, lights, dust, smell, construction equipment, and construction traffic. Changes in traffic volume during construction could negatively affect recreational users' experiences. These adverse impacts also would potentially affect lands adjacent to leasing areas, not to just the leasing areas themselves.

Changes to the recreational setting could occur during the operations and reclamation stages. Long-term impacts include landscape modifications such as well pads, roads, pipelines, power lines, and facilities. Routine maintenance activities could have the potential to adversely impact visitor experiences, although activity would be less and of shorter duration during this stage.

4.13.3.3 Impacts to ROS Class Characteristics

Mineral development activities in ROS classes SPNM and SPM could create long-term adverse effects in terms of compatibility with existing recreation activities, physical and social settings and the quality of the visitor experiences. In ROS classes that do not have stipulations precluding or limiting disturbance, post-leasing development could cause minor, short-term impacts during drilling and completion operations to long-term impacts to the recreational experience when wells are put into production. Impacts to the quality of recreational experiences would likely be negligible to minor within the leasing areas that have already been modified by surface disturbance and associated visual impacts and noise.

4.13.3.4 Impacts to Dispersed Recreation and Developed Recreation Sites

The values of developed recreation sites and facilities would be preserved through the application of stipulations across all alternatives or site-specific mitigation at the time of development. Opportunities to pursue a variety of dispersed recreation activities (e.g., trail-based motorized and non-motorized activities), would remain. However, the extent and quality of those dispersed recreation opportunities would likely change or diminish proportionately to the extent of active oil and gas development activities across all alternatives.

4.13.4 Impacts by Alternative

Impacts by alternative for the recreation resource were determined by considering where recreational uses may be preserved by stipulations that exist specifically for the resource. The analysis then takes into account stipulations that were developed to address a wide range of resources and may, by default, afford coverage to recreational uses.

Table 4.13-1 shows the percent of NSO stipulations within management areas with a recreational emphasis. There are no management areas with a recreational emphasis in Zones 1 and 4. Analysis of potential impacts to management areas as well other aspects of recreation are presented below by alternative.

Table 4.13-1 Percent of NSO Stipulations by Management Area

Management Area	Management Area Name	Stipulations	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Zone 2						
3.31	Backcountry year-round motorized	% of Management Area with NSO	36	36	93	93
3.32	Backcountry non-motorized with winter motorized	% of Management Area with NSO	100	100	100	100
Zone 3						
4.3	Dispersed Recreation	% of Management Area with NSO	0	0	83	0
		% of Management Area CTL	NA	NA	NA	100

4.13.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Under Alternative 1, NSO stipulations developed to address other resources would preclude surface disturbance in areas of high recreational value should they be implemented. These include NSO stipulations for roadless areas, bighorn sheep habitat, and slopes greater than 60 percent. The entirety of Zone 1 would be under NSO stipulations. Zone 2 would offer the second highest amount of acreage under NSO, followed by Zones 3 and 4. As shown in **Table 4.13-1**, within Management Area 3.31 (Backcountry-Year-round Motorized), 64 percent would be without NSO stipulations, which could affect the desired condition of the WRNF of maintaining a natural appearing landscape (USFS 2002). Within Management Area 3.32 (Backcountry Non-Motorized with Winter Motorized), 100 percent within Zone 2 would be under NSO stipulation. No acreage in Zone 3 for Management Area 4.3 (Dispersed Recreation) would be under a NSO stipulation.

A resource-specific NSO for Authorized Sites and Facilities would be applied to 108 acres in Zone 1. Within Zone 2, the portion of the leases closest to the Beaver Creek trailhead would be largely surrounded by SLT; the areas closest to Cayton trailhead would be NSO. Within Zone 3, a TL would be applied to 2 miles of Snowmobile Corridors, which would eliminate oil and gas development activity in designated corridors between December and April 1. A CSU stipulation for Sensitive Level 1 Travel Routes would constrain development near 97 miles of travel routes in Zone 2 and 3,360 miles in Zone 3. In all zones, TL stipulations would be in place to preclude surface disturbance in some portions of big game winter range from December 1 to April 14, which also would facilitate a more natural setting for winter recreational activities such as snowshoeing; however, this stipulation does not apply to operations and maintenance of production facilities.

Table 4.13-2 details stipulations by ROS classification for Zones 1 through 4 to show what ROS classifications may be covered and where there are areas used for recreation that could potentially be impacted because they would not be covered by stipulations. There could be potential adverse effects to SPNM and SPM ROS Class objectives because those objectives may not be retained over the short or long term due to the availability of these areas for surface-disturbing activities. Section 4.13 contains a description of ROS objectives. The greatest potential for adverse impacts from development would occur within the Summer ROS classification SPNM, where there is the greatest amount of acreage available for development without NSO stipulations. For winter ROS, the highest potential effects would be within

the SPNM classification where there is the greatest amount of acreage available for development without NSO stipulations.

Table 4.13-2 Stipulations by ROS Classification for Zones 1 to 4, Alternative 1

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
Zone 1 Summer ROS						
NSO	NA	NA	100	NA	100	NA
CSU	NA	NA	0	NA	0	NA
TL	NA	NA	0	NA	<1	NA
Zone 1 Winter ROS						
NSO	NA	NA	100	0	100	NA
CSU	NA	NA	0	0	0	NA
TL	NA	NA	0	0	<1	NA
Zone 2 Summer ROS						
NSO	NA	NA	1	34	50	0
CSU	NA	NA	21	11	0	0
TL	NA	NA	9	43	52	0
Zone 2 Winter ROS						
NSO	NA	NA	3	20	49	0
CSU	NA	NA	97	4	1	0
TL	NA	NA	43	45	54	0
Zone 3 Summer ROS						
NSO	NA	40	0	1	14	0
CSU	NA	10	3	7	2	0
TL	NA	10	6	14	23	0
Zone 3 Winter ROS						
NSO	NA	40	NA	0	0	0
CSU	NA	10	NA	5	0	0
TL	NA	10	NA	28	0	0
Zone 4 Summer ROS						
NSO	NA	NA	0	5	0	NA
CSU	NA	NA	0	0	0	NA
TL	NA	NA	0	57	26	NA
Zone 4 Winter ROS						
NSO	NA	NA	NA	3	0	NA
CSU	NA	NA	NA	0	0	NA
TL	NA	NA	NA	79	26	NA

Zone acreage is as follows: Zone 1: 10,114; Zone 2: 24,938; Zone 3: 42,767; Zone 4: 2,562.

Impacts from Projected Future Oil and Gas Development

Under Alternative 1, the potential exists for approximately 416 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 892 acres and long-term surface disturbance of 387 acres. The majority of this proposed disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area.

Under Zone 1, all surface disturbances would be precluded, thus preserving the values of the Summer and Winter Roaded Natural and SPNM ROS classes present in the Zone. Within Zone 2, 34 percent of Summer SPM and 50 percent Summer SPNM ROS classes, respectively, would be covered by NSOs; the NSO coverage of Winter ROS classes would be similar. Zones 3 and 4 would have little no coverage afforded to ROS winter or summer classes by NSO stipulations. Hunters utilizing GMU 42 for both deer and elk would experience the most disruption to hunting activities as the majority of Zones 1 and 2, as well as a portion of Zone 3 are within GMU 42. GMU 43 also overlaps a sizable portion of Zone 3 and would experience disruption as well to hunting activities. Hunters who have historically used these GMUs may choose to relocate to different GMUs during the most intensive phases of development, although hunters who relocate may return during the less intensive production and operation phase as development activity decreases. Developed trailhead recreation sites such as Babbish Gulch, Four Mile Complex, South Branch of Thompson Creek, Dexter Park, and Braderich Creek, and winter trailheads such as 2-Fourmile Complex, Marion Gulch, and Spring Gulch Nordic Ski Area are adjacent to Zone 3 and would potentially experience unnatural sound effects, dust, construction equipment traffic, and potential changes to the visual landscape. The Sunlight to Powderhorn snowmobile trail also would potentially experience these same impacts to the recreational setting. Zone 2 is the only zone that contains developed recreation sites, which consists of the Beaver Creek and Cayton trailheads; the portion of the leases closest to the Beaver Creek trailhead would be largely surrounded by SLT; the areas closest to Cayton trailhead would be NSO; however, nearby development and production activities could still result in recreationists relocating to a more natural setting. Similarly to hunters, historical users of both developed and undeveloped recreational resources, particularly within the Thompson Divide area, may choose to relocate recreational activities away from areas where lease development activities would result in unnatural sound effects, lights, dust, smell, construction equipment and traffic, as well as visual changes to the landscape. Some recreationists who relocate may return after the more extensive development phases are completed. The threat of spills and the subsequent potential for degradation of fishing opportunities is another potential recreation impact from lease development activities. Section 4.16 details the possibility of spills as well as potential measures to reduce spill risk.

These impacts would be lessened by development activities being spread along a 20-year timeframe, minimizing the chance of extensive lease development occurring concurrently.

4.13.4.2 Alternative 2

Stipulation Coverage

Stipulations affecting recreational resources under Alternative 2 would the same as Alternative 1 with the exception of minor changes to eight leases in Zone 3. Types of stipulations are discussed in Section 4.13.2.

Table 4.13-1 details NSO coverage within management areas that have a recreational emphasis. Potential impacts under Alternative 2 would be the same as under Alternative 1, with the same amount of acreage under NSO stipulation for management areas within Zones 2 and 3. Changes to stipulations under Alternative 2 for Zone 3 Management Area 4.3 would include a slight reduction of CSU in regards to (0.2 acre) travel routes and the introduction of a TL for travel routes of 156 acres. All other stipulations for Management Area 4.3 in Zone 3 would remain the same. Ultimately, more coverage of recreation-related resources and activities would be afforded under Alternative 2.

Impacts to summer and winter ROS classifications from potential development would be similar under Alternative 2 as Alternative 1; with the exception that more acreage would be covered by NSO, CSU, and TLs under Alternative 2 in Zone 3. **Table 4.13-3** details Zone 3 stipulations coverage of the ROS classifications that could potentially be impacted. Stipulation in the other three zones would be the same as under Alternative 1.

Table 4.13-3 Stipulations by ROS Classification for Zone 3, Alternative 2

Stipulation Type	ROS Classifications					
	Urban (acres)	**Rural (acres)**	**Roaded Natural (acres)**	**SPM (acres)**	**SPNM (acres)**	**Primitive (acres)**
Zone 3 Summer ROS						
NSO	NA	40	3	3	16	0
CSU	NA	10	7	21	2	0
TL	NA	10	7	38	24	0
Zone 3 Winter ROS						
NSO	NA	40	NA	9	0	0
CSU	NA	10	NA	10	0	0
TL	NA	10	NA	33	0	0

Impacts from Projected Future Oil and Gas Development

Impacts from projected future oil and gas development would be the same under Alternative 2 as under Alternative 1, with the exception that stipulations within eight leases would be enhanced, offering an increased level of coverage to recreational resources in those eight leases.

4.13.4.3 Alternative 3

Stipulation Coverage

Table 4.13-1 details NSO coverage within management areas that have a recreational emphasis. Potential impacts under Alternative 3 would be less than under Alternative 1, as the majority of acreage within Management Area 3.31 (Zone 2) and Management Area 4.3 (Zone 3) would fall under NSO stipulations. NSO stipulations coverage within Management Area 3.32 (Zone 2) would remain the same.

Resource-specific NSO for Authorized Sites and Facilities would be applied to 125 acres in Zone 1, 2,823 acres in Zone 2 and 1,088 acres in Zone 3 and a CSU for Authorized Sites and Facilities would be applied to 406 acres, 6157 acres and 3,181 acres of Zones 1, 2, and 3, respectively. The NSO stipulation for Summer Non-motorized Recreation would be applied to 872 acres in Zone 2. Leases nearby the Beaver Creek and Cayton trailheads would be primarily NSO, thus preserving the values of developed recreation within the leasing zones. A CSU for Designated Winter Grooming would be applied to 3 miles of routes in Zone 2, 42 miles in Zone 3, and 4 miles in Zone 4. This stipulation would limit access on designated winter groomed routes to over-the-snow vehicles between mid-November and late May and would not allow plowing along these routes. Within Zone 3, a CSU stipulation for High Concern Travel Ways or Use Areas would be applied to 6,117 acres in Zone 2 and 18,943 acres in Zone 3 would constrain development near travel routes). In all zones, TL stipulations would be in place to preclude surface disturbance in some portions of big game winter range from December 1 to April 14, which also would facilitate a more natural setting for winter recreational activities such as snowshoeing during construction; however, this stipulation does not apply to operations and maintenance of production

facilities. Ultimately, more coverage for recreation-related resources and activities would be afforded under Alternative 3 than under Alternatives 1 or 2.

Table 4.13-4 details stipulations coverage by ROS classification for Zones 1 through 4. There could be potential adverse effects to SPNM and SPM ROS Class objectives. Impacts to summer and winter ROS classifications from potential development would be less under Alternative 3 than Alternative 1, as more acreage would be covered by NSO under Alternative 3, affording enhanced preservation of recreational resources and reducing impacts to ROS objectives.

Table 4.13-4 Stipulations by ROS Classification for Zones 1 to 4, Alternative 3

Stipulation Type	ROS Classifications					
	Urban (percent)	**Rural (percent)**	**Roaded Natural (percent)**	**SPM (percent)**	**SPNM (percent)**	**Primitive (percent)**
Zone 1 Summer ROS						
NSO	NA	NA	100	NA	100	0
CSU	NA	NA	100	NA	100	0
TL	NA	NA	00	NA	53	0
Zone 1 Winter ROS						
NSO	NA	NA	100	NA	100	0
CSU	NA	NA	100	NA	100	0
TL	NA	NA	00	NA	53	0
Zone 2 Summer ROS						
NSO	NA	NA	16	85	87	0
CSU	NA	NA	22	100	100	0
TL	NA	NA	10	87	92	0
Zone 2 Winter ROS						
NSO	NA	NA	75	96	84	0
CSU	NA	NA	100	100	100	0
TL	NA	NA	48	85	91	0
SLT	NA	NA	0	0	0	0
Zone 3 Summer ROS						
NSO	NA	30	9	94	88	0
CSU	NA	100	12	100	100	0
TL	NA	10	7	47	54	0
Zone 3 Winter ROS						
NSO	NA	30	NA	86	0	0
CSU	NA	100	NA	100	0	0
TL	NA	10	NA	59	0	0
Zone 4 Summer ROS						
NSO	NA	NA	0	88	57	NA
CSU	NA	NA	0	100	100	NA

Table 4.13-4 Stipulations by ROS Classification for Zones 1 to 4, Alternative 3

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
TL	NA	NA	0	100	100	NA
SLT	NA	NA	0	0	0	NA
Zone 4 Winter ROS						
NSO	NA	NA	NA	93	57	NA
CSU	NA	NA	NA	100	100	NA
TL	NA	NA	NA	100	100	NA

Note: Zone acreage is as follows: Zone 1: 10,114; Zone 2: 24,938; Zone 3: 42,767; Zone 4: 2,562.

Impacts from Projected Future Oil and Gas Development

Under Alternative 3, the potential exists for approximately 413 wells to be drilled from 59 well pads. These actions could potentially result in initial surface disturbance of 886 acres and long-term surface disturbance of 384 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area. Under Zone 1, all surface disturbances would be precluded, thus preserving the values of Summer and Winter SPNM ROS classes present in the zone. Within Zone 2, almost all Winter and Summer RN, SPM, and SPNM ROS classes would be covered by NSOs. Within Zone 3, almost all Winter and Summer SPM ROS class areas and Summer SPNM Class would be covered by NSO stipulations; Winter SPNM ROS class areas (which comprise about 125 acres) would not have NSO coverage. Within Zone 4, almost all Winter and Summer SPM, and over half of winter and summer SPNM ROS classes would be covered by NSOs.

Additionally, within Zone 3, specifically dispersed recreational activities such as hunting in GMU 42, use of the Sunlight to Powderhorn snowmobile trail, and adjacent summer and winter trailheads would experience less impact resulting from an increase in stipulations under Alternative 3 as well as a slight decrease in the number of anticipated wells and corresponding well pads.

4.13.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Table 4.13-1 details NSO stipulations within management areas that have a recreational emphasis. Potential impacts under Alternative 4 would be the same as Alternative 3 in Zones 1, 2, and 4. In Zone 3, 100 percent of Management Area 4.3 would be CTL. Ultimately, more coverage for recreation related resources and activities are afforded under Alternative 4 than Alternative 1.

Under Alternative 4, 29 miles of designated routes that are covered by a CSU for Designated Winter Grooming under Alternative 3 would be within the cancelled leases. The remaining 14 miles would continue to have the CSU stipulation applied to them. The 28,000 acres of leases that would be cancelled in Zone 3 also includes over half the areas previously covered by NSO and CSU stipulations for Authorized Sites and Facilities.

Table 4.13-5 details stipulations by ROS classification for Zone 3 in the form of stipulation acreage of the ROS classifications that could potentially be impacted. There could be potential adverse effects to SPNM and SPM ROS Class objectives. Impacts to summer and winter ROS classifications from potential development would be less under Alternative 4 as Alternative 1, as more acreage would be covered by

NSO and lease cancellations, affording enhanced coverage of recreational resources and reducing impacts to ROS objectives.

Table 4.13-5 Stipulations by ROS Classification for Zone 3, Alternative 4

Stipulation Type	ROS Classifications					
	Urban (percent)	Rural (percent)	Roaded Natural (percent)	SPM (percent)	SPNM (percent)	Primitive (percent)
Zone 3 Summer ROS						
NSO	NA	0	1	37	0	0
CSU	NA	0	1	39	0	0
TL	NA	0	1	24	0	0
CTL	NA	100	11	61	100	0
Zone 3 Winter ROS						
NSO	NA	0	NA	29	0	0
CSU	NA	0	NA	33	0	0
TL	NA	0	NA	26	0	0
CTL	NA	100	NA	67	0	0

Source: BLM 2014b.

Impacts from Projected Future Oil and Gas Development

Under Alternative 4, the potential exists for approximately 366 wells to be drilled from 55 well pads. These actions could potentially result in initial surface disturbance of 821 acres and long-term surface disturbance of 356 acres. The majority of this disturbance would occur in Zone 2, followed by Zones 3, 1, and 4, in order from high to low disturbance area. Impacts would be the same as Alternative 3 in Zones 1, 2, and 4. Within Zone 3, lease cancellations would preclude development in about 30 percent of the summer SPM, 100 percent of Summer SPNM, and 67 percent of winter SPM ROS areas within the zone. With consideration of NSO stipulations and areas closed to leasing; surface disturbance would be precluded on 98 percent of Summer SPM and 100 percent of Summer SPNM areas (versus 94 and 86 percent under Alternative 3, respectively) and 95 percent of winter SPM (versus 86 percent under Alternative 3). As with Alternative 3, Winter SPNM ROS class areas (which comprise about 125 acres) would not be precluded from surface disturbance. Cancellation of leases in Zone 3 would result in a substantial reduction to potential recreation impacts specifically within the Thompson Divide area, as well as to hunters potentially utilizing GMU 43, and recreationists utilizing the Sunlight to Powderhorn snowmobile trail, and adjacent summer and winter trailheads. **Figure 2-13** shows areas that would be closed to leasing in Zone 3 under Alternative 4.

4.13.4.5 Alternative 5

Stipulation Coverage

There would be no stipulations. All leases would be cancelled.

Impacts from Projected Future Oil and Gas Development

Although there would be no future development under this alternative, as all leases would be cancelled, ground-disturbing activities would take place to plug and abandon the existing wells and reclaim roads and other infrastructure. It is projected that approximately 86 acres of roads and well pads would be reclaimed, with the majority taking place in Zone 2. Approximately 10 acres of well pad and road

reclamation would occur in Zone 3. This disturbance would result in short-term impacts to recreational resources from noise, lights, dust, construction equipment, and construction traffic, ending when well pad and road reclamation activities are completed.

4.13.4.6 Summary of Impacts

In summary, within the analysis area the maximum net long-term disturbance in acres across Alternatives 1 through 4, estimate from the RFDS, is less than 0.8 percent of the detailed analysis area. Future surface-disturbing activities would occur under all alternatives and could affect or change the recreation setting as described by ROS classes depending on the density of site-specific locations and their duration. Under Alternatives 1 through 4 the potential for negative effects lies mostly within SPNM and SPM ROS Classes where characteristics of remoteness and naturalness would be vulnerable without stipulations precluding or limiting surface disturbance. Impacts to developed recreation areas and dispersed recreation could be mitigated through the application of NSO, CSU, and TL stipulations. Negative effects could be realized in some site-specific locations both short- and long-term.

The RFDS for Alternatives 1 and 2 could result in 892 acres of initial surface disturbance and 387 acres of long-term surface disturbance, bringing potential impacts to ROS Classifications, management areas with a recreational emphasis, and developed and dispersed recreation resources. Additional impacts resulting from noise, lights, dust, smell, construction equipment, and construction traffic associated with lease development could cause recreationists, particularly within the Thompson Divide area, to relocate to a more natural setting. These potential impacts would be lessened by the application of NSO, CSU, and TL stipulations, but given the amount of surface disturbance projected for each zone relative to the acreage of each ROS class that is not precluded from surface disturbance by NSO stipulations, the RFDS for Zones 2, 3, and 4 could be developed in any ROS class; in Zone 1, all surface disturbance would be fully precluded.

The RFDS for Alternative 3 would be almost the same (886 acres of initial surface disturbance and 384 acres of long-term surface disturbance); however, the potential for development would be minimized in most ROS Classes. Surface disturbance would be fully precluded in Zone 1 and NSO protections would generally be between 80 and 95 percent in all ROS classes in Zones 2, 3, and 4, reducing potential impacts to ROS Classifications, management areas with a recreational emphasis, and developed and dispersed recreation resources. A slightly less amount of acreage would be impacted within Zone 3, resulting in a corresponding reduction in recreation impacts when compared to Alternatives 1. Alternative 3 also would constrain development in and near authorized sites and facilities, summer non-motorized recreation areas, and designated winter groomed routes to a greater degree than Alternative 1.

The RFDS for Alternative 4 could result in 821 acres of initial surface disturbance and 356 acres of long-term surface disturbance In Zone 3, the combination of lease cancellations and NSO stipulations would decrease the acreage in which development would take place; the potential for development in all other zones would be the same as Alternative 3. This would result in substantially less impacts to recreational resources than under Alternative 1.

Alternative 5 would result in the least surface disturbance and the least impact to ROS classes, management areas with a recreational emphasis, and developed and dispersed recreation resources. This alternative would result in the least potential impacts to recreation resources than under any alternative.

4.13.5 Cumulative Impacts

4.13.5.1 Cumulative Impacts Analysis Area

The CIAA would be the same as the analysis area described in Section 4.13.1.1.

4.13.5.2 Past, Present, and Reasonably Foreseeable Future

Actions Past and Present Actions

Past and present actions are broken into three surface-disturbing activities: fluid and solid mineral development, transportation corridors, and other development, such as ROWs for pipelines and telephone lines. Impacts to recreational resources from past and present surface-disturbing activities are similar to those described in Section 4.13.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the total leasing area.

Reasonably Foreseeable Future Actions

There are no reasonably foreseeable future actions which would result in surface-disturbing activities within the CIAA for recreation. Approximately 6,000 acres within the leasing area would be a part of the South Rifle Habitat Enhancement Project. This would result in beneficial impacts to recreation within the CIAA as habitat improvements would foster a more natural setting, conducive to the recreational environment.

4.13.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Reasonably foreseeable development associated with the Proposed Action and alternatives would result between 0 acres (Alternative 5) to 387 acres (Alternatives 1 and 2) of long-term surface disturbance. This is between 0 and 46 percent of the total cumulative long-term surface disturbance within the CIAA. With consideration of past and present actions, RFFAs, and alternatives, the total cumulative impact would affect less than 1 percent of the CIAA.

As previously noted, the South Rifle Habitat Enhancement Project would occur within the recreation CIAA, contributing to a more natural recreational setting. At 6,000 acres, this would occur on 7 percent of the recreation CIAA. If selected, Alternative 5 also would contribute to a more natural recreational setting by removing 75 existing wells within the leases.

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4.14 Livestock Grazing

4.14.1 Analysis Assumptions and Approach to Analysis

4.14.1.1 Analysis Area

The analysis area for livestock consists of the portion of the 19 grazing allotments overlapped by the 65 existing leases under evaluation within Zones 1 through 4 as described in Section 3.14 (see **Figure 3.14-1**).

4.14.1.2 Scoping Issues

Potential issues related to livestock grazing were identified during the project scoping meetings and will be analyzed quantitatively or qualitatively in this section. These issues include the following:

- Loss of forage due to an increase in roads, pipelines, and well pads;
- Compromised quality of forage vegetation due to the generation of fugitive dust emissions;
- Health concerns for livestock due to the generation of fugitive dust emissions;
- Loss of public land that can no longer support the same level of livestock grazing, compromising the viability of ranching operations;
- Increased establishment and spread of noxious weeds;
- Increased potential for trespass and illegal hunting;
- Increased calf-mother separation, and/or stress to calves from human presence and traffic resulting in lower weight gains and corresponding loss of income for livestock operators (loss of income is more fully discussed in Section 3.17, Socioeconomics);
- Increased difficulty in managing cattle due to roads, open gates, and damage to rangeland improvements;
- Livestock exposure to hydraulic fracturing fluids due to contaminated water; and
- Changes in perception of the public that local livestock is no longer grass-fed or free of chemicals, with resulting economics impacts to operations supplying high-end markets. (This issue is not analyzed in detail because it would be speculative to assume that there would be changes to the perception of the local beef industry in the absence of any incidents of livestock exposures).

4.14.1.3 Assumptions

The impact analysis assumes that operators will comply with existing laws and regulations. Additional assumptions include the following:

- Areas that receive reclamation would need a minimum of two years rest, or until the Forest Service decides that reclamation is successful, before they would be eligible for livestock grazing;
- Reclamation efforts would occur within one year of construction disturbance activities;
- Current allotment carrying capacities are appropriate and reflect the desired level for present and future livestock grazing;
- Short-term impacts are defined as less than 4 years;

- Despite variations in vegetation communities that exist within allotments, the impact analysis assumes uniform production for estimating reductions to forage from disturbance and an average of 12 acres per Animal Unit Month (AUM); and
- AUMs would be lost from short-term disturbances temporarily and from long-term disturbances permanently.

4.14.1.4 Impact Indicators used for Analysis

The indicator for quantitative impacts analysis to livestock grazing will be the short- and long-term loss of AUMs and potential reductions to permitted use for livestock operators.

4.14.1.5 Methods of Analysis

The impact analysis for livestock grazing is designed to address the nine scoping issues mentioned above to the degree possible. The methods for analyzing these impacts are as follows:

- Estimate acres of disturbance, associated loss of AUMs, and changes to permitted use resulting from short- and long-term surface disturbance within lease areas.
- Qualitatively discuss fugitive dust emissions resulting from anticipated construction activities, traffic, and associated health issues related to livestock.
- Qualitatively discuss the potential for invasion and spread of noxious weeds (invasive weeds are more fully discussed in Section 3.6, Vegetation).
- Analyze increased access to the analysis area based on estimated miles of new well pad access roads.
- Discuss potential for livestock to become exposed to chemicals related to oil and gas development. This topic also is discussed in Section 3.5, Water, and Section 3.16, Hazardous Materials and Human Health and Safety.

4.14.2 Stipulations Coverage Related to Livestock Grazing

There are no stipulations that apply specifically to livestock grazing or livestock grazing operations; however, any stipulations that overlap the lease area within a grazing allotment could restrict, modify, or preclude oil and gas development, resulting in a reduction or elimination of potential impacts to grazing allotments. Four categories of stipulations affect development within lease areas, but only NSO stipulations would reduce impacts to forage vegetation (see Section 1.1.5 for additional information regarding stipulations). CSUs can be used to impose constraints to specific activities, including the relocation of proposed facilities more than 200 meters from the originally proposed site in order to reduce impacts to designated resource values. The NSO stipulation is the most restrictive and precludes any surface-disturbing activity within the NSO boundary.

4.14.3 Impacts Common to All Alternatives

Impacts would vary by alternative, including those surface-disturbing activities that result in the short- or long-term removal of forage vegetation, changes to the permitted use within allotments, or change in access to water sources or other rangeland improvements. Many impacts may vary in quantity but would be common to all alternatives because they would result from similar operation, maintenance, or decommissioning and reclamation activities. In addition to the effects of surface disturbance resulting from reasonably foreseeable fluid mineral development, impacts common to all alternatives may include the following:

- Compromised quality of forage vegetation due to the generation of fugitive dust emissions;
- Potential health concerns for livestock due to the generation of fugitive dust emissions;

- Increased spread of noxious weeds;
- Increased potential for illegal hunting;
- Increased calf-mother separation, and/or stress to calves from human presence and traffic resulting in lower weight gains and corresponding loss of income; and
- Increased difficulty in managing cattle due to roads, open gates, and damage to rangeland improvements.

Any surface-disturbing activities and vehicular travel along unpaved roads have the potential to produce air-borne dust known as fugitive dust emissions. The deposition area would vary greatly depending on particle size and wind speed and direction. The degree and extent of effects would vary depending on wind, frequency of precipitation events, and the application and effectiveness of dust suppression techniques. It is reasonable to assume that vegetation occurring within the deposition area would receive dust settling on surface areas. Flat, horizontal, broad leaves would be affected more than thin vertical leaves or blades. This can affect plant health and vigor by impeding photosynthesis and proper growth and can adversely affect the palatability of forage vegetation. Although the affected vegetation would not be temporarily or permanently displaced, it would be less nutritious and desirable for livestock forage temporarily.

Fugitive dust emissions also have the potential to cause respiratory illness in cattle known as Bovine Respiratory Disease. This occurs when exposure to dust irritates the bronchial tubes and creates pneumonia type symptoms. Calves are more susceptible than older cattle. Livestock operators, especially those running cow/calf operations, may find it necessary to alter their grazing system to avoid exposing livestock to high volumes of dust.

Surface-disturbing activities as well as increased human presence have the potential to introduce or spread noxious or invasive plant species. Noxious weed species known to occur in the lease areas include knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), leafy spurge (*Euphorbia esula*), and tansy ragwort (*Senecio jacobaea*) (USFS 2011). The degree of impacts from the introduction or spread of noxious and invasive pant species ranges from providing competition to desirable forms of vegetation (sometimes to the extent of establishing large monoculture areas) to the toxic poisoning of livestock that graze upon them.

Under all but Alternative 5, access to the lease areas would require the construction of new roads so traffic volumes would increase from current conditions (see Section 4.10, Transportation). This could adversely impact livestock grazing operations in a few ways listed below that may result in a financial loss for livestock operators.

- The construction of new roads could result in damage to fences and gates, requiring the livestock operators to collect stray livestock.
- Additional roads may lead to accidental or intentional trespass and possibly even livestock theft.
- Increased traffic volumes would increase the potential for livestock/vehicle collisions and can result in calves being separated from their mothers or simply cause calves to become stressed resulting in reduced weight gain.

An average of 1 mile of road per well pad would be constructed. An estimated 5 miles of new roads would be constructed in Zone 1, 46 miles in Zone 2, 7 miles in Zone 3, and 1 mile in Zone 4. It is unlikely that road construction in Zones 1, 3, and 4 would have much of an effect on grazing allotments due to the relatively low mileage; however all of Zone 2 is overlapped by grazing allotments so all of the 46 miles of new roads would occur within allotments. Under Alternative 5 all roads would be reclaimed.

It also is possible that the construction of new roads could be a benefit to livestock operators, making access to the allotment and management activities more convenient. It is not uncommon for ranchers to request roads to be left unreclaimed on private property or for oil and gas developers to assist ranchers with constructing rangeland improvements through the use of their equipment.

Wherever oil and gas development occurs, there is the potential for accidents that result in the release of toxic substances that can range from relatively benign to highly toxic. Cases have been documented where contaminants (typically wastewater) have entered into water sources and exposed cattle developed health issues such as reproductive failure, trouble producing milk, and neurological damage. In a New Solutions article (Bamberger et al. 2012) several toxic releases related to oil and gas development were documented in detail. One case describes some livestock exposure to hydraulic fracturing fluid that resulted in the death of 17 cows in less than 1 hour. In another case, the liner of a wastewater impoundment failed and the wastewater flowed into a pasture and watering pond. Of the 140 cattle that were exposed to the wastewater 70 died and there was a high occurrence of stillborn calves and stunted growth. The 60 cattle kept on a separate pasture had no health issues.

4.14.4 Impacts by Alternative

The analysis of impacts by alternative will focus on assessing the acreage of lease/allotment overlap, surface-disturbing activities that could occur within the leases, and the area that potentially would be covered by NSO stipulations. None of the existing stipulations are designed to apply to livestock grazing, but would reduce impacts if they are implemented for other reasons if they limit surface disturbance in grazing allotments or move the locations of facilities away from productive forage. A stipulation could be waived if it is determined that the associated resource is not present, so the acreage of stipulations coverage could be reduced before development occurs, resulting in potentially higher impacts to grazing allotments. **Table 4.14-1** presents the acreage of overlapping lease areas and allotments and the percentage of the total allotment occupied by leases.

Table 4.14-1 Lease Area and Allotment Overlap per Zone

Zone	Allotment	Allotment/Lease Acreage of Overlap	% of Total Allotment	% of Total Zone
1	Wallace Creek C&H	48	<1	<1
2	Battlement Creek	500	10	100
	Beaver Creek C&H	795	17	
	Buzzard	476	4	
	Cache Creek C&H	4,998	48	
	Cheney Creek	180	4	
	Hunter C&H	2,753	46	
	Mamm Creek C&H	633	10	
	West Divide C&H[1]	14,540	26	

Table 4.14-1 Lease Area and Allotment Overlap per Zone

Zone	Allotment	Allotment/Lease Acreage of Overlap	% of Total Allotment	% of Total Zone
3	Coal Basin C&H	3,285	17	99
	East Divide C&H	5,500	29	
	Lake Ridge C&H	3,597	30	
	Muddy S&G	126	2	
	North Thompson/Four Mile C&H	19,059	51	
	Threemile C&H	923	21	
	West Divide C&H[1]	9,799	17	
4	Lantern Ridge S&G	2,561	29	100

[1] Total overlap for both Zones 2 and 3 equals 24,339 acres. This represents 43 percent of the total allotment acres.

C&H = Cattle and Horse Allotment; S&G = Sheep and Goat Allotment

4.14.4.1 Alternative 1 (No Action Alternative)

Under Alternative 1 the BLM would release the suspended leases and development would be allowed to occur according to the terms of the lease.

Stipulation Coverage

With the exception of the Threemile C&H allotment, all of the allotments that are overlapped by leases also are overlapped to some extent by NSO stipulations that could offer some form of reduction to impacts, as shown in **Table 4.14-2**. Areas covered by NSO stipulations account for approximately 19 percent of the allotment acreage within Zones 1 through 4. In the case where allotments are 100 percent covered by a NSO stipulation, oil and gas operators would have to horizontally drill to the targeted play from outside of the allotment boundary. NSO stipulations therefore do not guarantee that development will not occur within the associated allotments but surface development would be precluded in those areas, thus reducing impacts to forage vegetation.

Table 4.14-2 Alternative 1 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	135	27
	Beaver Creek C&H	795	381	48
	Buzzard	476	20	4
	Cache Creek C&H	4,998	4,903	98
	Cheney Creek	180	180	100
	Hunter C&H	2,753	1,670	61
	Mamm Creek C&H	633	633	100
	West Divide C&H[1]	14,540	1,884	13

Table 4.14-2 Alternative 1 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
3	Coal Basin C&H	3,285	809	25
	East Divide C&H	5,500	109	2
	Lake Ridge C&H	3,597	395	11
	Muddy S&G	126	14	11
	North Thompson/Four Mile C&H	19,059	1,620	9
	Threemile C&H	923	0	0
	West Divide C&H[1]	9,799	53	<1
4	Lantern Ridge S&G	2,561	65	3
	Total	**69,773**	**12,919**	**19**

[1] Total stipulations for both Zones 2 and 3 equal 2,918 acres. This accounts for 21 percent of the allotment/lease overlap area.

Impacts from Projected Future Oil and Gas Development

Surface disturbance for Alternative 1 would total 892 acres of short-term disturbance and 387 acres of long-term disturbance related to the construction, operation, and maintenance of well pads, access roads, and pipelines. **Table 4.14-3** shows the projected surface disturbance acreage per zone that would result from reasonably foreseeable oil and gas development under Alternative 1.

Table 4.14-3 Alternative 1 Surface Disturbance per Zone

		Short-term Disturbance (acres)	Long-term Disturbance (acres)
Zone 1	Well Pads	30	18
	Roads/Pipelines	46	15
	Total	76	33
Zone 2	Well Pads	273	160
	Roads/Pipelines	411	136
	Total	684	296
Zone 3	Well Pads	44	26
	Roads/Pipelines	67	22
	Total	111	48
Zone 4	Well Pads	9	5
	Roads/Pipelines	12	4
	Total	21	9
All Zones	**Total**	**892**	**387**

Less than 1 percent of Zone 1 is occupied by grazing allotments and of that, 100 percent of the allotment is overlapped by a NSO stipulation; therefore, it is unlikely that surface disturbance would have an impact on forage vegetation. However, if the total amount of disturbance were to occur within the allotment, it is estimated that there would be a loss of 6 AUMs due to short-term disturbance. As

development progresses, areas would be revegetated and only 3 AUMs would be lost to long-term disturbance. Zones 2 through 4 are 99 to 100 percent occupied by grazing allotments; therefore, it is reasonable to assume that surface disturbance will occur within allotments. The total amount of surface disturbance would equate to a loss of 57 AUMs for short-term disturbance and 25 AUMs for long-term disturbance in Zone 2, 9 and 5 AUMs for short- and long-term disturbance in Zone 3, respectively, and 2 and 1 AUMs for short- and long-term disturbance in Zone 4, respectively. Thirty-nine percent of Zone 2 is overlapped by NSO stipulations that may preclude development. It is possible that surface disturbance could occur off of the lease due to horizontal drilling. Zones 3 and 4 are 8 and 3 percent overlapped by NSO stipulations, respectively; therefore it is reasonable to assume that development could occur within allotments without being affected by stipulations. After consideration of all NSO stipulations, the potential for the invasion and spread of noxious weeds within allotments would be limited to Zones 2, 3, and 4 and would be most associated with 816 acres of initial disturbance within lease allotments covered by those zones.

4.14.4.2 Alternative 2

Under Alternative 2, the BLM would address inconsistencies between the 1993 WRNF ROD (USFS 1993a) and the lease stipulations by modifying the affected leases to include the stipulations as presented in the ROD.

Stipulation Coverage

Four allotments overlap with leases in Zone 3 that would be modified with additional acreage of stipulations. Approximately 3,302 additional acres of CSU, NSO, and TL stipulations would modify 8 existing leases as detailed in **Table 4.14-4**. These stipulations may translate to additional reduction to impacts for livestock and livestock grazing operations. The additional stipulation coverage would increase the total NSO coverage within allotments in Zone 3 to 8 percent; reducing the loss of AUMs by 43 and surface disturbance by 517 acres compared to the No Action Alternative.

Table 4.14-4 Alternative 2 Allotments with Additional NSO Stipulations

Zone	Allotment	Acreage of Lease Overlap	Additional Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
3	East Divide C&H	5,500	74	1
	North Thompson/Four Mile C&H	19,059	148	<1
	Threemile C&H	923	295	32

Impacts from Projected Future Oil and Gas Development

Surface disturbance associated with Alternative 2 would be the same as for Alternative 1 (see **Table 4.14-3**); however, an additional 517 acres of Zone 3 would be covered by NSO stipulations. This would increase the total area of the zone covered by stipulations to 8 percent and reduce the loss of AUMs by 43 compared to the No Action Alternative. It is likely that all RFDS development could still occur within allotments without being affected by stipulations; however it would reduce the overall area in which disturbance could occur, thereby restricting the spread of noxious weeds and dust.

4.14.4.3 Alternative 3

Under Alternative 3, the BLM would modify the 65 existing leases to conform to the stipulations identified for the Proposed Action in the 2014 WRNF Final EIS (USFS 2014a).

Stipulation Coverage

All of the allotment areas that are overlapped by lease areas in Zones 1 through 4 are 81 to 100 percent overlapped by NSO stipulations that could reduce impacts from surface disturbance. Overall, Zones 1 through 4 are 88 percent covered by NSO stipulations as detailed in **Table 4.14-5**. NSO stipulations may require oil and gas operators to horizontally drill to the targeted play from off the lease. This does not guarantee that development will not occur within the associated allotments, but surface development would be constrained to those areas that are not covered by NSO, thus reducing impacts to forage vegetation.

Table 4.14-5 Alternative 3 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulations
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	469	94
	Beaver Creek C&H	795	567	83
	Buzzard	476	466	98
	Cache Creek C&H	4,998	4,590	92
	Cheney Creek	180	180	100
	Hunter C&H	2,753	2,539	97
	Mamm Creek C&H	633	632	99
	West Divide C&H[1]	14,540	12,152	84
3	Coal Basin C&H	3,285	3,018	92
	East Divide C&H	5,500	5,266	96
	Lake Ridge C&H	3,597	3,318	92
	Muddy S&G	126	125	99
	North Thompson/Four Mile C&H	19,059	16,176	85
	Threemile C&H	923	658	99
	West Divide C&H[1]	9,799	7,960	81
4	Lantern Ridge S&G	2,561	2,352	92
	Total	**69,773**	**61,193**	**88**

[1] Total stipulations for both Zones 2 and 3 equal 20,112 acres. This accounts for 84 percent of the allotment/lease overlap area.

Impacts from Projected Future Oil and Gas Development

Surface disturbance would only occur within areas of allotments in the lease areas where there is no coverage by NSO stipulations. This would preclude development within the Wallace allotment in Zone 1 and the 910 acres of initial surface development in Zones 2 through 4 would have to occur within the 8,580 acres that are not covered by NSO stipulations, leaving 61,193 acres undisturbed and unaffected by the impacts mentioned above (by loss of AUMs, the spread of noxious weeds as well as dust and new or increased vehicular traffic). Development also could occur from outside the lease areas and still affect grazing allotments.

4.14.4.4 Alternative 4 (Proposed Action)

Under Alternative 4 the BLM would modify or cancel the 65 existing leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Draft ROD (USFS 2014b).

Stipulation Coverage

Several of the leases within the associated allotments would be cancelled or terminated thereby reducing the acreage of lease allotment overlap. All of the remaining allotment areas overlapped by leases in Zones 1 through 4 would be affected by NSO stipulations that could offer some form of reduction to impacts, as shown in **Table 4.14-6**. With consideration of NSO stipulations only, surface disturbance is reduced to between 71 to 100 percent. NSO stipulations may require oil and gas operators to horizontally drill to the targeted play from off the lease. This does not guarantee that development will not occur within the associated allotments, but surface development would be precluded in those areas, thus reducing impacts to forage vegetation.

Table 4.14-6 Alternative 4 Allotment Acreage Covered by NSO Stipulations

Zone	Allotment	Acreage of Allotment/Lease Overlap	Acreage of NSO Stipulations	% Overlap Area Covered by NSO Stipulation
1	Wallace Creek C&H	48	48	100
2	Battlement Creek	500	469	94
	Beaver Creek C&H	795	568	71
	Buzzard	476	466	98
	Cache Creek C&H	4,998	4,590	92
	Cheney Creek	180	180	100
	Hunter C&H	2,753	2,539	92
	Mamm Creek C&H	633	633	100
	West Divide C&H	14,540	12,152	84
3	Coal Basin C&H[1]	46	46	100
	East Divide C&H[1]	4,051	3,816	94
	Lake Ridge C&H[1]	8	3	38
	Muddy S&G[1]	125	125	100
	North Thompson/Four Mile C&H[1]	265	256	97
	Threemile C&H[1]	3	3	100
	West Divide C&H	9,799	7,960	81
4	Lantern Ridge S&G	2,561	2,352	92
	Total	**41,874**	**36,158**	**86**

[1] Total acreage of leases within allotment has been reduced in Column 3 (Acreage of Allotment/Lease Overlap) to account for lease cancelations proposed under Alternative 4.

Impacts from Projected Future Oil and Gas Development

If surface disturbance were to occur within the lease areas the impacts would be similar as those discussed under Alternative 1; however, this alternative provides 71 to 100 percent NSO coverage for allotments in Zones 1 through 4 (over 36,000 acres). Surface disturbance would only occur within allotments in the lease areas where there is no coverage by NSO stipulations. This would preclude

development within the Wallace allotment in Zone 1 and the 744 acres of initial surface development in Zones 2 through 4 would have to occur within the 5,716 acres that are not covered by NSO stipulations. Alternative 3 provides a greater amount of NSO coverage; however, Alternative 4 proposes less surface disturbance which would greatly reduce the potential for the invasion and spread of noxious weeds and impacts from fugitive dust emissions.

4.14.4.5 Alternative 5

Under Alternative 5 the BLM would cancel all 65 leases, plug and abandon 75 wells, 16 well pads (totaling 38 acres), 48 acres of access roads, and all ancillary facilities and equipment in Zones 2 and 3.

Stipulation Coverage

Stipulations would not be necessary to reduce impacts to livestock grazing allotments from development as all leases would be cancelled and no development would occur in the foreseeable future.

Impacts from Projected Future Oil and Gas Development

Short-term impacts would occur due to plugging and abandoning well and well pads and reclaiming access roads. All disturbed areas would be reclaimed to pre-disturbance conditions. The Forest Service would be responsible for approval of reclamation methods and determining when reclamation is satisfactory. Impacts from the 86 acres of surface-disturbing activities required to remove infrastructure and implement reclamation in Zones 2 and 3 would be similar to the types discussed in Section 4.1.3, Impacts Common to All Alternatives; however, the exposure to these impacts would be for a much shorter duration. The extent of impacts would be the least of all alternatives and 86 acres (7 AUMs) of reclaimed areas within the grazing allotments would be available for grazing once reclamation is determined to be successful. Reclamation activities could initially result in the introduction and spread of noxious weeds; however successful reclamation would include eradication of noxious weeds.

4.14.4.6 Summary of Impacts

Oil and gas development under Alternatives 1 and 2 would have the greatest potential for impacts to livestock grazing operations within the analysis area due to the least amount of coverage from associated stipulations (25 and 30 percent and the lease areas, respectively). This does not necessarily equate to less surface disturbance under Alternative 2 compared to Alternative 1; however, it would influence where development would take place, some disturbance may occur off-lease or the same amount of disturbance may be concentrated into a smaller area. Under Alternatives 3 and 4, 100 percent of the allotments areas overlapped by leases would receive coverage from stipulations. Under Alternative 5 stipulations would not affect the associated allotments because no future development would occur and existing wells, pads and roads would be plugged, abandoned, and reclaimed with the intention of returning 86 acres to pre-disturbance condition.

4.14.5 Cumulative Impacts

4.14.5.1 Cumulative Impacts Analysis Area

The CIAA for livestock grazing consists of the 16 grazing allotments overlapped by the 65 existing leases under evaluation within Zones 1 through 4 in their entirety (308,666 acres).

4.14.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Within the CIAA for mineral development, past and present transportation corridors, and other development total 1,109 acres (<1 percent of the CIAA). The impact of all past and present actions would result in a long-term loss of 92 AUMs.

Reasonably Foreseeable Future Actions

Known RFFAs associated with oil and gas development would result in an estimated 599 acres of long-term surface disturbance within the grazing allotments overlapped by Zones 1 through 4 leases (<1 percent of the CIAA). This equates to a loss of about 50 AUMs. Of the 599 acres, 14 acres of long-term surface disturbance may result from recently approved or pending APDs within the next few years, resulting in a loss of about 1 AUM. NSO stipulations developed through the 2014 Final EIS would be applied to the associated allotments outside of the lease boundaries on Forest Service-managed lands.

There are no other activities that would result in surface disturbance within the allotments in the CIAA.

Projects with countervailing impacts would include any actions that would increase production or improve the quality of desirable vegetation for livestock grazing. Known projects include wildlife habitat improvements, hazardous fuels reduction treatments, oak brush thinning, and other vegetation treatments. These projects are estimated to result in 6,000 acres of short-term impacts; however, they are designed to provide long-term improvements.

4.14.5.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

With consideration of past, present and reasonably foreseeable future actions and the contribution of Alternatives 1 through 5, cumulative long-term surface disturbance in the CIAA would range from 1,795 acres to 2,524 acres (less than 1 percent of the CIAA under all alternatives), with a corresponding loss of AUMs ranging from 150 AUMs (if Alternative 5 were selected) to 210 AUMs (if Alternative 1 were selected). The contribution of the alternatives to cumulative AUM loss would range between 5 and 32 percent.

If chosen, Alternative 5 would have countervailing impacts within the lease areas from the removal and reclamation of well pads and access roads. A total of 86 acres would be reclaimed resulting in the estimated production of 7 AUMs. Of this 76 acres (6 AUMs) would be in Zone 2 and 10 acres (1 AUM) would be in Zone 1.

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4.15 Scenic Resources

4.15.1 Analysis Assumptions and Approach to Analysis

4.15.1.1 Analysis Area

The analysis area is composed of the 65 leases (lease area) which are divided into four zones within Mesa, Garfield, Pitkin, and Rio Blanco counties, south of I-70, between the towns of De Beque and Carbondale, except for one lease northeast of Meeker.

4.15.1.2 Scoping Issues

During the public scoping process, the following issues and concerns for scenic resources were identified:

- Concern about impacts to the general landscape and rural character of the area and the impairment that oil and gas development is already contributing to some of the most remarkable scenery in the WRNF. Concerns focused on the Thompson Divide area, Crystal River Valley, the Elk Mountains, Roaring Fork Valley (located in and near Zone 3), and CRAs (located in portions of Zone 1, 2, and 3).
- Concern about impacts to the viewshed of the Jerome Park Conservation Easement, which currently provides views of Mount Sopris and other peaks in the Elk Mountains; the sandstone fins, and other features of the Thompson Creek Drainage; the Crystal River Valley from Thompson Creek Road; and Williams Peak. These areas of concern are in and near Zone 3.
- Concern for degradation of air quality and visibility (haze), fears that emissions resulting from construction and operations for oil and gas development would compromise the overall quality of the viewshed.
- Concern about impacts to the scenic integrity resulting from the proximity to recreational areas such as the Sunlight Ski Area and other outdoor recreation areas.
- Need for visual BMPs to preserve hunting, fishing, and dispersed recreational opportunities in the area. Examples include locating disturbance and equipment to minimize visual detection from adjacent areas, and painting equipment in neutral tones that match surrounding landscape.

While many of the issues are addressed in general terms, the general nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing some issues in detail. These issues would be addressed in more detail at the site-specific APD stage of permitting when additional NEPA analysis would be required.

4.15.1.3 Assumptions

For the purpose of the scenic resources analysis, the following assumptions were made regarding exploration and development of oil and gas leases as they relate to scenic resources.

- Oil and gas development cannot occur without use of drilling rigs and construction of roads, well pads, production facilities (such as compressor stations, tank batteries, treaters, and dehydrators), and pipelines.
- Night-time scenic characteristics would be affected at least temporarily if work proceeds 24 hours per day. Development would introduce flares from gas wells, rig and work area lighting, and traffic headlights that would be visible to Forest users during the evening hours.

- Roadways would alter the appearance of the landscape and how users circulate through the Forest, resulting in a change in visitor perceptions and views of the area.
- Modification of vegetation and soils cannot be avoided where development occurs.
- The impact analysis only evaluates the scenic resources within each lease, and does not extend beyond these boundaries. However, depending on the location of construction, surrounding vegetation, and other resources contributing to scenic quality, it is recognized that there is the potential for impacts outside of the lease area. Similarly, if stipulations preclude surface-disturbance within the lease, leases may still be developed through directional drilling from off-lease sites, and off-lease development may affect scenic resources within the lease area. The extent to which this would occur would need to be evaluated on a site-specific basis.

4.15.1.4 Impact Indicators Used For Analysis

The impact indicators used to evaluate scenic resources, as defined in the Forest Service Scenery Management System (SMS), are Scenic Attractiveness, Landscape Visibility and Scenic Integrity Objectives (SIOs) (USFS 1996). These indicators are designed to measure the quality of scenic landscape characteristics using predetermined metrics for each impact indicator category. Impacts to scenic resources are determined based on the percentage of stipulations designated cover the resource, and their potential for change caused by oil and gas development activities.

Scenic Attractiveness is measured based on the scenery class in which it falls (Class A, Class B, or Class C). Landscape Visibility consists of travelways and use areas, concern levels, and distance zones. Existing travelways and use areas are identified and classified in order to determine which existing observer positions to use in the Landscape Visibility analysis. Concern levels determines the relative importance of aesthetics to the public, this importance is expressed as concern Levels 1, 2, or 3. Distance Zones (Foreground, Middleground, and Background) are delineated from the travelways and use areas. Scenic Integrity is an indication of intactness and wholeness of the landscape. SIOs are used to describe the desired future condition for scenic quality and are described for each forest plan management area. Values are described as Very High, High, Moderate, Low, or Very Low[1]. A more detailed explanation of these indicators can be found in Section 3.15. Using Scenic Attractiveness, Landscape Visibility, and SIOs impacts are analyzed by determining the type and amount of coverage available for each category from stipulations, as well as the areas left open to surface disturbance and therefore essentially available for future oil and gas development (subject to site-specific approvals).

4.15.1.5 Methods of Analysis

Impacts to scenic resources depend on the visual contrast created between a proposed project and the existing landscape. This contrast can be measured by comparing pattern elements (form, line, color, and texture) and pattern character (dominance, scale, diversity, and continuity) of a proposed project with the existing landscape. It is possible to identify the extent to which the scenic character of an oil and gas facility will exhibit scenic contrast within the landscape, or its converse, scenic compatibility. This process includes review of the scenery inventory (Scenic Attractiveness, Landscape Visibility, SIOs, etc.) to determine the underlying scenic value on an area, and to assess the effects to the scenic value from a proposed project including changes to the landscape character and alterations to scenic integrity.

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[1] While not part of the SMS system, the limited data provided by the GMUGNF included a High/Moderate SIO classification.

Making lands available for oil and gas leasing does not involve any direct effects on scenery, as leasing does not authorize any surface disturbing activities. Future oil and gas development would be subject to site-specific environmental study and permitting requirements. No alternatives propose oil and gas development so this analysis relies on a RFDS that projects future potential surface disturbing activities in support of oil and gas development. Potential future development of oil and gas leases might result in impacts to scenery. Scenery will be measured in the percentage of acres of Scenic Attractiveness, Landscape Visibility, and SIOs potentially impacted. Impacts to Scenic Attractiveness, Landscape Visibility, and SIOs are evaluated by the type and amount of coverage provided to scenic resources by lease stipulations under each alternative. Within each alternative, the impact analysis is broken out for each of the three scenery inventory components by the four zones in the analysis area. The level of coverage provided to the resource is determined using the extent of resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within the analysis area.

Resource-specific NSOs and CSUs are stipulations that were designed specifically to limit the impacts of oil and gas development on a certain resource, in this case scenic resources. Because some resources tend to be closely correlated to scenic quality, this analysis also will evaluate NSO stipulations for resources determined to rely in some part on high scenic quality ("resource-related NSOs"). Because NSO stipulations prevent all surface disturbances within the boundary of that stipulation, only NSO stipulations relating to the visual quality of a particular resource (e.g., travel routes, recreation areas, etc.) are included in the resource-related portion of the analysis. Resource related CSUs are not considered in this analysis because application of the stipulation may still result in surface disturbance affecting scenic quality.

The final portion of the analysis presents the percentage NSOs overlapping the scenic resources within the analysis area. These stipulations would provide a level of coverage to scenic resources through the elimination of surface disturbance if the resources for which they were developed are found to occur within the leases. If the resources are found not to exist in the area, the operator may obtain a waiver or exception so the NSO stipulation would not be implemented. The coverage from NSOs not designated for scenic resources would be overestimated if not all stipulations are implemented.

Scenic Attractiveness impacts are analyzed based on stipulation coverage within Class A, Class B, and Class C areas, as well as where the lack of stipulations might allow for future oil and gas development. Any future development has the potential to lower the Scenic Attractiveness score, which could result in a downgrade of the Scenic Attractiveness class. Class A areas are not present within Zones 1 and 4, while Class C areas are not present at all within the analysis area. Class B areas are present within each of the four zones.

Impacts to Landscape Visibility are analyzed using distance zones within the three concern levels. Concern Level 1 is considered to be of high importance, Concern Level 2 is of medium importance, and Concern Level 3 carries low importance within this indicator category. Distance zones refer to the distance between the vantage point for a viewer and the area within the lease being observed. Foreground is up to 0.5 mile from the viewer, Middleground is up to four miles from the Foreground, and Background is 4 miles from the viewer to the horizon. The analysis considers where the lease area may be covered based on the visibility of an area from the point of perception. If an observer were to be located within a high quality scenic area, such as a sensitive travel route or recreation area, the lease areas covered by stipulations would be in the Foreground, Middleground, or Background of their vantage point. There are no Concern Level 1 Foreground or Concern Level 3 areas in Zone 1 and Zones 2 and 3 do not have any Concern Level 3 Background areas. The remaining Concern Levels, Distance Zones are present in all 4 zones.

SIO impacts are analyzed based on the level of stipulation coverage applied to SIO classifications. It is anticipated that potential impacts from oil and gas exploration activities would most likely exceed the SIO classifications for high quality scenic resources such as those in Very High, High, and Moderate areas. Impacts are analyzed to determine the level of coverage within the varying levels of importance of SIO categories. Zones 1, 2, and 4 do not have any Very Low SIO areas. Zones 2, 3, and 4 do not have any Very High SIOs, and Zones 3 and 4 do not have any High SIOs. Moderate and Low SIO areas are found within each of the four zones[2].

4.15.2 Stipulation Coverage of Scenic Resources

This oil and gas leasing analysis evaluates the effects of proposed lease stipulations that would minimize the potential impacts of oil and gas development on scenic resources. The definition of the purpose and implementation of each stipulation can be found in Appendix B of the 1993 WRNF Oil and Gas Leasing EIS (USFS 1993a) for Alternatives 1 and 2, and in Appendices A and B of the 2014 WRNF Oil and Gas Leasing Final EIS (USFS 2014a) for Alternatives 3 and 4. **Table 4.15-1** identifies the stipulations specific to scenic resources for each alternative.

Table 4.15-1 Lease Stipulations Specific to Scenic Resources

Stipulation	Alternatives 1 and 2 [1]	Alternatives 3 and 4 [2]
NSO		
High Scenic Integrity Objective Areas		X
CSU		
Sensitivity Level 1 Travel Routes	X	
Moderate Scenic Integrity Objective Areas		X
High Concern Level Travel Routes/Use Areas		X

[1] Alternative 1 and 2 have the same stipulations.

[2] Alternatives 3 and 4 have the same stipulations, but Alternative 4 would cancel all of part of 25 leases. Alternative 5 would cancel all leases and is therefore not included in this table.

Definitions: NSO: No Surface Occupancy; CSU: Controlled Surface Use.

The one stipulation that is specific to scenic resources under Alternatives 1 and 2 is the Sensitivity Level 1 Travel Routes CSU. Alternatives 1 and 2 do not have any other resource-specific NSO stipulations.

There are three stipulations specifically developed to address scenic resources under Alternatives 3 and 4: High Scenic Integrity Objective Areas (NSO), Moderate Scenic Integrity Objective Areas (CSU), and High Concern Level Travel Routes/Use Areas (CSU).

There are other resource-related stipulations that would minimize the potential impacts of oil and gas development on scenic resources, even though they were not developed for that purpose. Three that are closely correlated with high visual quality are:

[2] A High/Moderate SIO classification is found only on the GMUGNF, and is located within Zone 3. It is anticipated that potential impacts from oil and gas exploration activities would most likely exceed the objectives for this classification.

- Roadless Areas NSO (under all Alternatives, but revised under Alternatives 3 and 4 to address the 2012 CRR);
- RNAs NSO (under all alternatives but revised under Alternatives 3 and 4 to include the Lower Battlement Mesa RNA, which is in Lease Zone 1); and
- 1B Management Areas – Downhill Skiing NSO (under Alternatives 1 and 2 only).

There are additional NSOs that could overlay areas of high visual quality. Depending on the alternative, these may include, but are not limited to, geology/soils (steep slopes and sensitive soils), water resources (water influence zones), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). However, if the resources these stipulations are designed to address are not found to occur on the leases, the stipulations would not be implemented.

4.15.3 Impacts Common to All Alternatives

Due to the nature of the leasing decision, the exact location and extent of oil and gas development within the analysis area is unknown. It is anticipated that scenic resources would most likely be impacted in areas where there is surface disturbance and facility construction, and that these development would occur in areas not covered by the High Scenic Integrity Objective Areas NSO stipulation. Depending on the amount of contrast created in relation to the existing landscape and the sensitivity of the existing landscape, visibility of constructed features such as roads, pipelines, well pads, drilling rigs, and other associated structures and infrastructure could affect the scenic quality of the analysis area. The structures, as well as any equipment necessary for operation would contribute to color, line, form, and texture contrasts between the man-made development and the natural surroundings.

If the well is unproductive and is plugged and abandoned, the analysis area would experience impacts to scenic resources until final reclamation is complete.

If a well is determined to be productive, the taller exploratory drilling rig would be replaced with a lower profile structure for long-term use on the active well. Portions of the initial surface disturbance would be reclaimed. Impacts from roads, pipelines, and portion of the well pad that is not reclaimed, and production facilities would persist for the life of the well (20 to 30 years), with additional time to achieve full rehabilitation.

During both construction and operation phases, fugitive dust from construction or transportation on unpaved roads could lead to short-term color contrasts where plumes become visible in the atmosphere, as well as contribute to poor visibility and haze, obscuring the landscape and viewsheds.

Lighting associated with drilling rigs, oil and gas operations, and transportation could degrade the visual quality of the area by creating light pollution and making the development more easily visible during nighttime hours. These impacts could range from moderate to major, and short-term to long-term. While Operators would need to meet all occupational safety requirements; they also are directed by COGCC rules to minimize lighting impacts per Rule 803 which states, “to the extent practicable, site lighting shall be directed downward and internally so as to avoid glare on public roads and building units within seven hundred feet.”

Project design and best management practices would be used to mitigate issues related to scenic resources at site-specific environmental analysis stage. Examples include locating disturbance and equipment to minimize visual detection from adjacent areas, and painting equipment in neutral tones that match surrounding landscape.

A very small portion of the WRNF also overlaps with the GMUGNF. Approximately 2 percent of the lease area is comprised of GMUGNF lands. Although much of the scenic inventory is missing for the GMUGNF, existing data indicates that these small portions of the GMUGNF within the lease area have low potential for occurrence of oil and gas resources. The development of the RFDS in these areas is therefore unlikely (USFS 2014a, page 43).

Impacts Identified in the WRNF Final EIS

As discussed in the EIS for Future Leasing on the WRNF (USFS 2014a, page 329 – 330), the amount of contrast created between project facilities and the surrounding landscape is defined by how the proposed changes contrast with the basic scenic elements of line, form, color, and texture. The primary concerns associated with energy development on the scenic quality of the WRNF are the visibility of constructed features including roads, pipelines, well pads, and associated infrastructure; the presence of seismic or drilling equipment and transportation on Forest roads surrounding mobilization to seismic testing or drill sites; the long-term presence of a production facility; and ground disturbance associated with the constructed features.

Exploratory drilling would result in strong scenic contrasts resulting from vegetation removal, soil disturbance, the addition of linear road and pipelines in undeveloped areas, and the presence of equipment that does not easily blend into the landscape. Road and pipeline construction and well pad development would likely result in moderate to major scenic contrasts. Impacts would include strong color contrasts between the lighter colored soil of the road or well pad and other areas of disturbance and the surrounding vegetation. Drilling rigs would introduce moderate to major line, form, and texture contrasts. Lighting associated with the drilling rig also could impact the aesthetics of surrounding areas within sight of the activity. The degree of degradation is dependent upon the amount of contrast between the natural and constructed landscape, the viewing distance, and the concern of the viewer for scenic quality. The scenic impacts of drilling would be greater in areas visible from Concern Level 1 travel routes or viewpoints. These moderate to strong direct effects would be temporary, lasting from approximately 2 to 3 months per well site (USFS 2014a, page 329).

4.15.4 Impacts by Alternative

The impacts to scenic resources by each alternative are analyzed by the percentage of lease area covered by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSO stipulations within the lease area. In addition, each alternative assesses the degree to which the resource may be impacted from the potential oil and gas development opportunities outlined in the RFDS.

4.15.4.1 Alternative 1 (No Action Alternative)

Stipulation Coverage

Alternative 1 is the No Action Alternative, and would reaffirm the lease stipulations on the existing 65 leases as they were originally issued. Under this alternative, the RFDS would include 398 vertical/directional wells and 18 horizontal wells. The potential for initial surface disturbance would be 892 acres, and the long-term surface disturbance would be 387 acres. There would be one stipulation specific to scenic resources:

- Sensitive Level 1 Travel Routes CSU—This stipulation would prevent the placement of collection facilities, well sites or exploration activity within routes that do not meet visual quality objectives (VQOs) and SIOs, as well as providing Forest visitors with quality experiences. The stipulation would require site clearings, collection facilities, structures, utilities and pipelines to be relocated when necessary to meet VQOs/SIOs. During the APD process, a visual site analysis would be completed to determine if vegetation, topography,

and proposed onsite design features would be sufficient to mitigate visual impacts. If the management practices are determined to be sufficient, the site will be accepted and relocation will not be required (USFS 1993a).

There would be no NSO stipulations specific to scenic resources under this alternative, but there would be two other NSO stipulations closely correlated with high scenic quality: Roadless Areas NSO and the 1B Management Areas—Downhill Skiing NSOs. However, these stipulations are not designed to address scenic resources, and if the protected resource is found not to exist on the ground, then the stipulation would not be implemented regardless of the level of scenic quality. The Roadless Areas NSO was developed to retain the roadless character of the area by precluding surface disturbance within the Battlement Mesa, Assignation Ridge, White River, and Pagoda Peak roadless areas. The 1B Management Areas—Downhill Skiing NSO was developed to preserve the investment of facilities within the site, the use authorized by permit, safety of the users, the natural environment that initially made the site desirable for the ski area, and the existing recreational experience. These lands are managed with an emphasis on providing for downhill or cross-country skiing on existing sites and maintaining selected sites for future skiing recreation opportunities (USFS1993a). The 1993 EIS does not identify any circumstances under which exceptions to either stipulation might be granted.

Additional NSOs that could overlay areas of high visual quality include, but are not limited to, geology/soils (steep slopes and sensitive soils), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). However, if the resources these stipulations are designed to address are not found to occur, the stipulations would not be implemented.

Scenic Attractiveness

Table 4.15-2 shows the extent of Scenic Attractiveness categories and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-2 Stipulation Coverage of Scenic Attractiveness under Alternative 1

Scenic Attractiveness Category	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Class A	0	0	0	0	0
Class B	9,623	0	0	12	100
Class C	0	0	0	0	0
Zone 2					
Class A	3,728	0	0	72	83
Class B	20,117	0	0	8	32
Class C	0	0	0	0	0
Zone 3					
Class A	1,089	0	0	0	51
Class B	41,542	0	8	0	7
Class C	0	0	0	0	0

Table 4.15-2 Stipulation Coverage of Scenic Attractiveness under Alternative 1

Scenic Attractiveness Category	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 4					
Class A	0	0	0	0	0
Class B	2,561	0	0	0	3
Class C	0	0	0	0	0

[1] Roadless Areas and 1B Management Areas – Downhill Skiing NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. With consideration of all NSO stipulations, there are 692 acres (approximately 41 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-2**, there would be limited coverage provided by resource-related NSO stipulations except for Class A areas within Zone 2. Within Zone 3, the resource-specific Sensitive Level 1 Travel Routes CSU stipulation would be applied along portions of CR-117; CR-313, and CR-300.3 (near Haystack Gate), and portions of CR-313 adjacent to East Divide Creek and the Garfield-Pitkin-Mesa county boundary.

With consideration of all NSO stipulations, half of Class A areas in Zones 2 and 3 would be precluded from surface disturbance if all NSOs were implemented. Class B areas within Zone 1 would be fully covered by any NSO stipulations, but would have minimal coverage in Zones 2, 3, and 4. As discussed in Section 4.15.3, the extent to which Scenic Attractiveness could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Landscape Visibility

Table 4.15-3 shows the extent of coverage provided to concern levels and distance zones through resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs by zone.

Table 4.15-3 Stipulation Coverage of Landscape Visibility under Alternative 1

Landscape Visibility	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Foreground 1	0	0	0	0	0
Middleground 1	219	0	0	2	100
Background 1	4,173	0	0	9	100
Foreground 2	813	0	0	53	100
Middleground 2	1,234	0	0	13	100
Background 2	461	0	0	3	100
Foreground 3	0	0	0	0	0
Middleground 3	0	0	0	0	0
Background 3	0	0	0	0	0

Table 4.15-3 Stipulation Coverage of Landscape Visibility under Alternative 1

Landscape Visibility	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 2					
Foreground 1	1,808	0	4	0	34
Middleground 1	7,035	0	0	8	20
Background 1	7,399	0	0	30	65
Foreground 2	4,608	0	0	19	39
Middleground 2	2,115	0	0	20	35
Background 2	222	0	0	21	32
Foreground 3	87	0	0	0	5
Middleground 3	6	0	0	0	30
Background 3	0	0	0	0	0
Zone 3					
Foreground 1	6,616	0	30	0	3
Middleground 1	19,604	0	4	0	5
Background 1	10,692	0	2	0	12
Foreground 2	3,707	0	3	0	18
Middleground 2	1,911	0	10	0	9
Background 2	311	0	2	0	5
Foreground 3	147	0	1	0	1
Middleground 3	146	0	3	0	6
Background 3	2	0	0	0	100
Zone 4					
Foreground 1	397	0	0	0	0
Middleground 1	856	0	0	0	1
Background 1	266	0	0	0	1
Foreground 2	206	0	0	0	0
Middleground 2	766	0	0	0	7
Background 2	52	0	0	0	1
Foreground 3	4	0	0	0	0
Middleground 3	2	0	0	0	0
Background 3	0	0	0	0	0

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 697 acres (approximately 42 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-3**, there is limited coverage provided by resource-specific CSU or resource-related NSO stipulations in any zone. NSO stipulations unrelated to scenic resources would fully

preclude surface disturbance within Zone 1, but generally do not limit surface development in important Landscape Visibility areas within the other zones. As discussed in Section 4.15.3, the extent to which Landscape Visibility could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Scenic Integrity Objectives

Table 4.15-4 shows the extent of SIO categories and percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs by zone.

Table 4.15-4 Stipulation coverage of Scenic Integrity Objectives under Alternative 1

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Very High	330	0	0	0	100
High	9,617	0	0	12	100
Moderate	26	0	0	0	100
Low	107	0	0	0	100
Very Low	0	0	0	0	0
Zone 2					
Very High	0	0	0	0	0
High	187	0	0	100	100
Moderate	4,592	0	0	48	68
Low	20,051	0	0	10	32
Very Low	0	0	0	0	0
Zone 3[2]					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	2,439	0	22	1	29
Low	40,117	0	7	0	7
Very Low	10	0	8	39	39
Zone 4					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	789	0	0	0	1
Low	1,772	0	0	0	3
Very Low	0	0	0	0	0

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

[2] Within Zone 3, there are 125 acres (less 1 percent of the analysis area) of the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, there are 14 acres (approximately 11 percent) of these areas that would be precluded from surface disturbance.

As shown in **Table 4.15-4**, with the exception of High SIOs in Zone 2, there would be limited coverage provided by resource-specific CSU or resource-related NSO stipulations in any zone. NSO stipulations unrelated to scenic resources would fully preclude surface disturbance within all SIOs in Zone 1, as well as the majority of the High and Moderate SIO areas in Zone 2. There are no High SIO areas in Zones 3 or 4 and implementation of other NSOs generally would not limit surface development for Moderate SIOs within these zones. As discussed in Section 4.15.3, the extent to which SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 1 comprises 417 wells on 60 well pads, resulting 892 acres of short-term disturbance and 387 acres of long-term surface disturbance, with consideration of roads and pipelines. Potential impacts are described in Section 4.15.3. The site-specific location of development would play a role in determining the impacts to scenic resources. In areas of lower scenic importance and sensitivity, future oil and gas exploration activities are not anticipated to substantially impact scenic resources in the area if BMPs are applied during design and construction. In areas of higher scenic importance and sensitivity, the degree to which these resources would be affected would be dependent on factors such as slope, aspect, terrain and vegetation in and around the site-specific location, as well as the amount of contrast between the natural and constructed landscape. Impacts may be short term to long term with minor to major adverse effects. Alternative 1 has no NSO stipulations specific to scenic resource, but resource-related and other NSO stipulations (if implemented) would preclude development of the RFDS in some higher scenic importance and sensitivity. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic researches within leases. These would be examined during the site-specific development phase. The potential for impacts to scenic resources from the RFDS is described by zone below.

Within Zone 1, Class B and High SIO areas are present in approximately 95 percent of the 10,114-acre zone. Approximately 43 percent of the zone is a User Concern Level 1 area (Middleground and Background distance zones) and 25 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Most of Zone 1 is within CRAs. There are no existing wells in this zone.

The Zone 1 RFDS comprises 36 total wells on 5 well pads (76 acres of short-term and 33 aces of long-term surface disturbance). With consideration of any NSOs, surface-disturbing activities associated with the RFDS could not be conducted on the Zone 1 leases. If some NSO stipulations are exempted to the degree that wells, well pads, roads, pipelines, and ancillary facilities could be constructed within the lease zone, resulting surface disturbance would comprise about 1 percent of the lease zone. If only resource-related NSOs were implemented, any or all of the RFDS could occur in Class B areas and Very High and High SIOs. Portions of the RFDS could occur in Moderate SIOs, and any or all of the RFDS could occur in any of the User Concern Level 1 and 2 distance zones. Potential impacts are described in Section 4.15.3. If these also were exempted, development would occur within portions of CRAs and depending on location, the views from CR-V and CR-T (located along the southwestern boundary of the leases) may be impacted. Development would not represent a large change to the overall landscape character within this zone if located in areas of lower scenic importance and sensitivity (Low SIO), but that may not be possible given the small percentage of Low SIO within the lease zone. Development of well pad, access roads, and pipelines would be inconsistent with the Forest Plan in Very High and High SIOs, and potentially in Moderate SIOs (which collectively cover 98 percent of the lease zone), even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 2, Class B and Moderate SIO areas are present in over 80 percent of the 24,938-acre zone. Approximately 65 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 27 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). The majority of the zone is within CRAs. Zone 2 contains 73 existing wells on 13 well pads, generally spread throughout the lease zone.

The Zone 2 RFDS comprises 319 total wells on 46 well pads, (684 acres of short-term and 296 acres of long-term surface disturbance). With consideration of any NSOs, on-lease development could occur in Class B areas, Moderate and Low SIOs, and all Concern Level 1 and 2 distance zones, as NSO stipulations cover 32 percent of the Class B areas and Low SIOs, 68 percent of Moderate SIOs areas, and between 20 and 65 percent of Concern Level 1 and 2 distance zones. No High SIO areas would be open to surface disturbance, but on-lease development could occur in 17 percent of Class A areas. Surface disturbance would be precluded in most, but not all, CRAs.

With consideration of only resource-related NSO stipulations, the potential for development areas of high scenic value would be somewhat increased. The southern lease zone boundary would be within one mile of Battlement Creek, Battlement Reservoir, Haystack Mountain, North Mamm Creek, and East Reservoir. The Beaver Creek trailhead would be adjacent to leases on the north side of the lease zone. Surface disturbance would not be permitted on the leases closest to these areas through the roadless area NSO stipulation, except for the portion of the lease closest to Battlement Creek (part of present-day CRAs), which would have standard leasing terms.

If resource-related NSO were exempted, on-lease development could occur within these or other portions of CRAs. Impacts to these and other visual important areas would be examined during site-specific NEPA analysis. If fully developed within the leases, the RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. However, it would quadruple the number of well pads and triple the number of wells within the lease, and it may not be possible to locate all well pads and ancillary facilities within areas of lower scenic importance and sensitivity (Low SIO) on leases that are predominately Moderate SIO (which are the leases closest to Battlement Creek, Battlement Reservoir, Haystack Mountain, North Mamm Creek, East Reservoir, and the Beaver Creek trailhead). Development of well pads, access roads, and pipelines may be inconsistent with the Forest Plan in Moderate SIOs even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 3, Class B and Low SIO areas are present in approximately 95 percent of the 42,766-acre zone. Approximately 86 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 14 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Most of the lease zone is within CRAs. There are 2 existing wells and three well pads in this zone, which are all located in the western portion of the lease zone.

The Zone 3 RFDS comprises 52 total wells on 7 well pads (111 acres of short-term and 48 acres of long-term surface disturbance). Most of the lease zone would have standard lease terms or timing limitations that do not address scenic resources. With consideration of all NSO stipulations, it is anticipated that a portion of the RFDS could occur in Class A areas since 49 percent would be open to surface disturbance, and that any or all of the RFDS may occur in Class B areas, since 93 percent of Class B areas would be open to surface disturbance. Any or all of the RFDS may occur in Moderate and Low SIOs since most of these areas would be open to surface disturbance. Portions of the GMUGNF High/Moderate SIO also would be available for surface disturbance. Any or all of the RFDS could occur in Concern Level 1 and 2 distance zones, since surface disturbance would not be permitted in only 5 to 18 percent of Concern Level 1 and 2 distance zones. The

resource-related roadless area NSO stipulation would generally not be applied to Zone 3 CRAs (see Section 4.12, Special Designations).

Within Zone 3, the Sensitive Level 1 Travel Routes CSU stipulation would provide moderate constraints to development in 22 percent of Moderate SIO and Foreground 1 areas. Operators may be required, during site-specific development, to submit a visual site analysis to determine if vegetation, topography, and proposed onsite design features would be sufficient to mitigate visual impacts and meet SIOs. These constraints would be applied along portions of CR-117 (Four-Mile Road) on 2 of the 3 leases crossed by the road; a small area where CR-313 and CR-300.3 intersect (near Haystack Gate), and portions of CR-313 adjacent to East Divide Creek and the Garfield-Pitkin-Mesa county boundary. All three roads are proposed haul routes (see **Figure 3.10.2**).

Sunlight Ski Area would be less than 1 mile from a lease located directly east of the resort, and 2 miles from the boundary of leases to the north and west of the ski area; additional leases would be located on the backside of the mountain. The leases to the north of the resort would be covered by some NSO areas, but most of the lease areas near the resort would not be constrained by NSO stipulations. The Jerome Park conservation easement and the Spring Gulch Nordic Ski area would be within a mile of some lease borders. Portions of some leases closest to the conservation easement would have NSO stipulations. Leases would be generally located on the opposite (west) side of ridgelines of portions of the easement. The Roaring Fork Valley would be located almost 4 miles northeast of the closest lease. The leases would not be covered by NSO stipulations, but would be generally located on the opposite side of a ridgeline. The Crystal River Valley and SH-133 (a scenic byway) would be located about 3 miles east of the closest lease. Mt. Sopris and the Maroon Bells Wilderness Area would be located about 6 miles east of the lease zone, while the Elk Mountain Range would generally be over 10 miles away from the lease zone. Some of the portions closest to the Crystal River Valley/SH-133 could be covered by NSO stipulations and, in general, the leases closest to these areas are generally located on the opposite sides of ridgelines.

Thompson Creek Road (CR-109) is generally located to the east of the lease zone, with a 0.3-mile section of the road crossing one of the easternmost leases. The lease area surrounding that section of road would be covered by NSOs. As noted previously, a CSU stipulation would be applied to portions of Four-Mile Road within two leases; however, the third lease would have standard lease terms. Impacts to these and other visually significant areas would be examined during site-specific NEPA analysis. If fully developed within the leases, the RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. This would represent a large increase in the number of wells and a moderate increase in the number of well pads. This development, along with increased transportation, may affect the general landscape character within this zone. Effects from development would be experienced particularly within the eastern portion of the zone (the Thompson Divide area, which currently has no wells and is within CRAs), unless located in areas of lower scenic importance and sensitivity (i.e., Low SIO, which comprises about 90 percent of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas (which collectively comprise about 10 percent of the lease zone) even if design criteria, mitigation measures, and BMPs are implemented. However, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located. Impacts to CRAs are discussed in Section 4.12, Special Designations.

Within Zone 4, Class B areas are present in over 99 percent of the 2,562-acre zone. Approximately 30 percent of the zone is a Moderate SIO area; the remainder is a Low SIO area. Approximately 60 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 40 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells within this zone.

The Zone 4 RFDS comprises 10 total wells on 1 well pad (21 acres of short-term and 9 acres of long-term surface disturbance). The zone would be primarily covered by standard lease terms or timing limitations that do not address scenic resources. It is anticipated that any or all of the RFDS may occur in Class B areas, any SIO area and any Concern Level 1 and 2 distance zone, since surface disturbance is generally not precluded in any lease area. RFDS development would comprise less than 1 percent of the lease zone and given the low number of wells and well pads, it would minimally affect the landscape character. Development may be inconsistent with the Forest Plan in Moderate SIOs; however, given the low number of proposed wells, it is assumed that Moderate SIOs can be avoided. There are no areas of concern identified in scoping comments that are within or near Zone 4.

4.15.4.2 Alternative 2

Stipulation Coverage

Alternative 2 would modify 8 of the 65 existing leases to address inconsistencies with the 1993 EIS and ROD. This alternative would add stipulations to these eight leases that were identified in the 1993 EIS and ROD, but not attached to leases as they were issued. Under this alternative, the RFDS would include 398 vertical/directional wells and 18 horizontal wells. The potential for surface disturbance would be 892 acres of initial disturbance and 387 acres of long-term disturbance.

NSO and CSU stipulations for scenic resources under Alternative 2 would be the same as discussed for Alternative 1 for Scenic Attractiveness. There are a few differences in regards to percentages of coverage provided by the resource-specific CSU, resource-related NSOs, and any NSO stipulations for Landscape Visibility, and SIOs for scenic resources within the analysis area. The differences between Alternative 1 and Alternative 2 stipulation are displayed in **Table 4.15-5** and **4.15-6**.

Table 4.15-5 Stipulation Coverage of Landscape Visibility under Alternative 2

Stipulation	Landscape Visibility	Alternative 1	Alternative 2
		Percent of Scenic Resources	
Zone 1			
Impacts between Alternative 1 and Alternative 2 are the same.			
Zone 2			
Impacts between Alternative 1 and Alternative 2 are the same.			
Zone 3			
Resource Specific CSUs	Foreground 1	30	**38**
Resource-specific CSUs	Middleground 1	4	**6**
Resource-related NSOs[1]	Foreground 1	0	**1**
Any NSOs	Middleground 1	5	**6**
Any NSOs	Background 1	12	**14**
Any NSOs	Middleground 2	8	**10**
Zone 4			
Impacts between Alternative 1 and Alternative 2 are the same.			

[1] Roadless Areas NSO and 1B Management Areas – Downhill Skiing NSO.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 697 acres (approximately 42 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

Table 4.15-6 Stipulation Coverage of Scenic Integrity Objectives under Alternative 2

Stipulation	SIO Category	Alternative 1	Alternative 2
		Percent of Scenic Resources	
Zone 1			
Impacts between alternatives are the same.			
Zone 2			
Impacts between alternatives are the same.			
Zone 3[1]			
Resource-specific CSUs	Moderate	22	**36**
Resource-specific CSUs	Low	7	**8**
Any NSOs	Low	7	**8**
Zone 4			
Impacts between alternatives are the same.			

[1] Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, there are 14 acres (11 percent) of these areas that would be precluded from surface disturbance.

As shown in **Tables 4.15-5** and **4.15-6**, all of the differences between Alternative 1 and Alternative 2 are within Zone 3. Landscape Visibility and SIOs would provide a higher percentage of coverage to scenic resources under Alternative 2; however, the increase in coverage would be marginal across all categories. An exception lies within Moderate SIOs, where the Sensitive Level 1 Travel Routes CSU would provide 14 percent more coverage. As discussed in Section 4.15.3, the extent to which Landscape Visibility and SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 2 projects the same number of well pads and amount surface disturbance as Alternative 1, but projects one fewer well. The potential for on–lease development of the RFDS would be similar to Alternative 1 except that in Zone 3:

- The Level 1 Travel Route CSU stipulation would be added to Lease 066706, so that all portions of Four-Mile Road crossing the leases would be covered by this CSU; and
- A resource-related NSO (1B Management Areas-Downhill Skiing) would be applied to portions of Lease 066693, the closest lease to the Sunlight Ski Area (located less than 1 mile to the east).

Although the amount of the lease zone that would not permit surface disturbance if all NSO stipulations were implemented would be slighter higher than Alternative 1, the overall potential for development would still be similar: Most of the lease zone would have standard lease terms or timing limitations that do not address scenic resources. There would still be potential for a portion of the RFDS to occur in Class A areas, and any or all of the RFDS may occur in Class B areas, High/Moderate (GMUGNF), Moderate, and Low SIOs, as well as all of the Concern Level 1 and 2 distance zones.

Impacts to the key areas identified in scoping comments would be similar to Alternative 1, except that scenic quality in the Foreground 1 areas along Four-Mile Road and Middleground 1 distance zone located in the lease to the east of Sunlight Ski Area would be better maintained through

application of CSU and NSO stipulations. Impacts to these and other visually important areas would be examined during site-specific NEPA analysis.

4.15.4.3 Alternative 3

Stipulation Coverage

Alternative 3 modifies the 65 existing leases to match the stipulations for future leasing identified in Alternative 2 from the 2014 WRNF Final EIS. Under this alternative, the RFDS would include 395 vertical/directional wells and 18 horizontal wells. The potential for surface disturbance would be an initial 886 acres of short-term and 384 acres of long-term disturbance.

The stipulations specifically designed to provide address scenic resources in Alternatives 3 include High Scenic Integrity Objective Areas NSO, Moderate Scenic Integrity Objective Areas CSU, and High Concern Level Travel Routes/Use Areas CSU. Descriptions of these stipulations and how they might affect the analysis area are as follows:

- High Scenic Integrity Objective Area NSO—Preserves the existing High scenic integrity in areas where the landscape character appears intact. Disturbance must remain consistent with the form, line, color, texture, and pattern of the landscape to ensure changes are not apparent.
- Moderate Scenic Integrity Objective CSU—Preserves the scenic resources and the character of the landscape. To meet SIOs, the Forest Service may require special analysis and mitigation plans for activities proposed along areas with Moderate SIOs. At the time operations are proposed, the lessee may be required to submit visual simulations and visual resource and interpretive assessments. In addition, they may be required to submit plans for Forest Service approval showing that all structures would have minor visual impacts to the surrounding landscape and meet the SIOs. A computer generated perspective may be required as part of the visual impact assessment.
- High Concern Travelways/Use Areas CSU—Preserves the existing landscape character and maintains the existing SIOs along the High Concern Level 1 travel routes in Foreground views. To meet SIOs in Foreground Views, the Forest Service may require special analysis and mitigation plans for activities proposed near High Concern Level 1 travel routes (highways, roads, railways, trails, waterways, vista points, trailheads, campgrounds, other recreation sites, etc.) as defined in the WRNF LRMP. At the time operations are proposed, the lessee may be required to submit visual simulations and visual resource and interpretive assessments. In addition, they may be required to submit plans to the Forest Service showing that all structures would have minor visual impacts to the surrounding landscape and meet the SIOs. A computer generated perspective may be required as part of the visual impact assessment.

An exception may be granted for the High and Moderate Scenic Integrity Objective Areas stipulations if an environmental analysis demonstrates, through a site-specific review, that the effects of the proposed activity will not cause the area to fall below the identified SIOs (High and Moderate). Exceptions may be granted for the High Concern Travelways/Use Areas CSU stipulation if an environmental analysis demonstrates that impacts from the proposed activity can be mitigated, or would be negligible to the recreation, scenic, and historic values, and not visible within 0.5 mile Foreground Views (USFS 2014a).

Under Alternative 3, there are two other resource-related stipulations that would minimize the potential impacts of oil and gas development on scenic resources, even though they were not developed for that purpose: Roadless Areas NSO and RNAs NSO. The Roadless Areas NSO exists for the purpose of preserving the natural features that contribute to roadless characteristics. The

RNAs NSO exists for the purpose of retaining the integrity of proposed and designated RNAs for research. For both NSOs, the 2014 Final EIS identifies no circumstances in which an exemption would be granted, but a modification may be granted in an environmental analysis determines that the boundary of the designated areas has been modified and the portion of the leasehold is no longer within these areas. A waiver may be granted if an environmental analysis determines the entire leasehold is no longer within the designated area (USFS 2014a).

Additional NSOs that could overlay areas of high visual quality include, but are not limited to, geology/soils (steep slopes and sensitive soils) and water resources (water influence zones), wildlife (sensitive habitat), and vegetation (old growth, alpine, and other sensitive habitats). If the resources these stipulations are designed to address are not found to occur, the stipulations would not be implemented. However, many NSO stipulations overlay each other; thus, if one NSO stipulation is exempted, modified or waived, it is possible that the remaining NSOs might still be applied in areas of high visual quality.

Scenic Attractiveness

Table 4.15-7 shows the extent of Scenic Attractiveness categories and percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-7 Stipulation Coverage of Scenic Attractiveness under Alternative 3

Scenic Attractiveness Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Class A	0	0	0	0	0
Class B	9,623	100	0	100	100
Class C	0	0	0	0	0
Zone 2					
Class A	3,728	0	85	95	99
Class B	20,117	0	31	61	85
Class C	0	0	0	0	0
Zone 3					
Class A	1,089	0	95	93	100
Class B	41,542	0	49	55	86
Class C	0	0	0	0	0
Zone 4					
Class A	0	0	0	0	0
Class B	2,561	0	86	0	92
Class C	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. With consideration of all NSO stipulations, there are 1,448 acres (approximately 86 percent) of the GMUGNF lease area that would be precluded from oil and gas development.

As shown in **Table 4.15-7**, the High Scenic Integrity Objective Area NSO would fully preclude surface disturbance within Zone 1. The Moderate Scenic Integrity Objective Area and High Concern Travelways/Use Areas CSUs would provide coverage to the majority of Class A areas within Zones 2 and 3, and Class B areas in Zone 4. Class B areas would receive the most coverage in Zones 2, 3 and 4 from any NSOs. As discussed in Section 4.15.3, the extent to which Scenic Attractiveness could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Landscape Visibility

Table 4.15-8 shows the extent of Landscape Visibility and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-8 Stipulation Coverage of Landscape Visibility under Alternative 3

Landscape Visibility Categories	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Foreground 1	0	0	0	0	0
Middleground 1	219	100	0	100	100
Background 1	4,173	100	0	100	100
Foreground 2	813	100	0	100	100
Middleground 2	1,234	100	0	100	100
Background 2	461	100	0	100	100
Foreground 3	0	0	0	0	0
Middleground 3	0	0	0	0	0
Background 3	0	0	0	0	0
Zone 2					
Foreground 1	1,808	0	100	56	90
Middleground 1	7,035	0	37	59	79
Background 1	7,399	0	40	74	89
Foreground 2	4,608	0	10	73	92
Middleground 2	2,115	0	16	62	93
Background 2	222	0	28	48	78
Foreground 3	87	0	15	5	47
Middleground 3	6	0	0	3	67
Background 3	0	0	0	0	0
Zone 3					
Foreground 1	6,616	0	100	20	79
Middleground 1	19,604	0	45	56	80
Background 1	10,692	0	28	70	91
Foreground 2	3,707	0	20	71	92
Middleground 2	1,911	0	38	53	90

Table 4.15-8 Stipulation Coverage of Landscape Visibility under Alternative 3

Landscape Visibility Categories	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Background 2	311	0	36	43	91
Foreground 3	147	0	12	24	91
Middleground 3	146	0	5	71	97
Background 3	2	0	0	0	53
Zone 4					
Foreground 1	397	0	100	0	100
Middleground 1	856	0	76	0	90
Background 1	266	0	81	0	99
Foreground 2	206	0	100	0	85
Middleground 2	766	0	38	0	89
Background 2	52	0	58	0	91
Foreground 3	4	0	100	0	100
Middleground 3	2	0	0	0	100
Background 3	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. With consideration of all NSO stipulations, there are 1,454 acres (approximately 87 percent) of the GMUGNF lease area would be precluded from oil and gas development.

As shown in **Table 4.15-8**, the High Scenic Integrity Objective NSO would provide full coverage to lease areas within Zone 1. The resource-specific CSUs would provide full coverage for Concern Level 1 Foreground areas in Zones 2 and 3, while all Foreground areas would be precluded from surface disturbance in Zone 4. The remaining Landscape Visibility areas would experience the most coverage under any NSOs. As discussed in Section 4.15.3, the extent to which landscape visibility could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Scenic Integrity Objectives

Table 4.15-9 shows the extent of SIO categories and the percentage of coverage provided by resource-specific NSOs, resource-specific CSUs, resource-related NSOs, and any NSOs within each zone.

Table 4.15-9 Scenic Integrity Objectives Coverage under Alternative 3

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Zone 1					
Very High	330	0	0	87	100
High	9,617	100	0	100	100

Table 4.15-9 Scenic Integrity Objectives Coverage under Alternative 3

Scenic Integrity Objective	Scenic Resources within Analysis Area (acres)	Resource-specific NSOs	Resource-specific CSUs	Resource-related NSOs[1]	Any NSOs
		Percent of Scenic Resources			
Moderate	26	0	0	0	100
Low	107	0	0	0	100
Very Low	0	0	0	0	0
Zone 2					
Very High	0	0	0	0	0
High	187	0	0	99	100
Moderate	4,592	0	100	73	93
Low	20,051	0	21	62	85
Very Low	0	0	0	0	0
Zone 3					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	2,439	0	100	48	87
Low	40,117	0	44	57	86
Very Low	10	0	100	0	26
Zone 4					
Very High	0	0	0	0	0
High	0	0	0	0	0
Moderate	789	0	100	0	89
Low	1,772	0	55	0	93
Very Low	0	0	0	0	0

[1] Roadless Areas and RNAs NSOs.

Note: Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. With consideration of all NSO stipulations, 100 percent of these areas would be precluded from surface disturbance.

As shown in **Table 4.15-9**, High SIO areas within Zone 1 would receive full coverage from the High Scenic Integrity Objective NSO. The remainder of Zone 1 areas would be fully precluded from surface disturbance through any NSOs. Resource-specific CSUs would provide full coverage to Moderate SIO areas in Zones 2, 3 and 4, as well as Very Low SIO areas in Zone 3. The majority of remaining SIO areas in Zones 2, 3 and 4 are covered by NSO stipulations. As discussed in Section 4.15.3, the extent to which SIOs could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 3 includes 413 wells on 60 well pads, resulting 886 acres of short-term disturbance and 384 acres of long-term surface disturbance. Potential impacts are described in Section 4.15.3. The site-specific location of development would play a role in determining the impacts to scenic resources. In areas of lower scenic importance and sensitivity, future oil and gas exploration activities are not anticipated to substantially impact scenic resources in the area if BMPs

are applied during design and construction. In areas of higher scenic importance and sensitivity, the degree to which these resources would be affected would be dependent on factors such as slope, aspect, terrain and vegetation in and around the site-specific location; and the amount of contrast between the natural and constructed landscape. Impacts may be short-term to long-term with minor to major adverse effects. Alternative 3 has one NSO stipulation and two CSU stipulations specific to scenic resource, but resource-related and other NSO stipulations (if implemented) would constrain development of the RFDS in some areas of higher scenic importance and sensitivity. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic researches within leases. These would be examined during the site-specific development phase. The potential for impacts to scenic resources is described by zone below.

Within Zone 1, Class B and High SIO areas are present in approximately 95 percent of the 10,114-acre zone. Approximately 43 percent of the zone is a User Concern Level 1 area (Middleground and Background distance zones) and 25 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells in this zone.

The Zone 1 RFDS comprises 36 wells on 5 well pads (78 acres of short-term and 33 acres of long term surface disturbance). Resource-specific and resource-related NSOs would effectively prevent development within this lease zone. Additional NSOs overlaying these stipulations also would prevent development in portions of the lease zone. If some NSO stipulations are exempted to the degree that some or all of the RFDS may be developed on the leases, the resulting surface disturbance would comprise about 1 percent of the lease zone, and would likely occur within CRAs. Impacts would vary depending on the exempted stipulations, but development would be inconsistent with the Forest Plan in Very High, High, and potentially Moderate SIOs (which comprise over 98 percent of the lease zone) even if design criteria, mitigation measures, and BMPs are implemented.

Within Zone 2, Class B and Moderate SIO areas are present in over 80 percent of the 24,938-acre zone. Approximately 65 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 27 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). Zone 2 contains 73 existing wells on 13 well pads, generally spread throughout the lease zone.

The Zone 2 RFDS comprises 319 total wells on 46 well pads, (684 acres of short-term and 296 acres of long-term surface disturbance). Resource-specific NSOs would not preclude surface disturbance, and any or all of the RFDS could be developed in the leases areas. With consideration of only resource-related NSOs, any or all of the RFDS could still occur in Class B areas, User Concern Level 1 and 2 areas, and Moderate and Low SIOs; however, the majority of CRAs would be precluded from surface disturbance (see Section 4.12, Special Designations). If all NSO stipulations were implemented, most of the lease area would be almost fully covered against surface disturbance. If NSO situations are waived to the extent that the RFDS were to be developed on-lease, RFDS development would result in long-term surface disturbance in approximately about 1 percent of the lease zone. Impacts would vary depending on the location of exempted stipulations. Development may not represent a significant change to the overall landscape character within this zone if located in areas of lower scenic importance and sensitivity (Low SIO) and in areas where other well development is present, but that may not be practicable on leases that are predominately Moderate SIOs. Development in Moderate SIOs may be inconsistent with the Forest Plan even if design criteria, mitigation measures, and best management practices are implemented.

Within Zone 3, Class B and Low SIO areas are present in over approximately 95 percent of the 42,766-acre zone. Approximately 86 percent of the zone is a User Concern Level 1 area

(Foreground, Middleground, and Background distance zones) and 14 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are 2 existing wells and 3 well pads in this zone, all in the western portion of the lease zone (outside of the Thompson Divide area).

The Zone 3 RFDS comprises 49 total wells on 7 well pads (104 acres of short-term and 45 acres of long-term surface disturbance). Resource-specific NSOs would not preclude development of the RFDS in any lease area; however, the High Concern Travelways/Use Areas CSU would be applied to 100 percent of Moderate SIOs, 95 percent of Class A areas and 49 percent of Class B areas, 44 percent of Low and 100 percent of Very Low SIOs, and 100 percent of User Concern 1 foreground distance zones. The area covered by this stipulation would include the majority of the leases surrounding the Sunlight Ski Area, as well as the portions of CR-313 and CR-300.3 discussed under Alternative 1, but the stipulation coverage would be greatly expanded.

With consideration of only resource-related NSOs, any or all of the RFDS could still occur in some Class B areas and Moderate, Low, and Very Low SIOs. Development would not be permitted in most user concern levels and distance zones and CRAs (see Section 4.12, Special Designations). Under the coverage of any NSO stipulations, the potential for surface disturbance would be more limited but could still occur in Moderate, Low and Very Low SIOs. Some portions of the leases closest to the areas of concern discussed under Alternative 1 (Sunlight Ski Area, Jerome Park conservation easement, Crystal River Valley, Mt. Sopris) would be covered by NSO stipulations. The leases in the northeastern portion of the zone (closest to the Roaring Fork Valley and Carbondale) would generally not have NSO stipulation applied to them but would be covered by CSU stipulations. The lease area surrounding the Thompson Divide Road would be largely covered by CSU stipulations, and some nearby areas could be covered by any NSOs.

If fully developed on-lease, the Zone 3 RFDS would result in long-term surface disturbance in approximately 1 percent of the lease zone. This would represent a large increase in the number of wells and a moderate increase in the number of well pads. This development, along with increased transportation, may affect the general landscape character within this zone, particularly within the Thompson Divide, unless located in areas of lower scenic importance and sensitivity (e.g., Low SIOs, which comprises about 90 percent of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas (which collectively comprise about 10 percent of the lease zone) even if design criteria, mitigation measures, and best management practices are implemented. However, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located.

Within Zone 4, Class B areas are present on over 99 percent of the 2,562-acre zone. Approximately 30 percent is a Moderate SIO area; the remainder of the lease zone is Low SIOs. Approximately 60 percent of the zone is a User Concern Level 1 area (Foreground, Middleground, and Background distance zones) and 40 percent of the zone is a User Concern Level 2 area (Foreground, Middleground, and Background distance zones). There are no existing wells in the lease zone.

The Zone 4 RFDS comprises 10 total wells on 1 well pad (21 acres of short-term and 9 acres of long-term surface disturbance). Resource-specific NSOs would not preclude surface disturbance in any area of the lease zone; however, resource-specific CSUs would be applied to all Moderate SIOs, 50 percent of Low SIOs, most Class B areas, and all User Concern 1 and 2 foreground distance zones. With consideration of all other NSO stipulations, any or all of the RFDS could still occur in Moderate and Low SIOs and Class B areas. RFDS development would comprise less than 1 percent of the lease zone, and given the low number of wells and well pads, would minimally affect the landscape character. Development may be inconsistent with the Forest Plan in Moderate SIOs; however, given the low number of proposed wells, it is assumed that Moderate SIOs can be avoided.

4.15.4.4 Alternative 4 (Proposed Action)

Stipulation Coverage

Alternative 4 is the Proposed Action and modifies or cancels the existing leases to match the stipulations and availability decisions identified for future leasing in the 2014 WRNF Final EIS. NSO and CSU stipulations for scenic resources under Alternative 4 would be the same as discussed for Alternative 3, except that all or part of 25 leases in eastern portion of Zone 3 would be cancelled. For the leases that are not cancelled under Alternative 4, the stipulations and potential for future oil and gas development would remain the same as those discussed under in Alternative 3.

Scenic Attractiveness

Table 4.15-10 displays the percentage of Scenic Attractiveness classes within the leases that would be cancelled under Alternative 4.

Table 4.15-10 Scenic Attractiveness within Cancelled Leases under Alternative 4

Scenic Attractiveness Class	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
A	1,088 / 3	100
B	27,370 / 64	66
Total	**28,458 / 67**	**—**

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Scenic Attractiveness. Less than 1 percent of this area would be cancelled under this alternative.

Landscape Visibility

Table 4.15-11 displays the percentage of Landscape Visibility within cancelled leases.

Table 4.15-11 Landscape Visibility within Cancelled Leases for under Alternative 4

User Concern Level, Seen Area and Distance Zone	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
Foreground 1	3,411 / 8	52
Middleground 1	10,241 / 24	52
Background 1	9,505 / 22	89
Foreground 2	3,218 / 7	87
Middleground 2	1,297 / 3	68
Background 2	173 / <1	56
Foreground 3	136 / <1	93
Middleground 3	145 / <1	99
Background 3	2 / <1	100
Total	**28,127 / 65**	**—**

Note: The lease area also includes portions of the GMUGNF (approximately 2 percent of the lease area) that was not inventoried for Landscape Visibility. Less than 1 percent of the GMUGNF lease area would be cancelled under this alternative.

Scenic Integrity Objectives

Table 4.15-12 displays the percentage of SIOs covered by cancelled leases under Alternative 4. There are no Very High or High SIOs within Zone 3.

Table 4.15-12 Scenic Integrity Objectives within Cancelled Leases under Alternative 4

SIO Category	Area of Cancelled Leases in Zone 3 (acres) / Percent Total Zone 3 acreage (%)	Percentage of Scenic Attractiveness Class Cancelled in Zone 3 (%)
Moderate	2,437 / 6	100
Low	25,981 / 6	65
Very Low	10 / <1	100
Total	**28,428 / 67**	**-**

Note: Within Zone 3, there are 125 acres (less 1 percent of the analysis area) within the GMUGNF that are classified as High/Moderate SIO. Less than 1 percent of the GMUGNF High/Moderate area would be cancelled under this alternative

As shown in **Tables 4.15-10**, **4.15-11**, and **4.15-12**, the majority of Scenic Attractiveness, Landscape Visibility, and SIO areas in Zone 3 would generally be precluded from surface disturbance with the cancellation of leases under Alternative 4. As discussed in Section 4.15.3, the extent to which these three scenic resource categories could be impacted by future oil and gas development would depend on the specific characteristics of a proposed project.

Impacts from Projected Future Oil and Gas Development

The RFDS for Alternative 4 comprises 383 wells on 55 well pads, resulting 821 acres of short-term disturbance and 356 acres of long-term surface disturbance. Potential impacts are described in Section 4.15.3. Under Alternative 4, all or part of 25 leases in eastern portion of Zone 3 would be cancelled. As noted in Section 4.1.3, if surface-disturbing activities associated with the RFDS are moved off-lease due to NSO stipulations, there may still be visual impacts to the scenic resources within leases. Lease cancellations are therefore assumed to maintain scenic quality to a greater degree than NSO stipulations. The potential for impacts to scenic resources is described by zone below.

Within Zone 1, Zone 2, and Zone 4, the RFDS and impacts would be the same as under Alternative 3.

Within Zone 3, all or part of 25 of the leases would be cancelled in the eastern portion of the zone. These leases are closest to many of the areas of concern identified during scoping (CRAs, Sunlight Ski Area, Jerome Park conservation easement, Roaring Fork Valley, Crystal River Valley, Mt. Sopris, etc.). The Zone 3 RFDS would be reduced to 18 wells on 3 well pads (39 acres of short-term and 17 acres of long-term surface disturbance).

Within the remaining Zone 3 leases, resource-specific NSOs would not preclude on-lease development of the RFDS; however, the High Concern Travelways/Use Areas CSU would be applied to 100 percent of Moderate SIOs; 95 percent of Class A areas and 49 percent of Class B areas (as well as 44 percent of Low and 100 percent of Very Low SIOs; and 100 percent of User Concern 1 foreground distance zones. The area covered by this stipulation would include portions of CR-313 and CR-300.3, West Divide Creek, Flattop Mountain and other areas.

With consideration of resource-related NSOs, any or all of the RFDS could still occur in some Class B areas and Moderate, Low, and Very Low SIOs, while most user concern levels and

distance zones would be precluded from development. Most CRAs would be covered by NSO stipulations (see Section 4.12, Special Designations). With consideration of any NSO stipulation, surface disturbance would be more limited but could still occur in Moderate, Low, and Very Low SIOs. If fully developed on-lease, the RFDS would result in long-term surface disturbance in less than 1 percent of the lease zone. The development would represent a small increase in the number of well pads and a moderate increase in the number of wells, and would be located within some existing oil and gas development. This development may affect the general landscape character unless located in areas of lower scenic importance and sensitivity (e.g., Low SIO, which comprises the majority of the lease zone). Development may be inconsistent with the GMUGNF Forest Plan in High/Moderate SIO areas and the WRNF Forest Plan in Moderate SIO areas; however, all leases with Moderate SIOs also contain areas with Low SIOs in which development could potentially be located.

4.15.4.5 Alternative 5

Alternative 5 would cancel all 65 existing leases, and would plug and abandon existing wells; remove infrastructure; reclaim roads, well pads, and other ancillary facilities; and revegetate all areas of surface disturbance. The activities associated with well abandonment and reclamation would create 86 acres of surface disturbance.

There would be no future development under this alternative; however, there would be impacts to scenic resources from the surface disturbance required to plug and abandon the existing wells and reclaim any associated infrastructure. This alternative would require the plugging and abandonment of 75 wells and removal of all ancillary equipment (tanks, burners, etc.), as well as the reclamation and revegetation of 16 well pads and approximately 48 acres of access roads. All disturbances would occur in lease Zones 2 and 3; no surface disturbance would occur in Zones 1 and 4. Impacts would be similar to temporary construction impacts described in Section 3.15.3.

4.15.4.6 Summary of Impacts

<u>Alternative 1 (No Action)</u>

Under Alternative 1 there would be no resource-specific NSO stipulations. There would be one resource-specific CSU. Within Zone 1, if all NSOs were implemented, no portion of the RFDS (36 total wells on 5 well pads) could be developed on the leases. Within Zone 2, if all NSOs were implemented, it is anticipated that any or all of the RFDS (319 total wells on 46 well pads) could occur in Moderate and Low SIOs. Within Zone 3 there would still be potential for a portion of the RFDS (52 total wells on 7 well pads) to occur in High/Moderate, Moderate, and Low SIOs. A CSU designation specific to scenic resources would be applied to portions of Four-Mile Road and other travel routes. Within Zone 4, standard lease terms would allow on-lease development of the RFDS (10 wells on 1 well pad) in Moderate and Low SIOs. Development in Moderate SIOs may be inconsistent with the Forest Plan, and on some leases in Zone 2, it may not be possible to locate all new development within areas of lower scenic importance and sensitivity. In Zones 3 and 4, most leases contain areas with Low SIOs in which development would potentially be located.

<u>Alternative 2</u>

Alternative 2 would have the same potential impacts as Alternative 1 within Zones 1, 2, and 4. Within Zone 3, a CSU designation to specific to scenic resources would be applied to an additional portion of Four-Mile Road, and an NSO stipulation would be applied to a portion of the lease closest to Sunlight Ski Area. Impacts to the key areas identified in scoping comments would be similar to Alternative 1 except that scenic quality in the Foreground 1 areas along Four-Mile Road and the Middleground1 distance zone within the lease closest to Sunlight Ski Area would be better maintained through application of CSU and NSO stipulations.

Alternative 3

Under Alternative 3, there would be resource-specific NSO and CSU stipulations. Within Zone 1, resource-specific and general NSOs would not permit surface disturbance on most of the lease area. Any development of the RFDS (36 wells on 5 well pads) would have to occur off-lease. Within Zone 2, no resource-specific NSOs would constrain development; however, if implemented, general NSOs would preclude surface disturbance in most of the lease area. Development of the RFDS (319 total wells on 46 well pads) would likely have to occur off-lease. Within Zone 3, resource-specific NSOs would not preclude surface disturbance. General NSOs, if implemented, would not permit surface disturbance in portions of the lease area, but development of the RFDS (49 total wells on 7 well pads) could still occur in Moderate, Low, and Very Low SIOs. The High Concern Travelways/Use Areas CSU would be applied all Moderate and Very Low SIOs and in 44 percent of Low SIOs. Within Zone 4, the High Concern Travelways/Use Areas CSU would cover most high quality scenic resources, but the RFDS (10 wells on 1 well pads) could still occur in Moderate and Low SIOs.

Alternative 4 (Proposed Action)

Alternative 4 would have the same potential impacts as Alternative 3 within Zones 1, 2, and 4. Within Zone 3, 25 leases in the eastern half of the zone would be cancelled. The cancelled leases would be located in areas identified during scoping as having high scenic value. The High Concern Travelways/Use Areas CSU would cover most high quality scenic resources in the remaining Zone 3 leases, but the RFDS (18 wells on 3 well pads) could still occur in some Class B areas and Moderate, Low, and Very Low SIO areas.

Alternative 5

Under Alternative 5, there would be temporary impacts to scenic resources from the process of plugging and abandoning the 75 existing wells, reclaiming roads and well pads, and decommissioning ancillary facilities. The alternative would have 85 acres of short-term surface disturbance, but scenic resources would be maintained or improved over the long term.

Comparison

Alternative 1, the No Action Alternative, offers the least coverage of high scenic value resources. Alternative 5 offers the greatest opportunity to maintain or improve high scenic value resources over the long term through cancellation of all leases. Of the Alternatives proposing development, Alternative 4 offers the most coverage of high scenic value resources (through lease cancellations and application of resource-specific NSOs), followed by Alternative 3 (application of resource-specific NSOs) and Alternative 2 (which has slightly more coverage than Alternative 1).

Within each alternative, the small portion (approximately 2 percent) of GMUGNF land present within the lease area has a low potential for oil and gas development. In addition, if development were feasible, NSO and CSU stipulations would provide full coverage for all Scenic Attractiveness and Landscape Visibility classifications for each alternative. SIO coverage within the GMUGNF would follow the same impact analysis as discussed for the WRNF. Due to these factors, the development of the RFDS in the GMUGNF is unlikely.

4.15.5 Cumulative Impacts

4.15.5.1 Cumulative Impacts Analysis Area

The cumulative impacts analysis area (CIAA) for scenic resources is composed of the 65 lease areas (lease area), which are divided into four zones (Zone 1, 2, 3, and 4) and encompasses approximately 80,380 acres. The CIAA does not extend past the borders of these leases, and any scenic features beyond these boundaries have not been considered.

4.15.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and ongoing actions in the analysis area that influence scenic conditions may include road development, construction and maintenance of trails, off-highway vehicle use, the effects of water uses (stream diversion, reservoirs and dams, ditches, and spring developments), recreation use, livestock grazing and infrastructure such as fences and ponds, prescribed fire, timber harvest, invasive species, and mineral and energy development. Past and present actions with quantifiable surface disturbance primarily include fluid and solid mineral development, road development, and ROWs for pipelines and telephone lines. Within the CIAA for scenic resources, oil and gas development has impacted 38 acres, transportation corridors have impacted 91 acres, and ROW development has impacted 325 acres.

As discussed in Section 3.15, the forms, lines, colors, and textures of the landscape are mostly consistent with the natural scenery of the landscape, but are contrasted with ranches, residences, and existing oil and gas development. Other activities affecting the scenic landscape include sparsely distributed range improvements and unimproved roads associated with livestock grazing and range management. In addition, the analysis area is intersected by multiple transportation corridors (roadways and trails) that provide routes for the public to access the scenic and recreational resources within the analysis area.

Reasonably Foreseeable Future Actions

RFFAs are those for which there are existing decisions, funding, formal proposals, or which are highly probable based on known opportunities or trends.

RFFAs in the analysis area with the potential to influence scenic integrity include continued recreation; agricultural use and livestock grazing; prescribed burning and vegetation/habitat treatments management; timber harvests; and other infrastructure development such as roadway construction and decommissioning, pipeline construction, transmission line development, large culvert replacements, and communication sites. RFFAs with quantifiable surface disturbance or treatment acreage are summarized in Section 4.1 and are described in detail in **Appendix B**. There are no identified oil and gas–related or other surface-disturbing RFFAs within the Lease Area CIAA. There is an estimated 6,000 acres of proposed vegetation treatments within the Lease Area CIAA under the South Rifle Habitat Enhancement Project. Treatments include cutting sagebrush, oakbrush, and mountain shrub and prescribed fire for aspen, pinyon-juniper, and Douglas fir. Vegetation treatments designed to improve ecological conditions could indirectly enhance visual resources on a localized basis. However, in the short term, methods such as mechanical treatments or prescribed fire would directly create visual changes to landscape form, line, color, and texture. Impacts would range from minor to moderate, depending on the scope and magnitude of treatment and the methods used. In the long term, the potential for cumulative effects to scenic resources is anticipated to be minimal, as proposed treatments would affect about 7 percent of the analysis area and may ultimately enhance visual resources. All vegetation treatments on the WRNF lands would need to comply with 2002 Forest Plan.

4.15.5.3 Contribution of the Proposed Action and Alternatives to Cumulative Impacts

With consideration of the 454 acres of past and present surface disturbance, the Proposed Action and Alternatives would contribute between 0 (Alternative 5) to 46 percent (Alternatives 1 and 2) of the total cumulative long term surface-disturbing activities within the CIAA. If selected, Alternative 5 could have countervailing effects on visual resources, through eliminating some past oil and gas-related disturbance.

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4.16 Hazardous Materials and Human Health and Safety

4.16.1 Hazardous Materials and Solid Waste

4.16.1.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for hazardous materials and solid waste consists of the individual lease tracts and routes that would be used for the transportation of hazardous materials.

Scoping Issues

The following issues concerning hazardous materials and solid waste submitted by cooperating agencies and the public during scoping:

- Types and amounts of hazardous materials that will be used for drilling, hydraulic fracturing, and other aspects of oil and gas development.
- Methods to be used for transportation, storage, and use hazardous materials (including drilling and fracturing processes) to reduce risk of adverse impact to physical, biological, and other resources).
- Methods to be used for disposal of contaminants, including produced water.
- Contingencies to handle unexpected contaminations such as naturally occurring radioactive materials or accidental spills and releases.

While the above issues are addressed in general terms, the qualitative nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Methods of analysis are discussed below. Hazardous Materials issues would be addressed at the APD stage of permitting, when NEPA analysis of a site-specific Plan of Development would be required.

Assumptions

Assumptions to be used in the analysis of impacts resulting from hazardous materials include the following:

- The magnitude of potential impacts will be generally proportional to the level of oil and gas exploration and production activity.
- Operators would comply with all laws and regulations related to hazardous materials.

Impact Indicators

The main impact indicators for hazardous materials and solid waste would be statistical data indicating expected number of accidents, releases, incidents per well/mile pipeline/miles of road or other salient indicator.

Methods of Analysis

For the analysis of hazardous materials, the methodology includes the following:

- Review the proposed activities (as identified in the RFDS) and identify potential for hazardous materials that would be utilized or produced or solid waste generated; describe how and where hazardous materials would be utilized during construction, drilling, and production operations.

- Describe the relationship between leasing stipulations and resource of concern to identify areas where hazardous material use would not be allowed.
- Apply statistical data indicating expected number of accidents, releases, incidents per well/mile pipeline/miles of road or other salient indicator to projected development.
- Review and summarize applicable rules concerning the transport, storage, handling and disposal of hazardous materials and solid waste. Describe how oil and gas operations would comply with all applicable regulations.

4.16.1.2 Stipulations Addressing Hazardous Materials

There are no stipulations that deal specifically with hazardous materials and solid waste.

4.16.1.3 Impacts Common to All Alternatives

Hazardous materials and solid waste have the potential to impact water and soil resources due to spills and mishandling of those materials.

Transport and Storage of Hazardous Materials

As outlined in Chapter 3.0, **Table 3.16-1** (Potentially Hazardous Materials Used or Stored in Typical Oil and Gas Well Drilling, Completion, and Production Operations), there are a large variety of hazardous materials are used or stored in oil and gas drilling and production. While amounts are not known, it is expected that the amount of many of hazardous materials would exceed threshold planning quantities. Types of chemicals or materials that may be trigger reporting requirements include cement and associated additives; silica; shale control additives; drilling mud and associated additives; deflocculants; lubricants; alkalinity and ph control material; produced hydrocarbons; and fuels. Where facilities meet the storage threshold for fuels and lubricants, operators would maintain a certified SPCC Plan that would define the procedures, responses, and cleanup in case of a spill of petroleum-based materials. Any release in excess of a reportable quantity would be reported to according to USEPA, COGCC, BLM, and Forest Service procedures.

Hazardous materials and substances used for drilling and completion would be transported to well sites by trucks and stored in compliance with applicable rules and regulations. Per BLM SPCC regulations, all storage tank batteries, treaters, dehydrators, and other production facilities that have the potential to leak or spill any oil, glycol, or other fluid that may constitute a hazard to public health or safety would be surrounded by an appropriate secondary containment system capable of holding the entire contents of the largest single tank in use plus freeboard, or to contain a minimum of 110 percent of the capacity of the largest vessel, or placed on or within a diversionary structure to prevent spilled or leaking fluid from reaching groundwater or surface waters. The appropriate containment and/or diversionary structures or equipment would be constructed to help prevent discharges from a primary containment system from draining, infiltrating, or otherwise escaping to ground or surface water prior to completion of cleanup. Other requirements to reduce the risk of contamination to the environment from drilling and completion activities include requirements for well casing to eliminate interactions between well holes and surrounding groundwater near the surface; blowout preventers to control the release of subsurface fluids; and liners for pits containing process water, drilling fluid, and drill cuttings.

Produced Water

Produced water and liquid condensate would be disposed of by trucking or piping the water to an authorized disposal well but also may be utilized in hydraulic fracturing operations. Disposal would be determined during the APD process. It is estimated that when the field is mature each vertical or directionally drilled well would produce approximately 38,000 barrels of fluids (water and condensate) over the life of the well and that each horizontally drilled well would produce approximately 75,000 barrels of fluids (water and condensate) over the life of the well.

Spill and Release Data

Recent released statewide statistics indicate that while although oil and gas activity and the number of spill incidents have increased, the total of volume of oil spilled in 2014 was similar to 1999 in volume, and spillages in terms of the percent of total volume produced has decreased (now at 0.003 percent of the volume of oil produced (COGCC 2015a). During that same time period, spills of produced water decreased both in amount (reduced by over 50 percent) and by percent of volume produced (now at 0.005 percent of the total volume of produced water; COGCC 2015a). In 2014, the U.S. Department of Transportation (USDOT)-Pipeline & Hazardous Materials Safety Administration (PHMSA) reported 2,485,426 miles of gas gathering, distribution and transmission pipelines in the U.S. and 305 ”significant incidents” (defined as those with a fatality or injury requiring in-patient hospitalization; $50,000 or more in total costs, measured in 1984 dollars; highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; or liquid releases resulting in an unintentional fire or explosion; (USDOT 2015). This translates into an incident rate of 0.0001 incidents per mile per year. Using this incident rate, there would statistically need to be about 8,200 miles of pipeline constructed as part of the development of the existing leases before one incident would occur. The RFDS for the existing leases does not include an estimate of miles of pipeline, however, the 2004 Final EIS estimated approximately 1 mile of pipeline per wellpad (USFS 2014a, page 200). For the purposes of a comparative analysis, this estimate is used in Section 4.16.1.4, Impacts by Alternative.

Naturally Occurring Radioactive Materials

As noted in Chapter 3.0, very few domestic oil and gas wells in Colorado have been identified as having oil-field naturally occurring radioactive materials (NORM) wastes (or technologically enhanced NORM [TENORM]) (USEPA 2015g). Earlier studies noted that TENORMs resulting from produced water and oil-field equipment within the analysis area is at background or marginally detectable (USGS 1999). As a result, TENORM from oil and gas production is thought to be low in the analysis area. However, as noted in Section 3.3, Geology and Minerals, there are numerous uranium occurrences in Township 2 North (T2N), Range 92 West (R92W), where the Zone 4 lease is located, which may increase potential of encountering NORM.

There currently exist no Federal regulations that specifically address the handling and disposal of TENORM. Increased industry awareness and understanding of the problem also has provided better control of TENORM and have reduced the radiation exposure to workers and the public. The USEPA identified the following current BMPs for handling TENORM:

- Sludges containing elevated TENORM are dewatered and held in storage tanks for later disposal.
- Produced waters are reinjected into deep wells. No added radiological risks appear to be associated with this disposal method as long as the radioactive material carried by the produced water is returned in the same or lower concentration to the formations from which it was derived.
- Pipes contaminated with scale are cleaned at pipe yards either by sandblasting them with high pressure water or by scraping out the scale with a rotating drill bit. The removed scale is then placed in drums and stored for later disposal.
- Contaminated equipment may be cleaned and reused by the petroleum industry; disposed; or, if radiation levels are sufficiently reduced, sold for recycle. If equipment cannot be further decontaminated to acceptable levels, it is sent to a landfill licensed to accept NORM materials.
- In some cases contaminated steel may be reprocessed via smelting. During the smelting process molten steel separates from the NORM, which vaporizes and is released as a gas. If the steel mill has pollution control equipment, most of the NORM is trapped in the baghouses and scrubbers. A typical smelting operation is capable of capturing 99 percent of the particulate releases (USEPA 2015g).

Both the oil and gas industry and state regulatory agencies are currently examining and regulating TENORM in oil and gas production facilities (USEPA 2015g).

Solid Waste

Solid waste would be disposed of according to the process that generated the waste. For instance, Exploration and Production exempt waste not injected into disposal wells will be disposed at permitted off-site disposal facilities. Other wastes (trash, rubbish, garbage) will be appropriately containerized and disposed of in off-site in a municipal solid waste landfill. Particular care would be taken to prevent scavenging by wildlife while such waste is on location.

4.16.1.4 Impacts by Alternative

The following provides a comparison that the different alternatives would have on impacts on hazardous materials and public health and safety.

Alternative 1 (No Action Alternative)

Stipulation Coverage

There are no stipulations under Alternative 1 concerning the handling of hazardous materials and solid waste. There may be NSO stipulations that would preclude gas development activities within portions of the leases. However, gas development may still be accomplished from surface locations outside of an NSO area. There is therefore no lessening of the risk of spills and releases; potential impacts would just be removed from the analysis area.

Impacts from Projected Future Oil and Gas Development

In the absence of stipulations, gas development activities associated with 417 wells on 60 wellpads would be carried out in accordance with applicable rules and regulations. Using the 2014 Final EIS estimate of 1 mile of pipeline per wellpad, there would be approximately 60 miles of pipeline required to develop the existing leases. With application of the spill rates described above, development of the RFDS would result in 0.007 significant pipeline incidents per year. Over a 30-year lifespan of the RFDS, assuming a continuation of the same incident rate, there would be 0.22 significant incidents. There would be an estimated 692,626,365 gallons (16,491,104 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 825 barrels of spilled produced water over the 20- to 30-year life span of the wells. Compliance with regulations and best management practices for the transportation and use of hazardous materials would lower the risk from spills and releases. Disposal of solid waste in accordance with applicable rules would reduce the potential for impacts to soil and water and public health and safety.

Alternative 2

Stipulation Coverage

Same as Alternative 1, but there would be slightly more NSO leasing stipulations that would preclude gas development activities within portions of the leases.

Impacts from Projected Future Oil and Gas Development

Same as Alternative1, but there would be approximately 416 wells developed on 60 well pads. Pipeline incident rates and produced water spill rates would be the same as under Alternative 1.

Alternative 3

Stipulation Coverage

There are no specific stipulations under Alternative 3 concerning the handling of hazardous materials and solid waste. There is an NSO stipulation for Public Water Supply Source Areas that would preclude surface disturbance within 2,300 feet on either side of a designated surface water source (extending upstream five miles from the intake location) and within a 1.5-mile radius of a designated well or similar feature serving as a public water supply (also see Section 4.5, Water Resources). There also is an NSO stipulation for WIZ that would preclude disturbance within the WIZ of perennial and intermittent streams, lakes, wetlands, and naturally occurring ponds (defined as a minimum horizontal width of 100 feet from each side of the water-dependent feature, but which may be wider in areas with well-developed floodplains). The groundwater CSU stipulation may require special analysis and mitigation plans for proposed activities where specific groundwater resources exist, including contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities; however this stipulation covers a relatively small amount of acreage as compared to the total lease acres in the four zones (**Tables 4.5-3** and **4.5-4**). It is important to note that if gas development is accomplished from surface locations outside of an NSO area, there is no lessening of the risk of spills and releases; potential impacts are just removed from the analysis area.

Impacts from Projected Future Oil and Gas Development

In the absence of NSO stipulations, gas development activities associated with 413 wells on 60 wellpads would be carried out in accordance with applicable rules and regulations. Regardless of other NSO stipulations, surface disturbance would be precluded near Public Water Supply Source Areas and WIZ. Additional mitigation would be required in areas with a CSU groundwater stipulation. Mitigations would be determined on a site-specific basis but could include contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface would not be allowed.

Pipeline incident rates would be the same as under Alternative 1. There would be an estimated 687,758,400 gallons (16,375,200 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 786 barrels of spilled produced water over the 20- to 30-year life span of the wells.

Alternative 4 (Proposed Action)

Stipulation Coverage

There are no specific stipulations under Alternative 4 concerning the handling of hazardous materials and solid waste. There are NSO stipulations for Public Water Supply Source Areas and WIZ and a CSU stipulation for Groundwater (all described under Alternative 3). As with Alternative 3, if gas development is accomplished from surface locations outside of an NSO area, there is no lessening of the risk of spills and releases; potential impacts are just removed from the analysis area; however, the cancellation of 25 leases under this alternative would eliminate any potential for spills in and around Zone 3 leases, and the reduction of overall development (a reduction in the total number of wells from 416 to 383), would statistically lower the risk of spills and releases overall.

Impacts from Projected Future Oil and Gas Development

In the absence of stipulations, gas development activities associated with 383 wells on 55 wellpads would be carried out in accordance with applicable rules and regulations. Surface disturbance would be precluded near Public Water Supply Source Areas and WIZ. Additional mitigation would be required for areas with a CSU groundwater stipulation. Mitigations would be determined on a site-specific basis but could include contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities. Disposal of wastewater into the subsurface would not be allowed.

Using the 2014 Final EIS estimate of 1 mile of pipeline per wellpad, there would be approximately 55 miles of pipeline required to develop the existing leases. With application of the spill rates described in Section 4.16.1.3. Impacts common to All Alternatives, development of the RFDS would result in 0.0067 significant pipeline incidents per year. Over a 30-year lifespan of the RFDS, assuming a continuation of the same incident rate, there would be 0.20 significant incidents. There would be an estimated 687,758,400 gallons (16,375,200 barrels) of produced water over the life of the RFDS. Using the produced water spill rates described above, this translates into 786 barrels of spilled produced water over the 20- to 30-year life span of the wells.

Alternative 5

Under Alternative 5, all leases would be cancelled. Existing wells would be plugged and abandoned. Although there is risk of release of hazardous materials during reclamation, this alternative minimizes the risk of spills and releases over the long term. Reclamation would have to be conducted in a manner that would not increase the risk of hazardous materials releases. As with the other alternatives, activities would be carried out in accordance with applicable rules and regulations, BMPs, and conditions that may be imposed by the authorizing officer.

Impact Summary

Activities conducted under any of the alternatives carry risks of spill and releases of hazardous materials and solid waste. In the absence of stipulations, activities would be carried out in accordance with applicable regulatory programs. The No Action Alternative would statistically present the greatest risk for spills, followed by Alternatives 2, 3, 4, and 5. The risks are much less under Alternative 5 in compared with the other four alternatives since the major hazardous material that would be used would be petroleum fuels and other chemicals and materials used in gas production would not be present.

4.16.1.5 Cumulative Impacts

Cumulative Impacts Analysis Area

As shown on **Table 2.7-1**, the CIAA for hazardous materials is the 65 existing leases and the routes that would be used for the transportation of hazardous materials.

Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions and RFFAs are described in detail in Section 2.7 and in **Appendix B**. There are no additional oil and gas development proposed within the leases, but it is projected that 50,166 wells will be drilled on 6,830 pads across the WRNF and within the BLM CRVFO, GJFO, and WRFO. Development of these wells may use same road network as the Proposed Action and Alternatives for the transportation of hazardous materials.

Contribution of Proposed Action and Alternatives to Cumulative Impacts

Gas development associated with both reasonably foreseeable future actions and the alternatives would contribute an additional risk of hazardous material and solid waste contamination, as well as safety concerns in the CIAA. However, gas well operators would be required to comply with applicable rules and regulations which would reduce the risk of spills and releases.

4.16.2 Human Health and Safety

4.16.2.1 Analysis Assumptions and Approach to Analysis

Analysis Area

The analysis area for this analysis comprises the individual lease tracts and routes that would be used for the transportation of hazardous materials.

Scoping Issues

The following issues were submitted by cooperating agencies and the public during scoping:

- Protection of public health and safety in and around the analysis area.
- Cumulative and combined impacts of potential exposures to hydraulic fracturing fluids, produced water, hydrocarbons, priority air pollutants associated with equipment operations, VOCs, fine particulates, and ground-level O_3.
- Impacts to emergency and health care services.
- Increased noise due to reasonably foreseeable development.
- Accidental wildfires caused by construction equipment or workers or well explosions or other causes; hazards faced by wildland firefighters responding to fires in industrial interface created by additional wells.

While the above issues are addressed in general terms, the qualitative nature of the analysis in this EIS, without knowledge of site-specific proposals for oil and gas development, does not allow for analyzing these issues in detail. Methods of analysis are discussed below. Human Health and Safety issues would be addressed at the site-specific APD stage of permitting when additional NEPA analysis would be required.

Assumptions

- Operators would comply with all laws and regulations related to hazardous materials.
- The magnitude of potential impacts would be generally proportional to the level of oil and gas exploration and production activity.

Impact Indicators Used for Analysis

- Statistical data indicating expected number of accidents or other salient indicator;
- Estimated average level of noise and attenuation information;
- Socioeconomic information regarding impact to emergency services; and
- Acres of disturbance.

Methods of Analysis

- Human Health Impacts: Qualitative discussion of studies and conclusions, relative comparison of development levels and leasing stipulations related to air quality, surface water and groundwater quality, and public water supplies, by alternative.
- Transportation Safety: relative comparison of transportation needs by alternative.
- Worker Safety: qualitative discussion of risks associated with oil and gas industry.
- Fire: qualitative discussion of risks associated with oil and gas development and BMPs that are typically imposed at the site-specific (APD) level as COAs to minimize these impacts; relative comparison of transportation needs by alternative.
- Noise: qualitative discussion of typical decibel levels associated with oil and gas development, attenuation information and BMPs that are typically imposed at the site-specific (APD) level as COAs to minimize these impacts.
- Emergency Services: Summary of socioeconomic analysis.

4.16.2.2 Stipulations Providing Protections to Human Health and Safety

There are no existing or proposed stipulations under any alternative that relate specifically to human health and safety. However, the NSO stipulation for Public Water Supply Source Areas included under Alternatives 3 and 4 would provide a level of protection to public water supply source areas as defined by the State of Colorado's Source Water Assessment and Protection (CSWAP) program areas by prohibiting or limiting surface occupancy or use within 2,300 feet from each side of a designated surface water source and extending 5 miles upstream from the intake location. For groundwater sources, the NSO stipulation is extended to all areas within a 1.5-mile radius of a designated public water supply well or similar feature serving as a public water supply. Additionally, a CSU stipulation for groundwater resources included under Alternatives 3 and 4 specifies special design, construction, operation, mitigation, or monitoring may be required where specific groundwater resources exist. These consist of aquifers used as defined by the USEPA under the Safe Drinking Water Act as groundwater used as a municipal water supply, currently being used as a source of drinking water (i.e., domestic water wells), or with less than 10,000 parts per million total dissolved solids; also see discussion of Underground Sources of Drinking Water contained in Section 4.5, Water Resources). Mitigation may include use of contained drilling systems, specific design of fuel storage, spill plans and specific design of water handling facilities, and disposal of wastewater into the subsurface would not be allowed.

All NSO stipulations would prohibit or limit surface development in the area to which the stipulation applies and may provide additional protections to human health and safety in those areas. Because CSU and TL stipulations generally provide restrictions to address only the specific resources for which they were developed, they are not assumed to necessarily minimize potential impacts to human health and safety and are not considered in this analysis.

4.16.2.3 Impacts Common to All Alternatives

Impacts to human health and safety from the leasing action alternatives would not occur from the approval of leases, but could occur upon additional approval(s) that allowed for the physical development of the leases. Although the types of impacts that may occur from oil and gas development are summarized below, the locations and timing of specific development is not known and cannot be predicted through the leasing action. Therefore, this section discloses the potential risks that are posed through the leasing action, and analyzes the type and level of leasing stipulations provided by each alternative.

<u>Health Impacts from Oil and Gas Development</u>

- In recent years, public concern has become heightened regarding emissions of chemicals to the atmosphere in conjunction with oil and gas production and potential contamination of freshwater aquifers, domestic or municipal water wells, and surface waters, particularly in relation to hydraulic fracturing. Similar concerns also have been expressed more generally in relation to oil and gas development. The following sections summarize information contained in the 2014 CRVFO Proposed RMP/Final EIS (BLM 2015k) regarding five studies related to health impacts from oil and gas development in or near the leasing area (Colborn et al. 2010; CDPHE 2010; Coons and Walker 2008; McKenzie et al. 2012; and Witter et al. 2008; see BLM 2015k, Chapter 3.0, pages 219-223). Colborn et al. 2010: This study noted that: 1) toxic chemicals are used during both the drilling and fracturing phases of gas operations, 2) long-term health effects that may not be immediately recognized, and 3) waste evaporation pits may contain numerous chemicals on USEPA's Superfund list. The study's findings cited the difficulty of developing monitoring programs. To protect public health, the study recommended full disclosure of the contents of all products, extensive air and water monitoring, a comprehensive human health study, and regulation of hydraulic fracturing under the Safe Drinking Water Act (Colborn et al. 2010). In Colorado, operators are required by the COGCC to maintain a list of the chemicals

used in hydraulic fracture of each well and to submit that information to an online data repository (fracfocus.org).

- Colorado Department of Public Health and Environment (2010f): Conducted on behalf of the Garfield County Public Health Department, this study used data collected from four monitoring sites located in proximity to oil and gas developments. The study concluded that "the estimated cancer risks associated with the six [contaminants of potential concern] are not likely to result in significant health impacts. For non-cancer (chronic and acute) health hazards, the study concluded that "overall, significant non-cancer health effects are not likely to occur." However, this does not mean that health risks from living in proximity to oil and gas activities do not exist. For example, the cancer risks show a low to moderate potential increase in cancers (1.1 to 1.7 additional cancers per 10,000 residents during a 70-year exposure duration). For non-cancer health risks, the "hazard quotient" (rating) ranged from 0.4 to 0.9, with values less than HQ = 1 indicating no "appreciable" health impacts. The study did not compare data for the four sites analyzed to air concentrations in locations remote from oil and gas activities in the county or elsewhere in the state.
- Coons and Walker 2008: A non-peer-reviewed study conducted on behalf of Garfield County, this study used hypothetical emission and exposure scenarios to calculate potential risks from emissions of natural gas and associated VOCs, including the known carcinogen, benzene. For example, USEPA calculated an acceptable lifetime (70-year) cancer risk range at distances extending approximately 500 meters (1,650 feet) downwind from an uncontrolled well with all of its natural gas production released directly to the atmosphere. By assuming a 93 percent capture rate, the authors estimated that USEPA's acceptable 70-year exposure risk for a 70-year duration would extend only 75 meters (246 feet) downwind from a well with uncontrolled emissions. During normal operations, however, the actual recovery rate of natural gas and associated benzene is greater than 99 percent, including capture and use of natural gas onsite to power equipment. During flowback shortly after completing a well and before production equipment is fully utilized, natural gas is required to be ignited and consumed ("flaring"), a process also that destroys associated VOCs. The authors similarly assumed uncontrolled releases of vapors from hydrocarbon fluids stored on the pad at 20 tons of VOCs per year. However, the COGCC requires emission controls on all sources exceeding 5 tons per year. Because their hypothetical exposures used atypically high emission rates, a 70-year exposure duration (compared with the 30-year life of most wells), and a location very close to a well pad and constantly downwind from the pad, the potential health consequences reported by Coons and Walker (2008) are substantial overestimates compared with reasonable scenarios for the public. Coons and Walker (2008) also addressed reported illness rates among residents of Garfield County for a variety of afflictions, with the result that data for the county are generally within or below the reported illness rates for three other counties (Mesa, Delta, and Montrose) with much lower levels of oil and gas development. In comparing cancer rates in Garfield County to Colorado as a whole, Coons and Walker (2008) found a significantly higher rate of all cancers combined in the county than statewide for males from 1992 through 2000 and for females from 1992 through 1998. However, these periods pre-dated the rapid expansion of oil and gas development that began in the early 2000s. In contrast, cancer risks in the county were no higher than statewide for the period 2001 through 2005, which included the initial expansion of oil and gas. The authors cautioned that cancer has a lag time from exposure to expression and that additional monitoring is needed. However, the assumptions used in their study (no or very low recovery of produced natural gas and associated compounds and a 70-year exposure duration in proximity to a well pad always upwind from the receptor) do not reflect likely exposures to the public. Acknowledging the limitations of their study, the conclusion by Coons and Walker (2008) included the following statement: "There is no health crisis in Garfield County, but there are some health trends that should be monitored. We cannot say conclusively that any of these health trends are directly related to the presence of natural gas industry activities or other factors." Similarly, as noted by several comment letters received by the BLM

following public review of the Draft RMP/Draft EIS, the authors were quoted in the Glenwood Springs Post Independent newspaper (June 18, 2008) as saying that "…there is not a 'health crisis' because of rapid natural gas development in the county."

- McKenzie et al. (2012): This study used monitoring data collected by the Garfield County Public Health Department from a fixed station "in the midst of rural home sites and ranches and [natural gas development] during both well development and production" as well as "grab samples" collected from the perimeters of four well pads, at distances of 130 to 500 feet from the well pad center. The data were extrapolated to include 5 years of well development (construction, drilling, and completion) at a pad followed by 20 to 30 years of production and maintenance activities (30 years total duration). Although the report did not indicate significantly elevated cancer or non-cancer health risks for any modeled receptors, it did show higher risks within 0.5 mile of an oil and gas well pad. The Colorado Oil and Gas Association issued a press release on March 21, 2012, disputing the findings of McKenzie et al. (2012), citing for example atypically high emissions rates used in the calculations, an atypically long development period for a typical pad (5 years versus 1 year or less), more stringent operating requirements than when the samples were collected, and calculated risks below acceptable risk levels as normally used by the USEPA.
- Witter et al. (2008): A non-peer-reviewed study conducted on behalf of Garfield County, this study concluded that "human health risks and social impacts are associated with oil and gas development." Witter et al. (2008) based this conclusion largely on the types of chemicals used in, or produced by, oil and gas activities, and not on documented release rates of those chemicals to the environment and exposure to the public. Thus, their study cataloged potential risks associated with uncontrolled exposures, at unspecified exposure rates, and for unspecified exposure durations. In summarizing the results of the Coons and Walker (2008) report, Witter et al. (2008) cited the higher combined cancer rate among Garfield County residents compared with statewide statistics, but did not mention that the trend was true only in the 1990s, as noted above, and did not extend into the period 2001-2005 during which natural gas production expanded. They also noted that Garfield County has higher rates than statewide of chronic obstructive pulmonary disease, asthma, and low birth weight, the first two of which are higher in Colorado than in the rest of the nation despite a lower rate of tobacco use and a relatively young and fit population here. The authors made no speculation as to the possible contributors to these trends. However, the fact that the large majority of county and statewide residents are in urban areas distant from oil and gas drilling and production activities strongly suggests that the higher incidences of chronic obstructive pulmonary disease, asthma, and low birth weight are related to some other factor or combination of factors.

In addition to the studies referenced in the 2014 CRVFO Proposed RMP/Final EIS, a 2014 study by McKenzie et al. (2014) addressed the relationship between natural gas developments in Garfield County and birth defects (McKenzie et al. 2014). CDPHE dismissed the study, citing what it called flaws in its design, such as not differentiating between active and inactive wells, not determining how long the mother had lived in the area, not identifying potential exposure pathways, and not accounting for risks from various known contributors to birth defects, such as age and lifestyle. In addition, proximity to oil and gas correlated with lower risks from pre-term birth and low birth weight, seemingly counter to the conclusions about birth defects (Jones 2014).

Water Contamination

As discussed in Section 3.6, Water Resources, sources of potential surface water and groundwater contamination include leaks and spills of fluids such as fuels from storage containers, transportation accidents, leaks from impoundments, and well integrity breaches. In order to minimize the risk of contaminating shallow aquifers due to leaks and spills, transportation, storage and disposal of fuels and chemicals would be done in accordance with regulatory requirements of applicable federal and state programs. In addition, operators would maintain and implement SPCC plans for the potential release of

petroleum and emergency response plans for non-petroleum materials (various ingredients of fracturing fluids and well treatment chemicals).

Hydraulic fracturing has been implicated as a potential source of groundwater contamination and concerns have been raised about potential impacts to human health and safety. However to date, no contamination has been attributed to hydraulic fracturing in the analysis area (USFS 2014a). As noted in the 2014 Final EIS, the COGCC published an analysis in 2011 of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph: "Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing" (USFS 2014a).

Both the CRVFO Proposed RMP/Final EIS (BLM 2015k) and the 2014 Final EIS for Future Leasing on the WRNF (USFS 2014a) conducted a survey of available literature addressing the risk of water contamination. The CRVFO Proposed RMP/Final EIS and the 2014 Final EIS for Future Leasing on the WRNF summarize two reports related to the analysis area (see BLM 2015k Chapter 3.0, pages 219-221 and USFS 2014a, pages 149-150):

- Witter et al. 2008 (also discussed above): Identified two situations in Garfield County relative to environmental exposures. One was the reported occurrence of detectable levels of Ch_4 in 135 of 184 water wells, springs, seeps, ponds, and rivers sampled during a groundwater investigation conducted for Garfield County in 2006 (Papadopoulos 2007a). That study noted that Ch_4 may have been present due to natural levels in some of the bedrock formations penetrated by the water wells or recharging the seeps, springs, and surface water, and that Ch_4 also may be generated by a natural (bacterial) process within the water wells. Because the study could not identify the sources of Ch_4, Witter et al. (2008) were unable to conclude whether any of the Ch_4 in wells and natural waterbodies sampled by Papadopoulos resulted from oil-and-gas related activities or from secondary generation of Ch_4 by natural bacterial processes unrelated to oil and gas. The second situation was a documented occurrence of benzene and other organic compounds in surface water at seeps along West Divide Creek within the CRVFO (URS 2006). That occurrence, related to insufficient use of surface casing and cement to isolate shallow groundwater from the bore of a private (non-BLM-administered) well, led to the enactment of more stringent requirements by COGCC, also adopted by BLM. The COGCC also determined that migration of the Ch_4 to the seeps was not the result of hydraulic fracturing of the problematic oil and gas well.
- McMahon et al. 2011. A 2011 USGS report assessing Ch_4 in water wells in the Silt-Rifle area of the CRVFO, noted that trace concentrations are common in waters derived from the Wasatch formation, the surficial and shallow bedrock formation within which most of the non-alluvial water wells in the CRVFO are completed but documented Ch_4 higher than trace concentrations in four of 27 wells tested. One sample collected in the USGS study did contain Ch_4 of a type that indicated a thermogenic (deep) origin and was similar in geochemistry to Ch_4 contained in produced water from the Mesaverde formation, the primary hydrocarbon-producing formation in the CRVFO. However, the sample also contained biogenic Ch_4, indicating that it moved through the Wasatch formation while migrating toward the water well. The USGS report concluded that one of the 27 sampled water wells had been affected by Ch_4 from the Mesaverde formation; however, they did not conclude that the single water well with Ch_4 of deep origin had migrated to the water well as a result of oil and gas activities.

As discussed in Section 4.5, Water Resources, well integrity problems rather than hydraulic fracturing are the primary risks for groundwater contamination (COGCC 2011). The COGCC recently strengthened rules to increase protection of groundwater from oil and gas operations, including stricter casing and

cementing requirements, fracturing fluid disclosure, bradenhead monitoring of wells during hydraulic fracturing operations, groundwater baseline sampling, spill reporting requirements, mechanical integrity testing for certain classes of wells, and stricter enforcement and penalties.

The lack of specific evidence linking oil and gas operations with Ch_4 water wells does not preclude the fact oil and gas operations use and produce toxic contaminants that can adversely affect human health. As with spills and other accidental releases on pads or during fluids transport, potential risks from groundwater-borne chemicals would be statistically related to the amount of oil and gas activity as well as proximity to public water supplies. Because the exact locations or amounts of chemicals are not known, the relative amount of proposed development and level of protection provided by stipulations by alternative are used as an indicator of the risk to human health and safety in Section 4.2.1.4, Impacts by Alternative.

Air Emissions

Chemicals produced during oil and gas operations consist mostly of natural gas (Ch_4) and produced water, with a small amount of associated liquid constituents that are separated from the gas and produced water at the surface. Among the constituents of natural gas condensate are VOCs such as benzene, toluene, ethylbenzene, and xylenes. Active oil and gas wells can release atmospheric pollutants due to uncaptured gases produced from the wellbore; emissions from condensate tanks, separators, vehicle exhausts, pipeline compressor engines, and open pits containing hydrocarbon fluids; and fugitive dust from access roads and other disturbed surfaces. Abandoned wells may continue to be a source of pollutant emissions if not properly plugged and capped (BLM 2015k). As discussed in Section 4.2, Air Quality, the CARMMS high development modeling scenario shows that the predicted air quality impacts associated with the oil and gas development scenario for the CRVFO outside of the Roan Planning Area are not significant, and it is reasonable to conclude that any individual project-level oil and gas development would have an even lower contribution to the overall impacts.

Impacts to human health and safety from air emissions are therefore expected to be minimal but statistically the alternative with the greatest amount of development would have higher air emissions and a higher statistical risk to human health and safety in terms of air emissions. Because the exact level of emissions are not known, the relative amount of proposed development by alternative is used as an indicator of the risk to human health and safety in Section 4.2.1.4, Impacts by Alternative.

The 2014 CRVFO Proposed RMP/Final EIS summarizes a study of potential health risks of atmospheric emissions within the analysis area (see Chapter 3.0 of the Proposed RMP/Final EIS, page 224). The study (Colborn et al. 2012) reported on potential health risks of atmospheric emissions from a well pad across a period of 15 months before, during, and following drilling of 16 oil and gas wells, including hydraulic fracturing. The sampling site was described as a rural residence located 0.7 mile from the well pad near Battlement Mesa. The authors reported “no correlation between detected emissions…and wind direction” and inferred that atmospheric inversions may explain why concentrations were higher during winter and with calm winds. The authors did not assert that measured concentrations represented an acute or chronic health risk, but they did express concern about the concentrations of polycyclic aromatic hydrocarbons in relation to mental development of children exposed prenatally (before birth). That concern was based on studies in New York City and Poland in which pregnant women carried personal air monitors. The authors noted the difficulty in comparing results of studies using personal monitors to those with stationary samplers.

As noted in this study as well as the studies discussed in *Health Impacts from Oil and Gas Development,* some chemicals emitted to the atmosphere during oil and gas development have the potential for health effects with certain types, levels, and durations of exposure. However, emitted concentrations diffuse rapidly with increasing distance from the pad, and exposures to members of the public are of much short duration than those associated with chronic health effects. Consequently, no actual, existing health effects of oil and gas activities have been documented for the analysis area.

Transportation Safety

Human health and safety may be impacted by increased vehicle collision rates and or an increased risk of collision with wildlife. As discussed in Section 4.10, Transportation, depending on the development phase, oil and gas-related traffic would vary from several vehicles a week to approximately 50 round-trips per day for short periods. The development phases would include drilling, completion, operations/maintenance, and reclamation and may include the use of overweight, over-width, or over-length vehicles to serve oil and gas locations, in addition to other types of vehicles. The drilling and well completion phases would generate the most traffic and could be encountered throughout a 24-hour period. Long-term operations would consist of the daily travel of employees involved in the operation and maintenance of production wells and ancillary facilities such as compressors and pipelines and would mostly consist of pickup trucks, although heavy truck traffic could be encountered. Maintenance activities generally occur daily over the life of the anticipated oil and gas production (estimated to be up to 20 years).

On the basis of statistical probability, increased transportation would increase the potential for vehicle collisions and/or an increased risk of collision with wildlife. The State of Colorado reported a fatality rate of 1.03 deaths per 100 million miles traveled in 2013 (Insurance Institute for Highway Safety, Highway Loss Data Institute 2015). Actual mileages per well are not known, but the alternative with the greatest amount of transportation would have a higher statistical risk of fatalities. **Table 4.16-1** includes data from Section 4.10, Transportation regarding average of number daily round-trips from drilling/completion and operations / maintenance phases by alternative. It should be noted that the average daily vehicle round-trips by lease zone portrayed in **Table 4.16-1** would be spread over the potential development period of 20 years and would not be expected to occur within a 1-year timeframe. However, the totals do allow for a comparison between alternatives.

Worker Health and Safety

As discussed in the 2014 CRVFO Proposed RMP/Final EIS (BLM 2015k), Witter et al. 2008 presented data indicating that the rate of illness, injury, and fatality among oil and gas workers in Garfield County is higher than in most job sectors; however, the analysis in the CRVFO Proposed RMP/Final EIS concluded that fatality rates among oil and gas workers were approximately the same as agricultural workers, and that illness and injury rates are lower than for both agricultural and construction workers.

Table 4.16-1 Average Daily Vehicle Round-trips for All Well Pads by Alternative

Zone	Average Daily Vehicle Round-trips for All Well Pads	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	Drilling and Completion	673	673	673	673
	Operations and Maintenance	51	51	51	51
2	Drilling and Completion	6,019	6,019	6,019	6,019
	Operations and Maintenance	456	456	456	456
3	Drilling and Completion	977	977	911	343
	Operations and Maintenance	74	74	69	26
4	Drilling and Completion	185	185	185	185
	Operations and Maintenance	14	14	14	14
Total		**8,449**	**8,449**	**8,378**	**7,767**

In 2013, the oil and gas industry experienced a nationwide rate of 1.3 nonfatal accidents per 100 full-time workers and 12 fatalities per 100,000 workers (Bureau of Labor Statistics [BLS] 2013a,b). Potential for occupational accidents and mortality would be highest during peak drilling periods and would likely drop

in proportion to the decline in drilling and development activities. This rate is lower than the nationwide rate for agricultural workers (5.4 nonfatal accidents per 100 full-time workers and 23.2 fatalities per 100,000 workers; BLS 2013a,b) but higher in terms of fatalities than construction workers (3.8 nonfatal accidents per 100 full-time workers and 9.7 fatalities per 100,000 workers BLS 2013a,b).

The 2014 CRVFO Proposed RMP/Final EIS also noted that Witter et al. 2008 also reported that "rapid industrial change" may have deleterious impacts on the psychosocial welfare of the local population in terms of increased crime and drug use, but concluded that further study would be needed to determine if oil and gas drilling is contributing [to an increase in these rates] in Garfield County. To date, no further study has been conducted (BLM 2015k).

Hydrogen Sulfide Wells

At this time, the only hydrogen sulfide within the analysis area is associated with produced water, most likely due to the introduction of bacteria during work over or completion activities and is resolved by injecting of biocides to reduce the bacterial action producing the hydrogen sulfide (BLM 2015k).

Oil and gas wells within the leases are not expected to qualify under federal regulations as hydrogen sulfide wells. If the criteria levels as stated in the "Onshore Oil and Gas Order #6, Hydrogen Sulfide Operation" (43 CFR 3160) are reached, then the Public Protection and Safety Requirements would be instituted and the requirements of the Onshore Oil and Gas Order regarding Public Protection Plans, Training Regimens, Equipment Requirements, Warning Signs/Wind Socks, and Protective Fencing would be instituted and vigorously enforced.

Fire

Construction and operation activities associated with lease development that could be sources of ignition include welding, blasting, blading, small-engine use, off-highway vehicle, and vehicle traffic over vegetated areas, and parking vehicles in areas of tall, dry grass. Mitigation measures to reduce the risk of fire are typically proposed at the site-specific level. These may include the requirement for work vehicles to carry shovels, water, and fire extinguishers; restrictions against open trash burning; restrictions limiting vehicular use or spark-generating activities such as refueling, smoking, and welding to cleared areas; and requirements for approved spark arrestors in all engines.

The development of oil and gas includes the potential for well fires or explosions. Well blowouts are rare but can be extremely dangerous. They usually occur during drilling but also can occur during production (especially during well workover operations). If natural gas is in the blowout materials, the fluid may ignite from an engine spark or other sources of flame. Blowouts may take days to months to cap and control (Tribal Energy and Environmental Information 2015). Because of their intensity and the very particular circumstances that set blowouts and oil well fires apart from regular conflagrations, specially trained firefighters must be employed for fire response (Rigzone 2015). Blowout preventors are required on wells to minimize this risk; well design would be reviewed and approved by the BLM during the APD phase.

Fire risk would be proportional to the increased surface disturbance and increases in the sources of ignition and are assumed to increase with the alternative with the greatest amount of development. Local fire responders by zone are outlined in Section 3.16; however, response time is not considered in the analysis as well locations are not known, and depending on fire type, response crews may not be coming from local fire protection districts.

Noise

Development of the leases would result in noise impacts from construction and operation of producing wells, presence of work crews, vehicular travel and other elements of oil and gas development. Average noise levels for typical construction equipment range from 74 decibels on the A-weighted scale (dBA) for

a roller to 88 dBA for a crane (Harris, Miller, Miller, and Hanson, Inc. 2006). In general, the dominant construction noise sources are diesel engines, particularly if the engines are poorly muffled. Other sources of continuous noise include field compressors, bulldozers, and backhoes. For a general assessment of construction impacts, assuming a geometric spreading only (i.e., a decrease of about 6 dBA per doubling of distance from a point source; Truax 1999), it is estimated that the loudest piece of equipment operating at peak load would produce noise levels that would exceed the USEPA guideline for residential noise (55 dBA) at a distance of about 1,600 feet (USEPA 1974). Construction noise levels would be short-term and spatially limited and would be most noticeable during the development phase when construction, drilling, and completion activities would occur. Elevated noise levels also would occur along access roads as vehicles and heavy equipment traveled to each site. Impacts to human health and safety from noise would be dependent upon proximity to the area of development and may need to be analyzed at the site-specific APD level.

Emergency Services

As noted in Section 4.17, Socioeconomics, development of the leases would result in limited employment increases and are not expected to affect service demand under any alternative. In previous years, natural gas revenues have provided funding for new infrastructure improvements such as new hospital facilities that in turn result in emergency service benefits. The relative amount of proposed development by alternative is used as an indicator of risk to emergency services in Section 4.2.1.4, Impacts by Alternative.

4.16.2.4 Impacts by Alternative

Alternative 1 (No Action Alternative)

Under Alternative 1, the BLM would take no action by continuing to administer the leases with their current stipulations. The potential exists for development of approximately 416 wells to be drilled from 60 well pads.

Health Impacts from Oil and Gas Development

Alternative 1 proposes development of 416 well on 60 well pads. There are no surface water or groundwater resources-specific stipulations under this alternative. The general NSO stipulations related to other resources would overlay up to 23 percent of CSWAP areas and 9 percent of SWPPs. None of the Rule 317B areas would be covered. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Well development would result in increased vehicle trips during construction and operations. With consideration of the entire 20-year development period, Alternative 1 would have an average of 8,449 daily vehicle round-trips (see **Table 4.16-1**). The majority of this activity would occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development.

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 416 wells would result in approximately 892 acres of initial disturbance and 387 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2 (76 percent), followed by Zone 3 (12 percent). Development in Lease Zones 1 and 4 would be less than 10 percent of the total disturbance.

Emergency Services

Development of 413 wells would result in revenues impacts that would be distributed across multiple different governmental sectors including but not limited to: Public Safety, Public Health, Parks and Recreation, and Transportation.

Alternative 2

Under Alternative 2, eight leases would be affected by minor changes to stipulations.

Health Impacts from Oil and Gas Development

Alternative 2 would result in the same level of development as Alternative 1 (416 wells to be drilled from 60 well pads). There would be no water resources-specific stipulations under this alternative; but general NSO stipulations related to other resources would overlay up to 23 percent of CSWAP areas and 11 percent of SWPPs. None of the Rule 317B areas would be covered. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All.

Transportation Safety

Stipulation changes would not affect the transportation scenario outlined under Alternative 1 and the risk would remain the same (see **Table 4.16-1**).

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Oil and gas development under Alternative 2 would result in the same amount of initial and long term disturbance as Alternative 1. The distribution of disturbance between zones also would be the same as Alternative 1.

Emergency Services

Impacts to emergency Services would be the same as Alternative 1.

Alternative 3

Under Alternative 3, the BLM would modify the existing leases to apply stipulations that match those identified by the Forest Service for future leasing in its Proposed Action (USFS 2014a). Under Alternative 3, approximately 413 wells would potentially be developed 59 well pads. The reduction in well numbers would be in Zone 3.

Health Impacts from Oil and Gas Development

This alternative would apply more NSO stipulations as compared to Alternatives 1 and 2, which would affect where wells and roads could be developed, particularly in related to water sources. The NSO stipulation to limit surface disturbance in Public Water Supply Source Areas would overlay up to 9 percent of CSWAP areas, 89 percent of the Rule 317B areas and 89 percent of SWPP areas. General NSO stipulations and CTL areas (outside of existing leases) would cover 88 percent of both CSWAP and SWPPs, and 92 percent of the Rule 317B areas. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Alternative 3 would result in a slight decrease in transportation needs relative to Alternatives 1 and 2 (due to decreases in Zone 3). As with Alternatives 1 and 2, the majority of transportation activity would occur in Zone 2, followed by Zones 3, 1, and 4, in order of level of development. With consideration of the entire 20-year development period, Alternative 3 would have an average of 8,378 daily vehicle

round-trips, resulting in a slight increase in transportation safety relative to Alternatives 1 and 2 (see **Table 4.16-1**).

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 413 wells under Alternative 3 would result in approximately 886 acres of initial disturbance and 384 acres of long-term disturbance. The distribution of disturbance between zones would be the same as Alternative 1.

Emergency Services

Revenues impacts benefitting Public Safety and Public Health would be based on development of 413 wells, a reduction in 3 wells as compared to Alternatives 1 and 2.

Alternative 4 (Proposed Action)

Under Alternative 4, the BLM would modify or cancel existing lease stipulations and availability decisions identified for future leasing in the 2014 Draft ROD. Under Alternative 4, approximately 383 wells would potentially be developed on 55 well pads. Lease modification and cancellations would occur in Zone 3. NSO, CSU, and TL stipulations would be the same as under Alternative 3.

Health Impacts from Oil and Gas Development:

With the combination of NSO lease stipulations and areas closed to leasing, 45 percent of CSWAP areas, 89 percent of the Rule 317B areas, and 98 percent of the SWPP areas would be precluded from surface disturbance. General NSO and CTL would cover 93, 92, and 99 percent of CSWAP, Rule 317B, and SWPPs, respectively. Health implications from oil and gas development are discussed under Section 4.16.2.3, Impacts Common to All Alternatives.

Transportation Safety

Alternative 4 would result in a substantial decrease in transportation needs in Zone 3 as a result of lease cancellations. The majority of transportation activity would occur in Zone 2, followed by Zones 1, 3, and 4, in order of level of development. With consideration of the entire 20-year development period, Alternative 3 would have an average of 7,767 daily vehicle round-trips (see **Table 4.16-1**). This would result in increase in transportation safety due to the decrease in traffic levels relative to Alternatives 1, 2, and 3.

Fire

Risk from oil and gas development is discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Development of 383 wells under Alternative 3 would result in approximately 821 acres of initial disturbance and 356 acres of long-term disturbance. The majority of the disturbance would occur in Lease Zone 2 followed by Zones 1, 3, and 4.

Emergency Services

Revenues impacts benefitting Public Safety and Public Health would be based on development of 383 wells, a reduction in 33 wells as compared to Alternatives 1 and 2.

Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled. For producing leases, this action is not within the BLM's authority to implement so it would be necessary to pursue judicial action. For the purposes of analysis, it is assumed that this judicial action would result in the cancellation of all leases. There would be no potential for future development within the 65 leases because all leases

would be cancelled. Leases currently in production would be plugged and abandoned and well pads and roads would be decommissioned and reclaimed.

Health Impacts from Oil and Gas Development

There would be no future development, because this alternative would cancel all the leases. However, there would be potential for short-term impacts to surface water or air quality to occur when the existing wells are plugged and abandoned, and existing facilities reclaimed. However, this disturbance would be temporary and limited to areas already disturbed by oil and gas development. Upon successful reclamation of disturbed areas, the impact to water resources would be expected to be minimal, approaching a condition better than the baseline that already had the disturbed areas. There would be no further impact to air quality.

Transportation Safety

Traffic associated with these plugging and abandonment of wells would result in approximately 54 total vehicle round-trips, stretched over a 25-day period, resulting in minor impacts similar to transportation safety.

Fire

Risk from oil and gas development discussed under Section 4.16.2.3, Impacts Common to All Alternatives. Risk of fire from general construction would be present when existing wells are plugged and abandoned, and existing facilities reclaimed, but all risk of well blowout would be eliminated.

Emergency Services

Alternative 5 would cancel all well production, thereby eliminating all lease-related revenue that might fund emergency services.

Summary of Impacts

Health Impacts from Oil and Gas Development

Compared to the No Action Alternative, Alternatives 2 through 5 would progressively minimize the potential for impacts to water and air resources inside the lease boundaries through lower levels of development and stipulations that would limit development near Public Water Supply Source Areas. Note that the increased leasing stipulations within the lease areas under Alternatives 3 and 4 may cause some disturbance to occur off-lease as compared to the No Action Alternative. The cancellation of 25 leases under Alternative 4 would minimize the risk to human health and safety relative to Alternatives 1, 2, and 3; Alternative 5 would minimize the risk to human health and safety to the greatest degree by cancelling all leases.

Transportation Safety

Alternative 1 (the No Action Alternative) and Alternative 2 would have equal average daily vehicle round-trips and total trips and would result in the highest potential for vehicle collisions. Alternatives 3 and 4 would produce slightly less impacts to transportation resources as a result of the potential development of fewer wells pads and associated wells. Alternative 5 would produce fewer impacts than Alternative 1 and the least of any alternative as all leases would be cancelled and lease-related oil and gas transportation would cease after reclamation.

Fire

Compared to the No Action Alternative, Alternatives 2 through 5 would progressively reduce the potential for human-caused fires, well fires, or explosions within the lease area due to reduced well development, lower levels of surface disturbance, and reduced vehicle and equipment use.

Emergency Services

In comparison to the No Action Alternative (and Alternative 2, which proposed the same level of well development), Alternatives 3, 4, and 5 would progressively reduce oil and gas development revenues that would benefit emergency services. Alternative 5 would eliminate all lease-related revenue that might fund emergency services.

4.16.3 Cumulative Impacts

4.16.3.1 Cumulative Impacts Analysis Area

The CIAA for human health and safety is the four lease zones as well as the regional road network (see **Figures 3.10-1** and **3.10-2**). This area includes multiple county roads currently serving existing oil and gas operations, as well as state and U.S. highways.

4.16.3.2 Past and Present Actions and Reasonably Foreseeable Future Actions

Past and Present Actions

Past and present actions are broken into three surface disturbing activities: mineral development, transportation corridors, and other development, such as ROWs for pipelines and telephone lines as well as other developments (see **Appendix B**). Oil and gas development may pose impacts to human health and safety as described in Section 4.16.2.3, Impacts Common to All. Past and present actions have associated transportation that has affected and continues to affect transportation safety on the local and regional road network, as represented in current collision and fatality rates.

Reasonably Foreseeable Future Actions

There are no additional oil and gas developments or other surface disturbing RFFAs proposed within the leases; however oil and gas development outside the leases would increase traffic along the regional road network (which is included in the CIAA). It is projected that 50,166 wells will be drilled within the BLM CRVFO, GJFO, and WRFO, producing approximately 4,681,210 round-trips during construction. Rio Blanco County has identified several proposed road improvements and mitigations to improve transportation issues related to continued oil and gas development.

There are approximately 6,000 acres of proposed vegetation and hazardous fuels reduction treatments within the CIAA (see Section 4.1 and **Appendix B** for more details on RFFAs).

4.16.3.3 Contribution of Proposed Action and Alternatives to Cumulative Impacts

Health Impacts from Oil and Gas Development: Cumulative impacts within the CIAA would be the same as described for the alternatives.

Transportation Safety: RFFAs would produce approximately 4,681,210 round-trips during construction Development of the WRNF leases would contribute less than 1 percent to the cumulative transportation needs associated with oil and gas development in the region. Road projects, such as slated improvements to CR-5 in Rio Blanco County, would enhance travel safety.

Fire: Within the CIAA, 6,000 acres of proposed vegetation and hazardous fuels reduction treatments would provide countervailing impacts to human health and safety by addressing vegetative conditions that may lead to the uncontrolled spread of fires.

Emergency Services: There are no additional RFFAs proposed within the cumulative impacts CIAA. Cumulative impacts to emergency services would be the same as described for the alternatives.

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4.17 Socioeconomics

4.17.1 Analysis Assumptions and Approach to Analysis

4.17.1.1 Analysis Area

The affected region for the socioeconomic analysis consists of Garfield, Mesa, Pitkin, and Rio Blanco counties. The analysis focuses on the four counties as important governing jurisdictions and primary representative units of sub-regional economies. The counties also are important governmental entities responsible for planning and providing many public facilities and services.

The analysis evaluates the socioeconomic impacts for the communities surrounding the leases that would be expected to have the strongest socioeconomic relationships with projected future development activities and area resources. The local communities addressed for impacts to socioeconomics focuses on Parachute, Rifle, Silt, New Castle, Glenwood Springs, and Carbondale located in Garfield County, as well as the small community of De Beque in Mesa County. While other cities also could be affected by the leasing and future mineral development, they either have only a very limited potential relationship with natural gas activities (e.g., Meeker in Rio Blanco County) or are larger and more economically diversified cities (e.g., Grand Junction and Aspen) whose economic impacts are considered within the county level analysis. Due to the nature of some impacts and data limitations, not all socioeconomic impacts are evaluated at the local level.

4.17.1.2 Scoping Issues

The following socioeconomic issues and perspectives were raised during public scoping:

- Lease cancellation may negatively impact local economies by loss of jobs, tax revenues or affordable health care and emergency facilities supported by natural gas companies.
- Lease cancellation would result in a loss of extraction industry jobs and also related natural gas support service jobs.
- Cancellation of leases will have negative impacts on lessees and mineral owners, as well as any lessees and mineral owners on adjoining private lands.
- Compensation for cancelled leases should not only consider the lease value, but also include other factors such as compliance with NEPA and permitting, rental and royalty payments, expended capital and operational costs, and other investment losses.
- Concerns were raised on leases' long-term profitability and the financial impact to local government services (e.g., law enforcement, social and health services).
- The region may not be able to support transient workers housing and local services' needs and may experience adverse impacts to its social fabric from traffic, industrialization, air, water, and noise pollution.
- Natural gas employment gains may be temporary and less than job losses in the region's tourism, grazing, and other natural resources dependent industries.
- Local communities rely on outdoor recreational resources that could be negatively impacted by natural gas lease activities' impacts (e.g., traffic impacts, environmental degradation, and reduced access). Many commenters are concerned that jobs and businesses in the recreation industry and related businesses that depend on the region's natural resources could be jeopardized by oil and gas development.

- Communities such as Carbondale, Rifle, Silt, and New Castle have long marketed the abundance of WRNF's outdoor recreation opportunities to attract visitors and new residents. Many commenters are concerned that increased traffic volumes, noise, and pollution would change the character of the tourism destinations, deter visitors from coming to the area, decrease property values and diminish of the area's rural character.

4.17.1.3 Assumptions

The cost and revenue values of specific monetary transactions generally depend on a variety of considerations and factors. In addition to the effects of overall supply and demand conditions, the location, timing and quantities of the goods or services being exchanged can affect the actual expense paid or sales price obtained. As a result there is uncertainty inherent in the projections of future socioeconomic conditions and outcomes. Therefore, the socioeconomic impact analysis evaluates the potential leasing and development impacts on the region's economy by using average values, prices and quantities for the key factors being analyzed. The indirect and induced economic effects of future spending changes (e.g., from construction spending for the region or added government revenues) are estimated by input-output analysis using static prices and other model assumptions. These modeling assumptions will inevitably differ from the future economic reality as prices (e.g., oil and gas) are volatile which influences demand, substitution, regional economic structure, technological change, etc. The analysis is not forecasting outcomes (i.e., prices, production, or consumption) as such, but instead modeling regional economic impacts between the alternatives given on the noted and common assumptions. Consequently, this analysis is not a prediction of the future but rather an evaluation and, where possible, an estimation of how the alternatives will each impact the regional economy given the specific and commonly applied assumptions.

Additional analysis and discussion on the socioeconomic analysis's approach and assumptions is provided in **Appendix C**.

<u>General Assumptions</u>

The following general assumptions and approaches are used for the socioeconomic analysis:

- The type and magnitude of potential socioeconomic impacts on the region's other economic sectors from leasing and development depends primarily on the nature and extent of the interrelationships between the other economic sectors and the natural gas production activity within the leases under consideration.
- Published data, analysis, and lessees' past and projected future natural gas activities, employment, and development costs are used to assess the economic, demographic, community service, fiscal, and social consequences under each alternative.
- When necessary, available published data or professional judgment is used to determine the major subcategories of well development costs (e.g., labor, materials, equipment, and construction management) and local supply availability necessary for IMPLAN analysis.
- The IMPLAN modeling assumes that current relationships between sectors and county economies will remain constant in the future.
- Work force access and deliveries of materials and equipment to well sites will use the identified routes described in Section 4.10 and otherwise generally conform to the transportation impact analysis findings.
- Key indirect resource effects (e.g., annual recreation use levels and patterns; average rangeland carrying capacity changes) are characterized based on the findings of their corresponding impact analysis sections in this EIS. If the resource impacts have only been qualitatively

analyzed, then analysis of their socioeconomic values or effects can only qualitatively analyzed by the socioeconomic impact analysis.

- This analysis only considers construction and production that might occur during the 20-year time period of 2017 to 2036.
- If a lease is cancelled, the underlying mineral resources would nonetheless remain and would be available for potential future extraction.
- All values are in 2014 dollars.

Well and natural gas production assumptions are based on Chapter 2.0, Section 2.7.

Specific Assumptions

Analysis assumptions generally tend to be simplified so that the future socioeconomic impacts can be more readily identified without being overestimated and overstated. Consequently, many production assumptions will be based on straightforward geographic relationships and typically not factor in potential "economies of scale" or other site-specific considerations.

Natural Gas Development/Production Activity

- Exact well locations are unknown. This analysis attributes future well locations corresponding with each lease's acreage within the different counties. As such, lease stipulations might impact the number of potential wells that could be drilled but are assumed to have no impact on expense of drilling or operations.
- Almost all projected horizontal wells are projected to occur in Mesa County. Therefore, for purposes of the socioeconomic analysis, it is assumed that all of the horizontal wells would occur in Mesa with no horizontal drilling projected to occur in Garfield, Pitkin, or Rio Blanco counties.
- While 116 acres of the lease area are located in Gunnison County, no lease has greater than 7 percent in Gunnison County. Therefore, for purposes of the socioeconomic analysis, it is assumed that no drilling would occur in Gunnison County.
- This analysis assumes that all drilled wells will be viable for development as long-term production wells.
- New well construction would begin in 2017 and would continue at a constant annual rate over the 20-year period.
- Directional wells and horizontal wells are expected to produce a total of 1.2 Bcf and 6.4 Bcf, respectively. This production is expected to be constant over the expected 20-year operating lifespan, and each directional well is expected to produce 60 MMscf/yr and each horizontal well is expected to produce 320 MMscf/yr.
- The number of wells will not impact the amount of natural gas each well produces.
- The existing 75 wells currently in production would continue to operate until 2026 under Alternatives 1 through 4. These wells began producing between 2002 and 2012 and are conservatively assumed to have the weighted average start date of 2007. As each well is assumed to produce 1.2 Bcf over the course of its lifetime and is assumed to have produced 0.6 Bcf by 2017, the combined future production of the 75 wells is assumed to be 4.5 Bcf/yr for the remaining 10 years of their operating life. However, since the existing well production is part of the existing conditions for the Alternative 1 (No Action Alternative), only new well production is analyzed in the socioeconomic impact analysis for Alternatives1 through 4. Consequently, existing well production is only recognized as an economic loss under Alternative 5, which would cancel all well leases and close all 75 existing wells.

Natural Gas Development/Production Costs

- Average employment for construction of each well is 3.5 man-years and 10.5 man-years for directional and horizontal wells, respectively (BBC Research and Consulting [BBC] 2014).
- One well pad would include seven wells of any type and require an average of one mile of road (2010 WRNF RFD). Each mile of new road construction is expected to generate 3.1 job-years (SGM 2012; American Recovery and Reinvestment Act 2009).
- An estimated 200 and 800 full time equivalents (FTEs) are created respectively for every 1,000 producing directional and horizontal wells (BBC 2014).
- As a result of the region's past history of natural gas development and its current labor supply conditions, future labor sourcing is assumed to be 80 percent local resident and 20 percent non-local employment. Non-local workers would likely consist of both specialized skill employees and less skilled general laborers that would be needed for specific tasks or on a short-notice/ short-term basis (BLM 2015e).
- Some of these workers (especially the more skilled workers) may be interested and willing to relocate to the area. However, for the purposes of the socioeconomic analysis, it is assumed that all non-local workers might represent the development-related transient labor attracted to the region.
- Conversely, only a minor proportion (10 percent) of the development-related equipment or material spending is expected to originate within the region. Consequently, a 10/90 local/ non-local purchasing ratio for both equipment and materials is expected. The majority of the local economic benefit will likely result from in region value added from assembly or final manufacturing of equipment and materials. On-site consumption of natural gas also would account for a major proportion of development-related construction spending in the region (BLM 2015e).
- The 75 currently producing wells would either be abandoned after the decision is made in the ROD (assumed 2016) or once production has stopped (estimated 2026). As the action would be required in all alternatives at a similar future expense, these costs are not included in the analysis.

Future Natural Gas Revenues

- Natural gas production increases from the 65 leases under consideration would not influence future regional natural gas prices.

Government Revenues

- Direct county and local government agency revenues resulting from the future natural gas production in the lease area (i.e., federal mineral lease, severance and property taxes) are assumed to be comparable to the revenue generation rates from past regional natural gas production.
- The Office of Natural Resource Revenue collects 12.5 percent royalties from mineral extraction on federal land, of which almost 20 percent (2.45 percent gross) is assumed to be paid to the county where the well is located.
- Counties and local communities tax natural gas production at different mill levies. The socioeconomic analysis compares natural gas sales to the estimated property tax collected from natural gas revenues to project the future property tax revenues for every new dollar of natural gas sales (**Table 4.17-1**).

Table 4.17-1 Estimated Property Taxes and Severance Tax Rates (2012)

Area	Property Tax on County Production	Severance Tax Direct Distribution on Total Colorado Production
Four-county Region [1]	1.84%	0.11%
Garfield County	1.74%	0.05%
Mesa County	4.89%	0.04%
Pitkin County [2]	1.10%	0.01%
Rio Blanco County	1.10%	0.01%
Local Communities [3]	0.93%	0.04%

[1] Regional total only includes county governments.

[2] Pitkin County currently has no natural gas production. Pitkin's future property tax and severance tax rates are assumed to be the same as Rio Blanco County.

[3] Includes nearby school and special districts as well as the communities of Parachute, Rifle, Silt, New Castle, Glenwood Springs, Carbondale, and De Beque.

Source: Leeds 2014a.

- County severance revenues are indirectly tied to natural gas production in the county and severance is only paid for a particular well if the local property tax levies are less than 58 mills (Leeds 2014b). As a result, since Mesa County has an average levy greater than 58 mills it generates little to no severance taxes for Colorado, but does receive severance tax revenues from the state. **Table 4.17-1** shows the estimated direct distribution of severance tax percentage expected to be paid to the counties.
- The federal government pays "Payments in Lieu of Taxes" to local governments to help offset losses in property taxes from non-taxable federal lands. Payments in Lieu of Taxes are not expected to change as a result of the EIS alternatives and outside the scope of this document.
- Some or all of the leases may be canceled due to the new stipulations by BLM request or election by the lessee. Cancellation would occur through a BLM administrative process and would require that the BLM refund any bonus bids and lease payments. Should the lessee not accept the new lease stipulations on a producing lease, it may be necessary for the BLM to request judicial action to cancel the lease and determine any compensation due to the lessee. Any repayment expense is expected to be paid by the BLM and State of Colorado but is not expected to be passed on to the counties.
- If an Alternative (e.g., Alternative 4) cancels part of a lease, the BLM would refund any bonus bids and lease payments of this specific acreage. While a lease pad requires about 10 acres of initial surface disturbance, the locations may still not allow a lease pad. It is assumed that all leases with less than 100 acres remaining will be completely cancelled. In these cases, it is assumed that 100 percent of the parcel's bonus bids and lease payments will be refunded.
- Refunds are only based on the reduction in total acreage, While Alternatives 2 to 4 are expected to reduce production of certain parcels compared to Alternative 1, only under Alternative 4 limited refunds are expected to occur.

- County revenue generated from natural gas is expected to support current jobs and potentially generate new jobs. Based on the Garfield County 2012 Financial Report, the analysis assumes that 50 percent of the revenue will be retained as "Reserve Funds." The remainder is expected to be used for capital projects or services: road construction (7.5 percent); public building maintenance and repair (12.5 percent); other local government services (e.g., community development, airports and water) (15 percent); and county or program staff salaries (15 percent).

4.17.1.4 Impact Indicators Used for Analysis

Impact indicators for socioeconomic impacts are based on the key economic variables including total employment, income/spending changes, royalties, and taxes associated with mineral extraction. Changes in the key economic variables are used to determine the following impacts in the region.

- Socioeconomic impacts in the context of the region's past, current, and projected future natural gas development, construction, and operations.
- Potential effects on other users of the analysis area (e.g., grazing permittees and recreationists) from future natural gas development.
- Effects of temporary work forces on:
  - Local housing and labor market conditions;
  - State and local government revenues and demand for public infrastructure and services; and
  - Social conditions in the study area, particularly in and near the neighboring communities of De Beque, Parachute, Rifle, Silt, New Castle, Glenwood Springs, and Carbondale.
- Other potential development-related effects on local attitudes, opinions, and lifestyles (e.g., sense of place).

4.17.1.5 Methods of Analysis

The socioeconomic impact analysis quantifies the spending and employment associated with the projected future natural gas activity in the lease area under each alternative. Alternative 1 (No Action Alternative) would allow the leases to continue to be developed with the minimum number stipulations and consequently would result in the highest level of natural gas production activity in the region.

The socioeconomic impact analysis also estimates future annual natural gas production quantities, their expected sales value and net revenue effects on county and local government budgets from changes in royalties, fees and taxes. These projections are primarily intended to be descriptive of the various alternatives and to facilitate comparisons between their effects. The projections are not meant to be predictive of future socioeconomic conditions as there are numerous other important factors that also will affect the type and extent of future natural gas industry conditions.

Most of the other socioeconomic impacts are analyzed qualitatively or unassessed if there is insufficient information or unknown causal relationships to attribute future outcomes to the Alternatives. For example, many local residents have expressed concerns that future project-related natural gas production would decrease the attractiveness of the region's wilderness and natural resources to tourists or potential new residents which in turn could adversely affect the region's economy and property values. However, in the absence of demonstrable links between the development-related activities, regional wilderness resources, local tourism industry and real estate demand it would be speculative to attribute future property price effects to the Alternatives' varying expected future natural gas production levels.

The methods of analysis for socioeconomics include the following steps.

- Determine the proposed magnitude and timing of project construction, employment (construction and operations) and expenditure estimates of the lessees' future natural gas activity (as determined through the RFDS) for economic impact modeling.
- Compare the fiscal implications of the lease changes under different alternatives quantitatively, if possible, using the projected economic impacts to the government from continuing, cancelling, or modifying the leases that would be developed.
- Estimate the short- and long-term economic effects (jobs and income) using IMPLAN economic modeling to assess indirect and induced employment and income effects of development, with emphasis on the construction period activities and potential compensation transfers from federal, state, and local agencies.
- Apply IMPLAN modeling to estimate indirect and induced economic effects of expected future regional spending changes (e.g., from new well construction and increased government revenues).
- Assess the implications of oil and gas development on community, population, housing, public facilities and services, public education, and social conditions in the region using cost and IMPLAN modeling results.
- Model major state and local revenues (e.g., federal mineral lease payments and ad valorem taxes during operations) from with the capital investment and labor force income under each of the alternatives.
- Complete a qualitative assessment of the effects of the alternatives on county, municipal, and school district fiscal conditions based on the projected incremental changes in demands on public services, staffing requirements, facilities and other key governmental expenditure functions.
- Qualitatively discuss local social conditions focusing on the nearby communities and other users of public lands near the analysis area.
- Assess the development-related effects in the context of the cumulative long-term effects of other reasonably foreseeable development in the region. Detailed quantitative analysis of the cumulative scenario may be limited due to the expected lack of detailed data or speculative nature of other energy, mineral and community development projects.
- Analyze job impacts in terms of FTE. Consequently, a part-time job or seasonal employment would be represented as a fractional FTE value.

4.17.2 Impacts Common to Alternatives 1 through 4

Identifying lands as open to natural gas leasing would have no direct impacts on socioeconomic resources. Any effects of potential future development would be indirect and only measureable at the time of lease sale and once lease development subsequently occurs. Indirect impacts could occur from reasonably foreseeable development that could impact natural gas revenues, local government revenues, recreation, grazing, commute patterns and social conditions (e.g., local resident's quality of life and sense of place).

Stipulation Protections

NSO stipulations would prohibit site development on certain areas, minimizing impacts to both big game production areas used for hunting and livestock grazing allotments. By avoiding development to these lands, future usage of these lands for both recreation and grazing would continue unchanged. The extent

to which protected grazing and recreation use contribute to the regional economy would determine the extent to which the stipulations protect the region's socioeconomic resources.

NSO stipulations would prohibit specific areas from future drilling activities and therefore reduce the area available for future well site development. This could have adverse impacts on the future natural gas revenues due to higher costs of development compared to vertical wells and may have negative economic impacts for the region.

CSU and TL also would provide some protection to recreation, grazing and transportation, and socioeconomic resources, but not to the same extent as NSO stipulations.

Impacts from Projected Future Natural Gas Development

Natural Gas Production

Currently, there are nearly 15,000 operating natural gas wells within the four-county region (COGCC 2015g). In 2014 these wells produced more than 700 Bcf of natural gas (**Table 4.17-2**). Under the No Action Alternative 1, an average of over 200 new wells are expected to operate for the entire time between 2017 and 2036, which are anticipated to produce on average slightly more than 15 Bcf of natural gas annually. Although this additional natural gas would be equivalent to only 2 percent of the region's current (2014) production, Alternative 1's projected new natural gas production would result in approximately a 31 percent increase to Mesa County's current natural gas production levels.

Table 4.17-2 Current and Projected Future Regional Natural Gas Production - Alternative 1

Area	Current Natural Gas Production (2014)		Future Average Annual Natural Gas Production (2017-2036)	
	Wells [1]	Bcf [1]	Wells	Bcf
Colorado	53,400	1,572.4	218.6	15.6
Four-county Region	14,961	709.4	218.6	15.6
Garfield County	10,975	596.1	70.9	4.3
Mesa County	1,065	33.5	129.0	10.2
Pitkin County	0	0.0	13.5	0.8
Rio Blanco County	2,921	79.9	5.3	0.3

[1] This includes all natural gas wells that were productive as of March 2015.

Source: COGCC 2015g; USFS 2010a.

Natural gas production for Alternatives 2 through 4 would be similar to Alternative 1. Alternative 2's future production would be effectively the same as would occur under Alternative 1 (No Action Alternative). Alternatives 3 and 4 are projected to result in future total natural gas production that would be 1 and 7 percent, respectively less than that which would occur under Alternative 1. See Section 4.17.4 for more information.

Recreation Impacts

Recreation within the region and more specifically WRNF is an important component of the regional economy. Non-local recreation visitors contribute to the region's economy by their spending at local hotels, restaurants and other tourism related businesses (e.g., outfitters and guides). For every 1,000 non-local hunting and fishing visits, an estimated 1.4 jobs and $51,000 in labor income is generated in the region's economy. Similarly, for every loss of a 1,000 non-local hunting and fishing

visits, a loss to the region's economy of 1.4 jobs and $51,000 of labor income also would be expected (USFS 2014a).

Recreation use by local residents also can directly benefit the regional economy. However the economic impacts of local hunting and fishing use are more limited since local users will generally spend less on food and lodging within the region. If 1,000 local hunters and fishermen chose to hunt or fish outside the analysis area, 0.2 jobs and $8,000 would be lost within the region's economy (USFS 2014a).

Due to the lease areas more remote locations within WRNF and the mostly undeveloped character of the locations, the area's recreation consists of dispersed recreation activities (hiking, hunting and fishing). The current recreation use levels within the lease areas cannot be quantified. However, the majority of WRNF's recreational opportunities and use occur in WRNF's more eastern or northern areas. As a result, the majority of economic activity from WRNF-related recreation use also is associated with the recreation use in those other areas of the WRNF.

As discussed in Section 4.13, Recreation, the future oil and gas development activities would result in an initial surface disturbance of up to 892 acres and long-term surface disturbances of 387 acres within WRNF. As a result, future well development would directly affect only a very small portion of the assigned lease areas and an even lesser proportion of the WRNF.

The areas disturbed by the future well development activities would likely be incompatible and inaccessible for recreation use. While the lost acreage will reduce the total area available for recreational use, for WRNF visitors it will represent a negligible decrease in recreation access and opportunities. Beyond those areas little if any direct adverse effect on recreation use or the quality of the recreational experience can be attributed or expected. Few of the area's recreational users may be expected to physically interact with the future well development sites and those that do would likely be able to relocate and distance themselves from the well sites with little effort and limited inconvenience. As a result, in the absence of any expected negative effects within the area resulting in reduced use or degraded recreation experience, WRNF's future recreation use and its contribution to the region's tourism economy would be expected to remain unchanged.

Although it may be considered highly unlikely (especially due to the proposed stipulations), the area's hiking, hunting and fishing use could be altered if physical changes from the future well development noticeably change the area's landscape and habitat conditions. If the well development decreases hunting and fishing use and associated spending, outfitters, guides and area businesses dependent on hunting and fishing could be affected. The resulting income loss to these businesses could be expected to result in lower employment and income for the region's economy.

However, it is important to note that recreation user displacement from the lease area will not necessarily result in lost recreational use and spending if there are available substitute locations and opportunity for them. Although no carrying capacity analysis is available for the area and licensed guides have limited and designated use areas, even if some recreational use is displaced by the future well development activities, most of that use could likely be readily accommodated nearby within WRNF or elsewhere in the region.

Due to the lack of recreational use information for the lease areas, it is not possible to estimate the potential number and type of recreational use days that could be at risk of displacement and therefore estimate the magnitude of any related potential economic impacts to the outdoor tourism businesses. Nonetheless, while the job and income increases with the alternatives' natural gas development activities can be estimated, these should not necessarily overshadow the value of user experience provided by recreation on National Forest and Public Land Systems' lands and its contribution to the region's economy. With more wells and an absence of actions that support recreation opportunities a decrease in the value of experience for some users relative to the other alternatives could occur.

Grazing Impacts

As discussed in Section 4.12, Livestock Grazing, the future oil and gas development activities would result in an initial surface disturbance of up to 892 acres and long-term surface disturbances of 387 acres within WRNF. The total amount of surface disturbance would equate to a loss of 74 AUMs for short-term disturbance and 34 AUMs for long-term disturbance. While Alternative 2 would have similar impacts, impacts to Alternatives 3 and 4 would be slightly less than those described above. In comparison to the overall size of the region's grazing resources the small loss of AUMs could potentially be absorbed by other grazing lands that are currently underutilized.

In the unlikely event that other underutilized substitute grazing lands are unavailable, conservatively assuming a typical 4-month grazing season, the short–term loss of 74 AUMs would represent at most a carrying capacity reduction of 18.5 beef cattle. The corresponding potential long-term loss of 34 AUMS would represent at most a carrying capacity reduction of 8.5 beef cattle. In both cases, the AUM loss would likely be shared between several ranchers.

The economic cost to those ranchers is best represented by their net cost for an alternate substitute grazing lease (or feed) or possibly their net revenue (profit) loss for their reduced cattle. While the grazing loss would have a negative cost impact to the affected ranchers, the limited size of the reduction would not be expected to reduce the overall viability of their livestock operations. Consequently, the economic impact would be limited to the direct net cost/revenue effect on their livestock operations which in turn would have a negligible effect on the regional economy.

Transportation Impacts

As discussed in Section 4.10, the increase in average daily trips along the area's roads will be highest during well construction. The majority of added vehicles will be light trucks (for workers) followed by heavy truck traffic and to a much lesser degree, over-sized vehicles. Alternatives 1 and 2 are expected to result in the greatest traffic volume increases. Since the most development is projected for Zone 2, it also is expected to have the highest increase in traffic.

Along the analysis area's likely affected highways, its future traffic volumes would not be substantially higher than current levels as a result of the anticipated additional traffic generated from well development. Lease-related oil and gas development traffic is expected to increase by an average of 72 daily vehicle trips per well. The traffic growth may be expected to add vehicle use along sections of SH-13, SH-133, and SH-82 as well as US-6 and possibly I-70. Based on these roadways' current traffic levels, the increased traffic from the oil and gas development would have a negligible effect on travel conditions. Given the absence of any change in these roadways travel conditions, no effects on visitor or local residents use would be expected and consequently, no changes to these individuals' behavior or spending would occur. Therefore, given the negligible traffic increases on these roadways, no traffic related economic effects on the local communities or the regional economy would be expected.

While this traffic volume may not cause traffic congestion by itself, the additional truck traffic, noise, and dust may be easily noticed in rural areas. Although the roads in Zones 3 and 4 are projected to be only lightly used by heavy truck traffic for oil and gas development and production, these roads serve mostly recreation users and homeowners. As a result, traffic impacts from additional oil and gas development along potential haul routes (such as Four-Mile Road [CR-117] and Thompson Creek Road [CR-108] would be more noticeable. Impacts to these rural roads could include temporary conflicts with normal traffic, causing travel delays, decreased travel speeds, and increased vehicle collision rates with other vehicles and/or with wildlife.

The increase in vehicle traffic also could negatively impact the quality of life for those living in the vicinity of the development and particularly those that live along more frequently use travel routes. It is possible that in some cases, increased oil and gas traffic could potentially result in noise, dust and/or degraded

travel conditions that could reduce for some residents or individuals the area's attractiveness and desirability. In such cases this also could possibly result in some negative impacts to specific property's real estate values - at least during the period that elevated traffic levels from new well construction occur.

Social Impacts

None of the alternatives would be expected to reduce economic diversity (the number of economic sectors) or increase economic dependency, which occurs when the local economy is dominated by a limited number of industries. Shifts in emphasis could occur, but these would not be the result of any of the alternatives.

While the alternatives have the potential to affect local businesses and individuals, the relative contribution and the relative differences between the alternatives would not be large enough to have any measurable effect on economic diversity or dependency.

Estimates of the levels of employment and labor income that would be supported by the alternatives are based on projected new wells construction and subsequent natural gas production. Estimated average annual employment and labor income changes from natural gas development activities are summarized below for each alternative in the discussion of natural gas development impacts. The employment growth from the future oil and gas development is expected to be relatively limited with at most a minimal influx of temporary workers or new migrants. Given the very small number of the new job opportunities, the new employment and residents would not be expected to change the character or composition of the local county or surrounding local communities.

The components of quality of life can differ amongst individuals, however generally many components relate to income, employment and job satisfaction, affordable housing, health, food, culture, surrounding land uses, and amenities such as recreation and views. Impacts to quality of life can be perceived differently by individuals in part due to what they value and prioritize. Consequently, federal resource management decisions, such as this project can be perceived to impact quality of life differently.

Besides the quality of life effects related to changes associated with employment, population, and housing, there are perceptions of change to quality of life that may occur from growth and change, in general, of the kind that would occur under all of the development alternatives. These effects may be perceived as occurring because of attitudes toward oil and gas development held by particular communities and groups; they may be felt independent of the level of change to the economy and other factors.

In Garfield County, the commonly held perception that the county is split between the economic and social values of the western part of the county (where the energy industry is prominent) and the eastern part of the county (which has a greater focus on resort and nature tourism) would likely be reinforced by any of the development alternatives.

Across the region, a period of noticeable oil and gas development may be associated with the perception of a decline in public safety, which might occur independent of crime statistics. Similarly there may be a perception of decline in air and water quality. Each of these concerns would have an adverse effect on assessments of quality of life. Concerns such as these tend to be associated with the prominence of individual incidents and not necessarily correlated to an underlying growth or environmental trend.

The increased oil and gas development will likely be viewed unfavorably by many residents while others may appreciate its job creation and increased local spending. For residents concerned about the potential adverse impacts to regional and local air quality, water and other natural resources, less new oil and gas development will be preferred.

While most of the region's residents may have limited (if any) direct experiential interaction with the increased oil and gas development or its effects, they may nonetheless feel a related decrease to their quality of life and/or sense of place. These residents will likely perceive that any increase in oil and gas development will result in a corresponding decrease to the region's environmental/ecosystem integrity and natural wilderness and rural character. Accordingly, these individuals will prefer less new oil and gas development.

For groups having a strong identification with the historical character of northwestern Colorado, whether based on deep local roots or as part of an adopted value structure, the presence alone of the natural gas industry raises concerns about loss of traditional characteristics and access to traditional resources. Either actual change from the development alternatives or just a feeling that change may affect traditional values is a negative influence on such a group's perception of the quality of life. Some of the cultural attributes of this traditional value structure are the open space and low land cost for with traditional ranch agriculture and rural living, undeveloped, accessible land for hunting and fishing, and traditional rural and public lands landscape.

4.17.3 Impacts by Alternative

Each alternative's different stipulation requirements would result in changes in the future natural gas production activity and additional production costs; however, this socioeconomic analysis does not try to individually evaluate or determine the feasibility of future lease development. Instead, the analysis uses the development assumptions presented in Section 2.6.4. For the purpose of the EIS analysis, it is assumed that all the initial exploratory wells will be adequately productive to be developed as a production well as a conservative assumption to represent the maximum extent of future lease development and production. However, if an exploratory well proves to have limited production potential so that it is not economically feasible for future development, that lease's future natural gas production (and correspondingly any related lease development benefits or impacts) would be expected to be similarly reduced.

Any additional stipulation-related construction or production costs are generally expected to be absorbed by the operators (which may result in slightly reduced government revenue payments). The analysis also does not analyze the leases individually but focuses instead on average expected costs and government revenues. The analysis does not expect there would be any major overall increase in leaseholders' development or production costs. If there were overall increase in production costs, this would reduce the amount of pre-tax revenue, leading to reduction in government tax revenues.

Table 4.17-3 below provides a summary of the average annual production values over the 20-year study period between 2017 and 2036. Consequently, the average annual values shown in the table correspond approximately to the expected 2027 production conditions for the number of operating wells, gas production, revenue, employment, and county revenue. Production levels would be higher during the period from 2028 to 2036. Currently, there also are 75 existing wells in operation that would continue to produce under all Alternatives except for Alternative 5 through 2026.

Table 4.17-3 Annual Average Values by Alternatives (2017-2036)

Factor	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5[1]
New Well Construction (wells/yr)	20.8	20.8	20.7	19.2	0.0
Natural Gas Production (Bcf/yr)	15.6	15.6	15.5	14.4	-4.5
Sales Revenue ($ Million/yr)	$79.0	$79.0	$78.5	$73.3	-$18.8
Direct Employment (FTE/yr)	137.6	137.6	136.7	127.0	-15.0
Revenue to Counties ($ Million/yr)	$5.7	$5.7	$5.6	$5.4	-$1.4

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown for Alternative 5 are solely for the 2017-26 loss in natural gas production.

Table 4.17-4 provides the total natural gas produced for the region and each county individually for each Alternative. **Table 4.17-5** shows the percentage change for each Alternative compared to the Alternative 1 (No Action Alternative) baseline. There is no change between Alternatives 1 and 2 and only a very minor overall decrease in future production under Alternative 3 of less than 1 percent. Future natural gas production under Alternative 4 is projected decrease by only 7 percent when compared to Alternatives 1 and 2 future production levels. Alternative 5 would result in a comparative production loss not only due to abandoning 75 wells that are currently producing, but also from not developing the new wells that would be constructed under the No Action Alternative.

Table 4.17-4 Total Future Natural Gas Production by County (2017-2036)

Location	Total Gas Production (Bcf) (2017-2036)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5[1]
Four-county Region	311.5	311.5	309.6	288.9	-45.0
Garfield	85.1	85.1	87.8	81.8	-9.6
Mesa	203.9	203.9	199.6	199.7	-35.4
Pitkin	16.2	16.2	15.9	0.7	0.0
Rio Blanco	6.3	6.3	6.3	6.3	0.0

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown for Alternative are solely for the 2017-26 loss in natural gas production.

Source: USFS 2010a.

Table 4.17-5 shows the percentage change for each Alternative compared to the Alternative 1 (No Action Alternative) baseline. There is no change between Alternatives 1 and 2 and only a very minor overall decrease in future production under Alternative 3 of less than 1 percent. Future natural gas production under Alternative 4 is projected decrease by only 7 percent when compared to Alternatives' 1 and 2 future production levels. Alternative 5 would result in a comparative production loss not only due to abandoning 75 wells that are currently producing, but also from not developing the new wells that would be constructed under the No Action Alternative.

Table 4.17-5 Percent Change in Total Future Natural Gas Production Compared to Alternative 1

Area	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Four-county Region	0.0	-0.6	-7.4	-114.4
Garfield	0.1	3.2	-3.8	-111.3
Mesa	0.0	-2.1	-2.1	-117.4
Pitkin	0.0	-1.7	-95.7	-100.0
Rio Blanco	0.0	0.0	0.0	-100.0

4.17.3.1 Alternative 1 (No Action Alternative)

Alternative 1 is the No Action Alternative, which would reaffirm leases with current stipulations. Under Alternative 1, the BLM would take no action by continuing to administer the leases with their current stipulations. Those leases that are currently under suspension would be reaffirmed and could be developed at the discretion of the lessee.

Impacts from Future Natural Gas Development

Based on the Reasonable Foreseeable Development Scenario, Alternative 1 is projected to add a total of 416 new wells across the four counties over the next 20 years. The majority of the new wells, and most of the new surface disturbance, would occur in Mesa County (246 wells).

Impacts from New Well Construction and Production Operations

Over the 20-year analysis period, future lease development within the four-county region is expected to produce a total of 312 Bcf in natural gas with estimated revenues of approximately $1.6 Billion (**Table 4.17-6**). On average 20 directional wells and one horizontal well are expected to be constructed each year. Future new natural gas production from the leases would initially begin at 1.5 Bcf per year in 2017 and increase to 29.7 Bcf annually in 2036.

Table 4.17-6 Natural Gas Production in the Four-county Region - Alternative 1

Time Period	New Well Construction			Operating Wells	Natural Gas	
	Directional	Horizontal	Total		Production (Bcf)	Revenues ($ Million)
2017	19.9	0.9	20.8	20.8	1.5	$4.3
2036	19.9	0.9	20.8	416.4	29.7	$172.9
Total (2017-2036)	398.4	18.0	416.4	416.4	311.5	$1,580.4
Annual Average	**19.9**	**0.9**	**20.8**	**218.6**	**15.6**	**$79.0**

As seen in **Table 4.17-7**, nearly two thirds (65 percent) of this future natural gas production is expected to occur in Mesa County. The future value of natural gas produced from Mesa County is expected to be approximately $1.0 billion dollars. Garfield County would be the other primary production location with more than a quarter (27 percent) of the total future production coming from wells within its jurisdiction. Together Pitkin and Rio Blanco counties would produce a total of 22 Bcf that would account for the remaining 7 percent of the total natural gas production.

Table 4.17-7 Natural Gas Production by County - Alternative 1

Area	Total New Wells	Production (Bcf)	Sales Revenues ($ Million)
Garfield	135.0	85.1	$431.6
Mesa	245.7	203.9	$1,034.8
Pitkin	25.7	16.2	$82.2
Rio Blanco	10.0	6.3	$32.0
Four-county Region	**416.4**	**311.5**	**$1,580.4**

Figure 4.17-1 shows the number of wells constructed and the total number of producing wells on an annual basis between 2017 and 2036.

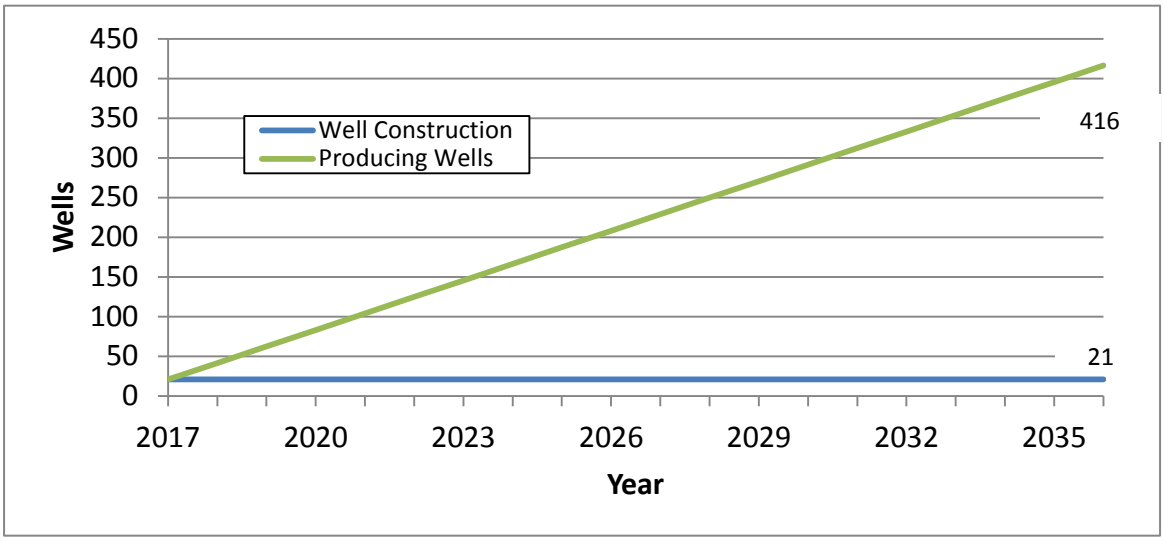

Figure 4.17-1 Projected New Well Construction and Operating Wells (2017-2036)

Under Alternative 1, future well drilling and natural gas production is expected to create an average annual direct employment of approximately 138 FTEs in the four-county region. Over the entire 20-year analysis period, the oil and natural gas development is projected to generate a total of 2,751 job-years of direct employment.

Table 4.17-8 shows the estimated future direct, indirect and induced impact to the regional economy from the future well construction and subsequent natural gas production activities. The related indirect and induced effects of the natural gas production activities were analyzed using IMPLAN input-output modeling of the counties and regional economies. Over the full 20-year time period, Alternative 1 would add a total of 592 jobs-years of indirect and 1,240 jobs-years of induced employment for the region. This future employment growth would correspond to an annual average increase of 29 new indirect and 62 induced FTEs.

Table 4.17-8 Total Employment and Revenue Impacts from Natural Gas Development and Operation (2017-2036) - Alternative 1

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (job-years)					
Direct	814.0	1,721.0	155.0	60.0	2,751.0
Indirect	118.8	345.1	9.3	9.6	592.8
Induced	260.0	884.0	29.6	9.6	1,240.2
Total	1,192.8	2,950.1	193.9	79.2	4,584.0
Income ($ Million)					
Labor Income	$83.1	$192.8	$16.4	$5.6	$309.1
Value Added	$49.9	$139.2	$7.4	$3.0	$217.4
Output	$277.8	$642.5	$42.7	$19.6	$1,021.3

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

Figure 4.17-2 shows the annual future employment growth that would be expected as additional natural gas wells are brought on-line and begin to operate. Future well construction activities are estimated to regularly employ approximately 88 persons per year between 2017 and 2036. While most (80 percent) of these jobs are expected to be staffed by workers from the region, up to 20 percent would likely be transient or new in-migrants to region. In which case, Alternative 1 would be expected to result in up to 18 new transient or new residents to the region.

As shown in **Figure 4.17-2**, future operational employment would steadily increase as the newly constructed wells start producing. Initially in 2017, the new operating wells would provide employment for approximately 5 FTEs, which would increase steadily to a total of 94 FTEs in 2036. All of these well operating and maintenance jobs can be expected to be staffed by residents of the region. Consequently, no new transient or new residents would be expected to the region as a result of the oil and gas development's future operations.

Overall, in 2036 a total of 182 FTEs would be employed for new well construction as well as operating and maintaining of the projected 416 operating wells. This would represent a total increase in employment of 2,751 job-years over the intervening 20-year period. The related total labor income for the region is estimated at $309.1 million. The natural gas production activity also is expected to result in a total value added of $217.4 million, with the increase of output to the region's economy of $1.0 billion.

Figure 4.17-3 shows total annual well construction and operations spending between 2017 and 2036. The annual total well construction cost is estimated to be $45 million (including road construction). The production cost in 2017 for the first 21 wells is estimated be approximately $0.8 million and expected to increase steadily to a total of $16.5 million in 2036. Over the 20-year period between 2017 and 2036, new well construction spending will total $948.7 million and production cost spending will total $32.9 million. As a result, over the 20-year analysis period, the total well development related spending is estimated to be $1.1 billion.

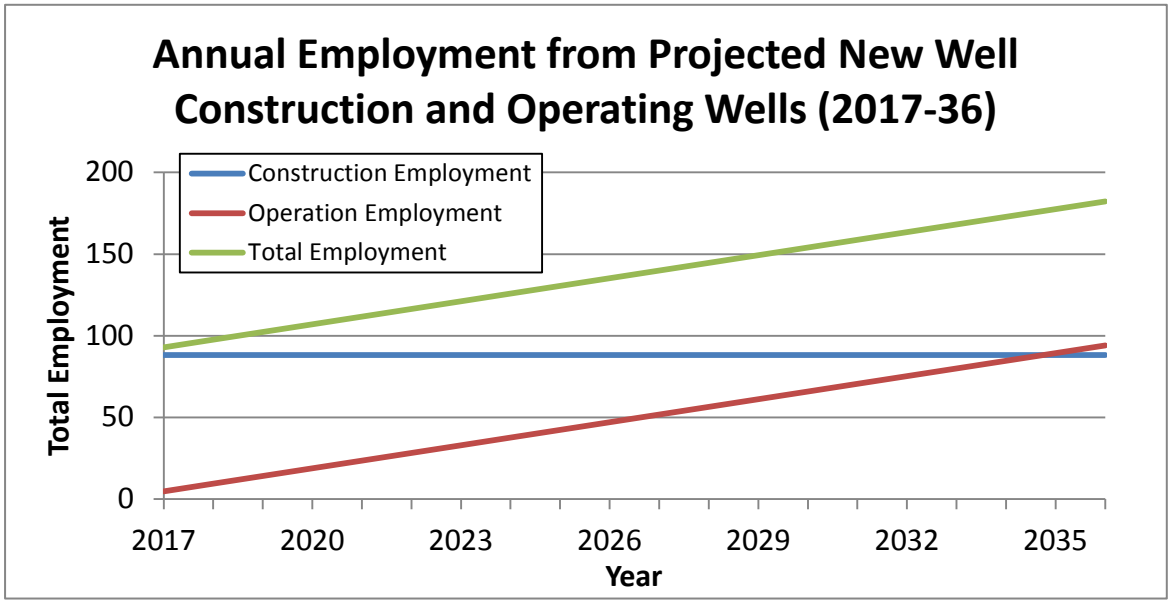

Figure 4.17-2 Annual New Well Construction and Operations Employment (2017-2036) – Alternative 1

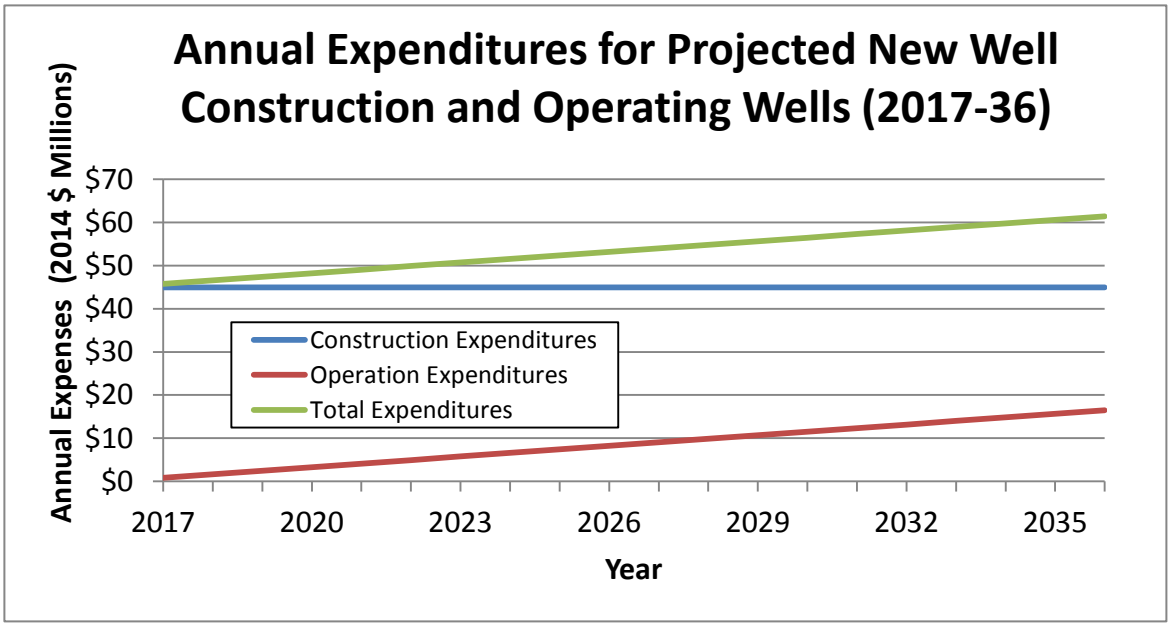

Figure 4.17-3 Annual New Well Construction and Operations Spending (2017-2036) – Alternative 1

As discussed above, future natural gas development related employment is expected to be 182 FTEs in 2036 and the majority of these new jobs (164 jobs or 90 percent of the total) are expected to be filled by workers already living and working in the region. Regardless, these new job estimates represent a maximum possible change to the region's future population and households. Even if all the new jobs were staffed by non-residents the change in population would be less than 1 percent of the region's current population. Within counties likely to experience the largest share of natural gas development (i.e., Mesa and Garfield counties) the total change in population would not exceed 1 percent of their current population. In addition, the region's housing vacancy rate (14 percent) would readily accommodate any increased housing demand from population changes since the required housing for that population would be than 1 percent of current vacancies.

Local Government Revenue Impacts

Natural gas and oil production provides significant local government revenues for the four-county region. As shown in **Table 4.17-9**, in 2012, the four counties' oil and gas revenue receipts (e.g., federal mineral lease (FML) and property tax payments) totaled $66.4 million, which was equivalent to nearly a quarter (24 percent) of their total General Fund Expenses that year.

Table 4.17-9 General Fund Expenses and Oil and Gas Revenues for the Four-county Region (2012) – Alternative 1 ($ Millions)

Area	General Fund Expenses	County Oil & Gas Revenues	Percent of General Fund Expenses
Four-county Region	$272.0	$66.4	24.4
Garfield County	$98.3	$44.7	45.5
Mesa County	$106.4	$10.3	9.7
Pitkin County	$47.2	$0.0	0
Rio Blanco County	$20.1	$11.3	56.2

Source: DOLA 2013; Garfield 2012; Leeds 2014a; Mesa 2012; Pitkin 2012; Rio Blanco 2012.

Table 4.7-10 shows the projected county revenues from the future natural gas development. While the counties typically save a sizeable portion of these revenues as reserve funds, they still represent significant contribution to their annual budgets. Alternative 1 would not alter any of the leases. In 2017, the county revenues from the future oil and gas development are expected to be $0.3 million and will increase steadily to $10.8 million by 2036. As a result, the four-county governments are expected to receive a total of nearly $99 million in oil and natural gas related revenue payments over the future 20-year analysis period.

Table 4.17-10 County Revenue from Natural Gas Development and Operations for the Four-county Region (2017-2036) – Alternative 1 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total Revenues
2017	$0.5	$0.1	$0.2	$0.0	$0.3
2036	$21.6	$4.2	$6.5	$0.1	$10.8
Total (2017-2036)	$197.6	$38.7	$59.4	$0.7	$98.8
Annual Average	$9.9	$1.9	$3.0	$0.0	$4.9

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $14.9 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, state of Colorado and all county and local agencies.

As discussed in **Appendix C**, the majority of future production is expected to occur in Mesa County, and Mesa is expected to receive more than 77 percent of this revenue. In addition, local communities are expected to receive an additional $14.9 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county. **Table 4.17-11** shows the estimated future employment and income impacts from the oil and gas revenues. The impact results include both the induced and indirect effects as estimated by the IMPLAN analysis.

Table 4.17-11 Total County Government Revenue Impacts (2017-2036) – Alternative 1

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (Job-years)					
Direct	63.7	257.0	8.6	3.8	332.3
Indirect	16.2	88.0	2.4	0.3	121.6
Induced	18.7	125.9	2.0	0.5	146.2
Total (2017-2036)	98.6	470.9	13.0	4.6	600.1
Income ($ Million)					
Labor Income	$4.4	$27.4	$1.1	$0.3	$36.9
Value Added	$5.0	$37.4	$1.3	$0.4	$49.6
Output	$9.2	$68.8	$2.3	$0.6	$89.8

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

It is conservatively assumed that half of the county revenues ($49.4 million) would likely be held as reserve funds (and therefore would not result in any spending impacts). As discussed in more detail in the Socioeconomic Technical Appendix (**Appendix C**), the agencies are expected to spend the remaining revenues on capital projects and for agency operations. Based on IMPLAN analysis of the expected future use of these remaining county natural gas revenues, direct employment in the

four-county region is expected to increase by 332 job-years over the 20-year time period. This job growth would be equivalent to an average annual direct employment increase of 17 FTEs.

The related indirect and induced effects of the natural gas revenues would add additional employment of 121 indirect and 146 induced job-years to the region over the 20-year analysis period. The employment growth would correspond to an average of 6 indirect and 7 induced FTEs annually. During the future 20-year time period, the region's total labor income also is estimated to increase by $37 million with an overall economic output increase of approximately $90 million.The natural gas related revenue payments to the county government and other agencies are generally intended to provide compensation to those agencies that might incur increased service or capital costs as a result of the gas development. For example, the County's share of FML revenues may be expected to offset road improvements that might be necessary from the increased use of county roads by well construction traffic.

As discussed above, the annual employment impacts from the future natural gas development are relatively limited with average annual total direct employment growth of 182 FTEs of which all but 18 would be filled by workers from the region's labor force. Only the 18 transient or in-migrant workers (and potentially their families) would represent a net increase in demand for local government services. Given the small magnitude of the increased service demand, the potential impacts to the region's public services and infrastructure will be negligible.

4.17.3.2 Alternative 2

Alternative 2 addresses inconsistences between the 1993 WRNF ROD and the lease stipulations as they were subsequently issued. In some cases, the leases did not include the stipulations as stated in the Forest Service decision document; these leases would be modified to include those stipulations under this alternative. Under Alternative 2, BLM would offer the lessees the option of either accepting the new lease terms or having the lease cancelled. Cancellation would be done through a BLM administrative process and would require that BLM refund all past bonus bids and lease payments.

However, since all the leases appear to have sufficient acreage for well pads, it is expected that there will be no cancelations under Alternative 2 and the same number of wells would be drilled. Consequently, the future socioeconomic impacts for Alternative 2 would be the same as those determined for Alternative 1.

4.17.3.3 Alternative 3

The Forest Service has updated the 1993 WRNF ROD with its 2014 Proposed Action for any future leasing. Under Alternative 3, the BLM would modify the existing leases to match this Proposed Action. Under this alternative, the BLM would offer the lessee the option of either accepting the new lease terms or having the lease cancelled. Any new wells to be developed on a lease with modified stipulations would be required to comply with the modified stipulations. Changes in lease stipulations would not apply to locations with producing wells because the constraints applied through lease stipulations only apply to exploration and development.

Under Alternative 3, the proposed stipulations are expected to have only a very limited impact on future well development within the WRNF. This analysis projects that no leases would be cancelled and consequently no future refund payments are expected to occur. Stipulations are expected to slightly reduce the total number of possible wells; overall, it is projected that a total of 413 future new natural gas well would be constructed, which would result in a net decrease of 3 future wells compared to Alternative 1.

As shown previously in **Table 4.17-4**, future natural gas production under Alternative 3 is projected to be 309.6 Bcf, which would correspond to a reduction of 1.9 Bcf from Alternative 1 (approximately 0.6 percent). Consequently, future natural gas sales, employment and county revenue impacts would be

similar, but slightly reduced from those under Alternative 1. Given the very minor (0.6 percent decrease) difference in their future natural gas production level, it is expected that there would be at most only very minor differences in the socioeconomic outcomes for Alternative 3. Consequently, the future socioeconomic impacts for Alternative 3 would be the same as those determined for Alternative 1.

4.17.3.4 Alternative 4 (Proposed Action)

Under Alternative 4, the BLM would modify existing lease stipulations in areas identified as open to future leasing by the Forest Service and cancel existing leases in areas identified as closed to future leasing. Although the Forest Service's decision on future leasing does not apply to these 65 previously issued leases, this alternative is designed to reflect the Forest Service's future management objectives for these lease areas. The primary difference between Alternatives 3 and 4 is that under Alternative 4, some leases (or parts of leases) would be cancelled to match the Forest Service draft decision for future leasing availability in the WRNF Draft ROD (2014). In the areas identified as open to future leasing in the WRNF Draft ROD (2014), the stipulations would be modified to be the same as those listed for Alternative 3.

Stipulations are geographically based and are not expected to have a significant reduction in total production. A total of 25 leases are projected to be cancelled in whole or in part, resulting in not only the repayment of bonus bids and lease payments, but also reduced future total natural gas production. **Table 4.17-12** shows the projected future well construction and natural gas production under Alternative 4. Over the 20-year analysis period, Alternative 4's total future natural gas production is projected to be 288.5 Bcf. This would result in a 23 Bcf decrease (equivalent to a 7 percent reduction) compared to the No Action Alternative.

Table 4.17-12 Natural Gas Production in the Four-county Area (2017-2036) – Alternative 4

Time Period	New Well Construction			Operating Wells	Natural Gas Production (Bcf)	Revenues ($ Million)
	Directional	Horizontal	Total			
2017	18.3	0.9	19	19.2	1.4	$4.0
2036	18.3	0.9	19	383.1	27.5	$160.3
Total (2017-2036)	365.7	17.4	383	383.1	288.5	$1,465.7
Annual Average	18.3	0.9	19	201.1	14.4	$73.3

Table 4.17-13 shows the expected future total quantity and value of natural gas that would be produced under Alternative 4 over the entire 20-year study period. The majority of this reduction in the region's future natural gas production is expected to occur in Pitkin County where future total natural gas production is anticipated to decrease from 16.2 Bcf (Alternative 1) to 0.7 Bcf (Alternative 4). The Alternative 4 stipulations are expected to result in only relatively small reductions in both Garfield and Mesa Counties' total future natural gas reductions (compared to Alternative 1).

Table 4.17-13 Natural Gas Production by County (2017-2036) – Alternative 4

Area	Total New Wells	Production (Bcf)	Sales Revenues ($ Million)
Garfield	127.3	81.8	$415.3
Mesa	244.6	199.7	$1,013.2
Pitkin	1.1	0.7	$3.5
Rio Blanco	10.0	6.3	$32.0
Four-county Region	383.0	288.5	$1,465.7

Table 4.17-14 shows the estimated future employment and income impacts over the entire 20-year study period from Alternative 4's future oil and gas development. Under Alternative 4, over the 20-year analysis period, well drilling and natural gas production is expected to add 2,540 job-years of new direct employment in the four-county region. This job growth would be equivalent to an annual average of 127 FTEs. The related indirect and inducted effects of the natural gas production activities will add a total of 547and 1,145 jobs-years, respectively to the region which would be equivalent to an annual average of 27 indirect and 57 induced FTEs. Over the 20-year analysis period, Alternative 4 has a lower growth in employment and labor income compared with Alternative 1 from natural gas development and operations, of the magnitude 5 percent for Garfield County, 6 percent for Mesa County, 91 percent for Pitkin County and no change for Rio Blanco County. For the four-county region as a whole, Alternative 4 has 8 percent lower growth in employment and income as compared with the No Action Alternative over the analysis period.

Table 4.17-14 Total Employment and Income Impacts from Natural Gas Development and Operations (2017-2036) – Alternative 4

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (Job-years)					
Direct	776.0	1,698.0	7.0	60.0	2,542.0
Indirect	113.3	362.1	0.4	9.6	547.7
Induced	247.5	716.7	9.3	9.6	1,145.8
Total	1,136.8	2,776.9	16.7	79.2	4,235.5
Income ($ Millions)					
Labor Income	$79.1	$190.2	$1.1	$5.6	$285.6
Value Added	$47.5	$146.0	$1.2	$3.0	$201.6
Output	$264.6	$601.9	$3.2	$19.6	$943.5

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC; IMPLAN 2015.

The annual future employment growth that would be expected as additional natural gas wells are brought on-line and begin to operate. Future operational employment would steadily increase as the newly constructed wells start producing. Initially in 2017, the new operating wells would provide employment for approximate 4 FTEs, increasing to 87 FTEs in 2036. Future well construction activities are estimated to consistently employ approximately 81 persons per year between 2017 and 2036. A total of 168 FTEs would be employed in 2036 for new well construction as well as operating and maintaining

of the projected 383 operating wells. This would represent a total increase in employment of 2,540 job-years over the intervening 20-year period. The related total labor income for the region is estimated at $286 million. The natural gas production activity also is expected to result in a total value added of $202 million, with the increase of output to the region's economy of $944 million.

Local Government Revenue Impacts

As shown in **Table 4.17-15**, Alternative 4's future natural gas production is projected to generate $93.6 million in total revenue payments for the four counties over the 20-year analysis period. This would correspond to an average annual revenue payment of $4.7 million to the region's county governments.

As discussed in **Appendix C**, over the 20-year lease period, Mesa County is expected to receive the greatest proportion of the future natural gas revenue payments ($74.6 million) with Garfield obtaining most of the remainder ($17.6 million). Rio Blanco and Pitkin Counties would each receive $1.2 million and $0.2 million, respectively. In addition, local communities are expected to receive an additional $13.7 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county.

Table 4.17-15 Estimated County Revenues from Natural Gas Development and Operation (2017-2036) – Alternative 4 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total
2017	$0.5	$0.1	$0.2	$0.0	$0.3
2036	$20.0	$3.9	$6.3	$0.1	$10.2
Total (2017-2036)	$183.0	$35.9	$57.2	$0.6	$93.6
Annual Average	$9.1	$1.8	$2.9	$0.0	$4.7

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $13.7 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, State of Colorado and all county and local agencies.

Table 4.17-16 shows the estimated future employment and income impacts from the natural gas revenues. The impact results include both the induced and indirect effects as estimated by the IMPLAN analysis.

Table 4.17-16 Revenue Impacts Generated from Natural Gas Development and Operation (2017-2036) – Alternative 4

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (FTE)					
Direct	62.4	251.6	0.5	3.8	314.9
Indirect	15.8	86.1	0.2	0.3	115.2
Induced	18.3	123.3	0.1	0.4	138.6
Total (2017-2036)	96.6	461.0	0.8	4.6	568.7
Income ($ Million)					
Labor Income	$4.3	$26.8	$0.1	$0.3	$34.9
Value Added	$4.8	$36.6	$0.1	$0.4	$47.0
Output	$9.0	$67.3	$0.1	$0.6	$85.1

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

It is conservatively assumed that half of the County revenues ($46.8 million) would likely be held as reserve funds (and therefore would not result in any spending impacts). Future county natural gas revenues are expected to result in increased direct employment of 314 job-years over the 20-year analysis period. This job growth would be equivalent to an average annual increase of 16 FTEs direct jobs for the region's economy.

The related indirect and induced effects of the natural gas revenues will add an additional 115 and 138 jobs, respectively, over the entire 20-year analysis period. This job growth would be equivalent to an average annual of 6 indirect and 7 induced FTEs. During the future 20-year time period, the region's total labor income also is estimated to increase by $34.9 million with an overall economic output increase of $85.1 million.

It is expected that 25 of the leases would be at least partially canceled and the leaseholders would be paid back for any rental fees and bonus bids. **Table 4.17-17** shows the estimated potential future bonus bids and lease payment refunds. Leaseholders had previously paid $1.0 million for the specific acreage that would be expected to be canceled, of which 49 percent ($0.5 million) was distributed to the state of Colorado. This value was calculated from bonus and rent payments from 1995 through 2014.

Table 4.17-17 Contract Cancellations Refunds to Lessees – Alternative 4 ($ Millions)

Location	Total	Non-federal Payment
Zone 1	$0.0	$0.0
Zone 2	$0.0	$0.0
Zone 3	$1.0	$0.5
Zone 4	$0.0	$0.0
Total	**$1.0**	**$0.5**

Approximately 40 percent of the non-federal revenues were subsequently distributed to the region's county and local governments, it uncertain whether the county and local governments would be required to pay back their share of the revenues received from cancelled leases. Under the similar circumstances of the Roan lease closures, the State of Colorado assumed sole responsibility for repayment of the non-federal share of the bonus bid and lease payment refunds. In which case, there would be no economic impact to the region's economy from the lessee refunds. If the county and local municipalities are require to repay their share of the received revenues they would need to refund an estimated total of $0.2 million.

4.17.3.5 Alternative 5

Under Alternative 5, all of the previously issued 65 leases would be cancelled. For producing leases, this action is not within the BLM's authority to implement so it would be necessary to pursue judicial action. For the purposes of the socioeconomic analysis, it is assumed that this judicial action would result in the cancellation of all leases. This alternative is included mainly to facilitate a full range of analysis from continuing the existing leases with their current stipulations to considering a scenario as close to not having issued leases (following the WRNF 1993 ROD) as is feasible today.

Under this alternative, all producing wells would have to be plugged and abandoned, infrastructure would be removed, roads, well pads, and other ancillary facilities would be reclaimed, and all disturbed areas would be re-vegetated. As with other alternatives, a decision to implement this alternative would not authorize any on-the-ground activities, including specific reclamation actions. If this alternative were selected, additional site-specific analysis would be required.

<u>Stipulation Protections</u>

Stipulations would not be necessary as all leases would be cancelled and no development would occur in the foreseeable future.

<u>Impacts from Future Natural Gas Development</u>

Under Alternative 5 no new natural gas wells would be developed within the 65 lease areas. In addition, the 75 currently producing wells would need to be plugged and abandoned, leading to loss of production for their remaining operational lives (10 years). Additionally, any impacts that would occur under Alternative 1 (No Action Alternative) (e.g., future new well construction) would not happen under Alternative 5.

Natural Gas Development Impacts

The four-county region would lose 45 Bcf of production over the 10-year period from the existing wells. As shown in **Table 4.17-18**, the estimated total value of the resulting future production loss is $188.2 million.

Table 4.17-18 Natural Gas Production in the Four-county Area – Alternative 5

Time Period	New Well Construction			Operating Wells	Natural Gas Production (Bcf)	Sales Revenues ($ Million)
	Directional	Horizontal	Total			
2017	0.0	0.0	0.0	-75.0	-4.5	-$13.0
2026	0.0	0.0	0.0	-75.0	-4.5	-$22.7
Total (2017-26)	0.0	0.0	0.0	-75.0	-45.0	-$188.2
Annual Average (2017-26)	0.0	0.0	0.0	-75.0	-4.5	-$18.8

[1] No new well construction; 75 wells abandoned with an average of 10 years of remaining production potential. Values shown are only for the 2017-27 loss in natural gas production by existing wells.

As can be seen in **Table 4.17-19**, the majority of the lost natural gas production would occur in Mesa County with the remainder lost from wells located in Garfield County.

Table 4.17-19 Natural Gas Production by County – Alternative 5

County	Wells	Natural Gas Production (Bcf)	Sales Revenues ($ Million)
Garfield	-15.0	-9.6	-$40.2
Mesa	-60.0	-35.4	-$148.1
Pitkin	0.0	0.0	$0.0
Rio Blanco	0.0	0.0	$0.0
Four-county Region	-75.0	-45.0	-$188.2

Additionally the project would lose future gas production and revenues that would otherwise be obtained under the Alternative 1 - No Action Alternative conditions. This would amount to an additional loss of 312 Bcf in future natural gas production that would have an estimated total future sales value of almost $1.6 billion.

Consequently, over the entire 20-year study period, under Alternative 5, there would be a total loss of 357 Bcf in future natural gas production with an estimated value of almost $1.8 billion.

The loss of natural gas production by the existing 75 operating wells under this alternative is expected to result in a direct employment loss of 150 FTEs in the four-county region between 2017 and 2026 (**Table 4.17-20**). The reduced labor income for the region is estimated to total $21.1 million. In addition, there would be a total value added loss of $12.1 million and $53.6 million decrease in economic output.

Table 4.17-20 Employment and Revenue Impacts Generated from Natural Gas Development and Operation (2017-2026) – Alternative 5

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment (Job-years)					
Direct	-29.0	-118.0	0	0	-150.0
Indirect	-4.7	-17.7	0	0	-24.6
Induced	-12.2	-76.6	0	0	-83.4
Total	-45.8	-212.2	0	0	-258.0
Income ($ Million)					
Labor Income	-$3.9	-$16.7	$0.0	$0.0	-$21.1
Value Added	-$2.3	-$9.9	$0.0	$0.0	-$12.2
Output	-$10.8	-$43.1	$0.0	$0.0	-$53.9

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

Since the construction (and subsequent production) of the 416 new wells in No Action Alternative also would not occur, there would be additional losses to the regional economy. Under the alternative, a direct employment loss of 2,751 job-years and a total economic output loss of $1.0 billion are estimated over the 20-year analysis period (**Table 4-17.8**). Over the same time period, Alternative 5 has a loss in employment and labor income compared with Alternative 1 from natural gas development and operations, of the magnitude 104 percent for Garfield County, 107 percent for Mesa County, 100 percent for Pitkin County and 100 percent for Rio Blanco County. For the four-county region as a whole, a 94 percent loss in employment and income is foreseen under Alternative 5 as compared with the No Action Alternative over the analysis period.

Decreases in direct employment in the analysis area would be 15 FTEs annually from 2017 through 2026. With current unemployment rates at 5.8 percent (Colorado Department of Labor and Employment 2015), total employment losses from the closure of the wells would only account for 0.1 percent of unemployed. Regardless, the change in unemployment would represent the maximum increase unemployment with many of the persons being able to find new work in the region.

Local Government Revenue Impacts

As discussed in Section 4.17.4.1 Alternative 1, natural gas operations generate significant revenue payments to counties. Not only would the four-county region no longer receive the projected payments identified in Alternative 1, but both Garfield and Mesa Counties would lose future revenue payments from the existing 75 wells that would be abandoned ten years before their estimated productive life is otherwise expected to end. The loss from current production for these two counties is estimated at $12.6 million over the 10-year period; with initial revenue loss of $0.9 million in 2017 and increasing to $1.5 million in 2026 (**Table 4.17-21**). In addition, local communities are expected to receive an additional $1.8 million of property tax and severance payments over the 20-year analysis period. The induced and indirect impacts for these payments are expected to be similar in type and proportional in magnitude to those paid to the county.

Table 4.17-21 Estimated County Revenues from Natural Gas Development and Operations (2017-26) – Alternative 5 ($ Millions)

Time Period	Four-county Region [1]				
	FML – Total [2]	FML – Counties	Property Tax	Severance Tax	Total [3]
2017	-$1.6	-$0.3	-$0.5	$0.0	-$0.9
2026	-$2.8	-$0.6	-$1.0	$0.0	-$1.5
Total (2017-26)	-$23.5	-$4.6	-$7.9	$0.0	-$12.6
Annual Average (2017-26)	-$2.4	-$0.5	-$0.8	$0.0	-$1.3

[1] Regional Total only includes county governments. In addition, it is estimated there could be an additional $1.8 million in property and severance tax payments to the local communities with a majority paid to schools and special districts. FML revenues are accounted for at the county level.

[2] Includes payments to federal government, State of Colorado and all county and local agencies.

[3] Due to rounding, values may not add up exactly.

[4] No revenues losses would occur after 2026 when the existing wells' natural gas production would otherwise end.

In addition, under Alternative 5 the counties would lose future gas revenues that would otherwise be obtained under the Alternative 1 conditions that would amount to an additional loss of $98 million. Consequently, under Alternative 5, over the entire 20-year analysis period, there would be a total loss to the counties of over $111 million.

Table 4.17-22 includes the revenue distribution on a county by county government basis. Both Garfield and Mesa counties would lose future revenue payments from the existing 75 wells that would be abandoned ten years before their estimated productive life is otherwise expected to end. The loss of government from current production for these 2 counties is estimated at $12.6 million over the 10-year period.

Table 4.17-22 Total County Revenue Impacts (2017-26) – Alternative 5 ($ Millions)

Time Period	County Oil and Gas Revenues				Total Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
2017	-$0.1	-$0.8	$0.0	$0.0	-$0.9
2026	$0.2	$1.3	$0.0	$0.0	$1.5
Total (2017-26) [2]	-$1.7	-$10.9	$0.0	$0.0	-$12.6
Annual Average (2017-26)	-$0.2	-$1.1	$0.0	$0.0	-$1.3

[1] Due to rounding, values may not add up exactly.

[2] No revenues losses would occur after 2026 when the existing wells' production would otherwise end.

Table 4.17-23 shows the projected future county government revenue impacts on a county-by-county basis. Based on the assumption that 50 percent of the revenues ($6.3 million) would be retained in a reserve fund, the lost natural gas revenues are expected to result in a total decrease of 42 job-years of direct jobs for the region over the 10-year analysis period. This is would be equivalent to an annual average of approximately 4 FTEs over the 10-year period that these wells would otherwise have remained in production. The related losses in indirect and induced effects of the natural gas production activities are 15 and 18 job-years, respectively, over the 10-year analysis period. This is would be equivalent to an average of approximately 1 indirect and 2 induced FTEs of loss employment each year between 2017 and 2026. Over entire the 10-year analysis period, there is expected to be a total of $4.6 million in lost labor income and a total economic output loss of $11.3 million.

Table 4.17-23 Total County Government Revenue Impacts (2017-26) – Alternative 5 ($ Millions)

Impact Type	County				Four-county Region [1]
	Garfield	Mesa	Pitkin	Rio Blanco	
Employment					
Direct	-5.3	-36.7	0	0	-41.7
Indirect	-1.3	-12.6	0	0	-15.3
Induced	-1.5	-18.0	0	0	-18.4
Total (2017-26)	-8.1	-67.3	0	0	-75.3
Income (Millions $)					
Labor Income	-$0.5	-$3.9	$0.0	$0.0	-$4.6
Value Added	-$0.7	-$5.3	$0.0	$0.0	-$6.2
Output	-$1.2	-$9.8	$0.0	$0.0	-$11.3

[1] The four-county region total includes additional inter-county indirect and induced impacts that are not represented in the individual county results. Consequently its total is typically slightly greater than the sum of the individual county impacts.

Source: BBC 2014; IMPLAN 2015.

In addition, it is assumed that as all of the leases would be cancelled, and the leaseholders would be refunded all rental fees and bonus bids. Leaseholders had previously paid $5.2 million, of which 49 percent ($2.6 million) was distributed to Colorado. These value were calculated from bonus and rent paid from 1995 through 2014. While a percentage of these funds were subsequently distributed to the counties, in accordance with similar circumstances for the Roan lease closures, it is expected that the counties (and any other local agencies) would not be required to repay any of their past revenues from the cancelled leases. Instead, the state of Colorado is expected to be solely responsible for repayment of the non-federal share of any necessary bonus bid and lease payment refunds. As a result, there would be no economic impact to the region's economy from the lessee refunds (**Table 4.17-24**).

Approximately 40 percent of the non-federal revenues were subsequently distributed to the region's county and local governments, it uncertain whether the county and local governments would be required to pay back their share of the revenues received from cancelled leases. Under the similar circumstances of the Roan lease closures, the State of Colorado assumed sole responsibility for repayment of the non-federal share of the bonus bid and lease payment refunds. In which case, there would be no economic impact to the region's economy from the lessee refunds. If the counties and local municipalities were required to repay their share of the received revenues they would need to refund an estimated total of $1.0 million.

Table 4.17-24 Potential Lessee Refunds – Alternative 5 ($ Millions)

Location	Total	Non-Federal Share
Zone 1	$0.3	$0.2
Zone 2	$3.2	$1.6
Zone 3	$1.7	$0.8
Zone 4	$0.0	$0.0
Total	$5.2	$2.6

Note: Totals may not add up exactly due to rounding.

Recreation Impacts

Alternative 5 would result in the removal of 75 wells, and consequently may have slight positive impact to the future landscape and habitat hunters and fishermen use. However, decommissioning of roads may reduce access to recreational opportunities. As this alternative has fewer wells relative to the other alternatives, this may result in a relative increase in the value of experience for some users.

Grazing Impacts

Surface disturbance for Alternatives 5 would result in a reduction of long-term disturbance related to the operation, and maintenance of well pads, access roads, and pipelines. All disturbed areas would be reclaimed to pre-disturbance conditions. The Forest Service would be responsible for approval of reclamation methods and determining when reclamation is satisfactory. The extent of impacts to grazing would be the least of all alternatives and reclaimed areas within the grazing allotments would be available for grazing once reclamation is determined to be successful.

Transportation Impacts

Alternative 5 is expected to have the least traffic volumes of all the alternatives. As a result, compared to Alternative 1, it could maintain or improve the quality of life for those residents living in the vicinity of the existing natural gas development.

Social Impacts

None of the alternatives would be expected to reduce economic diversity (the number of economic sectors) or increase economic dependency, which occurs when the local economy is dominated by a limited number of industries. Shifts in emphasis could occur, but these would not result in any of the alternatives.

While the alternatives have the potential to affect local businesses and individuals, the relative contribution and the relative differences between the alternatives would not be large enough to have any measurable effect on economic diversity or dependency.

Estimates of the levels of employment and labor income that would be supported by the alternatives are based on projected wells drilled and consequent natural gas production. Estimated average annual employment and labor income from natural gas leasing related outputs and activities are summarized for each alternative in the Natural Gas Development Impacts discussion.

4.17.3.6 Summary of Impacts

Alternatives 1 and 2 would result in the greatest economic impacts to the regional economy. The revenue of the total new natural gas production (i.e., over the entire 2017 to 2036 time period) is estimated to approach $1.6 billion. The value of Alternative 5's projected natural gas production lost from

the 75 existing wells is estimated to be $188 million. Combined with the forgone future natural gas production that would otherwise be obtained from new well development, compared to No Action Alternative conditions, Alternative 5 is expected to result in a total loss of natural gas production worth approximately $1.8 billion.

Only qualitative analysis of the alternatives economic impacts to recreation, grazing and transportation could be performed. The information constraints on both their current activity levels and the specific future natural gas production activities prevent quantitative analysis of the both the resource impacts themselves and consequently their related spending and economic effects. Furthermore, the relatively low use and expected limited interaction between the future natural gas development activities and other resources with potential economic sector impacts (e.g., recreation, grazing and transportation) suggest that no future economic impacts can be attributed to those uses from the future natural gas development.

However, while most of the region's residents may have limited direct experiential interaction with the increased oil and gas development or its effects, they may nonetheless feel a resulting decrease to their quality of life and/or sense of place from any new oil and gas development in the region. These residents will likely perceive that any increase in oil and gas development will result in a corresponding decrease to the region's environmental/ecosystem integrity and natural wilderness and rural character. Accordingly, these individuals will prefer less oil and gas development in the region.

Each alternative's quantifiable economic impacts are directly related to their corresponding projected natural gas production quantities. Future employment in the four-county region would increase from new short-term well construction jobs. There also would be an increase in the region from the more permanent jobs operating and maintaining the producing wells over their full 20-year expected operating lifespan. Under Alternatives 1 and 2, total jobs produced by natural gas development and operations are expected to be 93 FTEs in 2017 and increase to 182 FTEs by 2036; this would represent a total increase in employment of 2,751 job-years over the intervening 20-year period. Alternative 3 would be very similar, with total increase in employment of 2,733 job-years through the same 20-year period. Alternative 4 would generate slightly fewer annual jobs; with projections of 2,542 job years of new direct natural gas development employment which would represent a net decrease of approximately 209 job-years compared to the Alternative 1, No Action Alternative.

Alternative 5's projected annual employment lost from closure of the 75 existing wells is projected to result in total 150 lost job-years over the 10-year period that those wells would otherwise continue to operate. This would be equivalent to an average annual 15 FTE job loss for the region for the 10-year period. Combined with the forgone future employment growth that would otherwise be obtained from new well development, compared to No Action Alternative conditions, Alternative 5 is expected to result in a total future natural gas production employment loss of approximately 2,901 job years. This would be equivalent to an average annual 145 FTE job loss for the region over the 20-year period.

Alternatives 1, 2, and 3 are expected to generate total future county revenue payments of approximately $99 million over the 20-year period. Alternative 4 would result in slightly lower future total county revenue receipts of approximately $94 million – a net decrease of approximately $5 million compared to the Alternative 1 – No Action Alternative. The total county revenue loss from Alternative 5's closure of the 75 existing wells is projected to total approximately $13 million. Combined with the forgone future county revenues that would otherwise be obtained from new well development, Alternative 5 is expected to result in a total future county revenue loss of approximately $111 million compared to No Action Alternative conditions.

4.17.4 Cumulative Impacts

4.17.4.1 Cumulative Impacts Analysis Area

The CIAA would be the same as the analysis area described in Section 4.17.1.1 and will consist of the four-county region of Garfield, Mesa, Pitkin, and Rio Blanco counties.

4.17.4.2 Past and Present Actions

Past and present actions are broken into three surface disturbing activities: mineral development, transportation corridors, and other development. Other socioeconomic resources from past and present surface disturbing activities are similar to those described in Section 4.17.3. These actions make up 454 acres within the leasing areas, or less than 1 percent of the total leasing area.

4.17.4.3 Reasonably Foreseeable Future Actions

RFFAs would include oil and gas, as well as road, powerline, pipeline, reservoir, vegetation treatment, habitat improvement, and recreational trails projects. These projects also could contribute to increased levels of traffic, impacts to current recreation access, impacts to access of grazing lands, increased demands for labor, and changes to governmental revenues.

Oil and Gas

BLM manages approximately 6.72 million subsurface acres of federal lands within the four-county region. The majority (95.4 percent) are administered by three BLM FOs: The GJFO which manages 2.39 million acres; the WRFO which manages 2.25 million acres; and the CRVFO that manages 1.77 million acres. The WRNF occupies a large portion of the lands administered by these three BLM FOs. These field offices also manage lands located in other Counties outside the region.

In support of its land management and planning, the BLM periodically develops RFD Scenarios for its planning areas within its jurisdictions. A RFD is a long-term scenario used as a baseline for planning. It is a rational estimate of the possible future development based on potentially available productive areas that are not closed for development. The RFD projections include both fee and federal wells. The RFD estimates the potential oil and gas development activity on all lands including private or state lands. Consequently, the RFDs provide a likely upper limit estimate of its area's future cumulative oil and gas development.

The WRFO's most recent RFD was performed in 2007 and it estimated that up to 17,800 wells could be drilled over the subsequent 20 years (BLM 2007). The GJFO finalized a RFD in June 2012, which estimates that another 9,116 wells to be drilled in the next 20 years (BLM 2012). The RFD for the Roan Plateau projected that 5,470 federal and fee wells could be drilled within the Roan Plateau Planning Area (which is part of the CRVFO) within the next 20 years. The RFD for the Roan Plateau also reported that the CRVFO office wide RFD estimates that 14,792 wells could be drilled during the next 20 years (BLM 2014d). The cumulative analysis for the USFS Final EIS did not consider the cumulative effects of the other reasonably foreseeable oil and gas development in the region (USFS 2014a).

Based on these analyses, it is projected that up to 42,722 wells could be drilled within the BLM CRVFO, GJFO, and WRFO over the next 20 years. While the RFD include some areas outside the region, the oil and gas development nonetheless provide an indication of the potential overall future oil and gas development conditions for the region.

4.17.4.4 Contribution of the Proposed Actions and Alternatives to Cumulative Impacts

Oil and Gas

Development of the WRNF leases would add 416 new wells which would contribute less than 1 percent to the region's cumulative oil and gas development over the next 20 years. The other cumulative well development would increase road construction and further expand the regional road network with the region's rural areas. Well development also would result in increased employment opportunities and generate additional county revenues.

However, if future oil and gas development in region occurs at the level foreseen above there also will be the potential for adverse impacts to the region's economy and social resources. Such a high level of oil and gas development can be expected to attract and require new transient workers to the region, which could reduce the availability of affordable housing in the region and encourage greater residential development. The related population increase also may increase the demand for public services and increase the costs to county and local service agencies.

Reduce unemployment and the availability of better paying energy industry jobs could reduce the available labor force willing to work the lower paying jobs in the region's tourism-related businesses which in turn could threaten their viability.

The oil and gas development foreseen by the cumulative analysis also could have a noticeable impact on the region's wilderness, grazing and recreation resources. As future oil and gas development becomes more prevalent (as well as its related transportation and other impacts), these resources could be reduced in size (or accessibility) and/or degraded in quality. In either case, this could result in decreases in their use by tourists, ranchers and area residents. A substantial decrease in use would be expected to negatively affect any related businesses that are dependent on these users for their livelihood. For example, reduced tourism to the region would likely adversely and directly affect hotels and restaurants in the region.

The possible social impacts from natural gas development activities were described earlier in this section. The potential influx of new temporary or permanent residents drawn by a major increase in future oil and gas development in the region could affect the region's social character as these new individuals may have different values, interests and lifestyles than those of the existing residents. Furthermore, alteration of the region's natural setting, recreational opportunities and rural character by a major increase in oil and gas development also could adversely affect the existing residents' "sense of place" and "quality of life." While affordable housing could become scarcer as better paid energy industry workers relocate to the area, other residents could face reduced property values for some private homes if oil and gas activities (including visual and transportation impacts) reduce the attractiveness of their rural and natural setting.

However, the contribution to any of these possible outcomes by the action alternatives will be small as its oil and gas development growth would a very small portion (1 percent) of the any such cumulative effects. While the various action alternatives would in some way contribute the cumulative impacts, their addition or elimination would not be expected to noticeably change the future outcomes to the region's economy or social resources from the cumulative natural gas development.

Other Surface Disturbance

Other surface disturbing activities such as coal and gravel mining in Garfield County would likely incrementally increase traffic levels, affect recreation access and access to grazing lands, increase demands for labor, and result in changes to county revenues. However, their contribution to the cumulative impacts would be expected to be very small compared to the effects of the expected future new oil and gas development in the region.

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4.18 Environmental Justice

4.18.1 Analysis Assumptions and Approach to Analysis

4.18.1.1 Analysis Area

The analysis area for direct and indirect impacts to environmental justice includes U.S. Census Bureau tracts in Garfield, Mesa, Pitkin, and Rio Blanco counties that contain existing oil and gas leases.

4.18.1.2 Scoping Issues

No scoping issues related to environmental justice were identified by the public.

4.18.1.3 Assumptions

The assumptions used in this analysis of impacts are summarized below.

- Oil and gas leasing decisions in and of themselves have no direct impacts to environmental justice communities, but only indirect resources impacts that might potentially result in environmental justice impacts on communities of concern in the region.
- Any effects of leasing and potential future development would be only measureable at the time of lease sale and once subsequent lease development occurs.
- The natural gas leasing and stipulation decisions could indirectly impact numerous resources and result in future outcomes (e.g., natural gas revenues, local government revenues, recreation, grazing, commute patterns and social conditions) that could affect local populations.

4.18.1.4 Impact Indicators Used for Analysis

The following impact indicators were used in the analysis:

- Total population
- Percentage of the population with minority status (e.g., Hispanic or Latino, Black or African American, Asian American, American Indian or Alaskan Native, Native Hawaiian and other Pacific Islander)
- Percentage of the population with low-income status

4.18.2 Stipulations Providing Protections to Environmental Justice

NSO stipulations would prohibit site development on certain areas including avoiding impacts to culturally significant resources to Native American tribes as well as areas that local populations may use for subsistence or cultural practices.

4.18.3 Impacts Common to All Alternatives

As discussed in Section 3.18, Environmental Justice, there are currently no environmental justice communities located within the analysis area. In the absence of any such communities of concern, no environmental justice impacts would occur. Nonetheless, it should be recognized that there may still be the potential for Environmental Justice communities in the planning area, and additional analysis may be necessary at the project level to determine the potential for disproportionate adverse impacts. Such impacts could include housing, recreation, tourism, transportation and services, as well as air quality and noise. Should disproportionate adverse impacts be identified, then BLM would consider appropriate outreach to affected communities and needed mitigation measures to reduce impacts. Any affected communities may be involved in developing such measures.

Additionally, in accordance with federal environmental justice guidance, public involvement efforts for this project have been inclusive and the BLM has considered input from persons or groups regardless of race, color, national origin, income, or other socioeconomic characteristics (CEQ 1997).

4.18.4 Impacts by Alternative

4.18.4.1 Alternative 1

As discussed in Section 4.17, Socioeconomics, over the next 20 years Alternative 1 is expected to result in future employment and labor income growth (both directly and indirectly) from future natural gas development within WRNF. As the increased employment opportunities would be distributed across the entire population, including minority and low-income residents, the region's minority and low-income residents could experience benefits. In addition, Alternative 1 would continue to ensure access for subsistence uses, traditional materials, and cultural sites which would continue to provide valuable resources to communities in the area. Sustaining lifestyles, traditions, ceremonies, and heritage would remain an important part of the regional community lifestyle, rural character, and quality of life.

However, no environmental justice communities are located within the analysis area and consequently, in the absence of any such communities of concern, no environmental justice impacts would occur.

4.18.4.2 Alternative 2

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.3 Alternative 3

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.4 Alternative 4 (Proposed Action)

Potential effects to environmental justice populations within the analysis area are the same as described above in Alternative 1.

4.18.4.5 Alternative 5

As discussed in Section 4.17, Socioeconomics, Alternative 5 would result in decreases in future employment and labor income from lease cancellations and discontinuation of 75 currently operating wells. These economic losses would be distributed across the entire population, including minority and low-income residents and could adversely impact some minority and low-income residents in the region. However the total number of person currently employed by the current oil and gas production activities within the WRNF is minor compared to the overall regional economy.

Similar to Alternative 1, Alternative 5 would continue to ensure access for subsistence uses, traditional materials, and cultural sites, thereby sustaining lifestyles, traditions, ceremonies, and the heritage that remain an important part of community lifestyle, rural character, and quality of life.

4.18.5 Summary of Impacts

Overall no disproportionate and adverse effects to environmental justice communities are expected from any of the action alternatives as no environmental justice communities were identified within the study area.

4.18.6 Cumulative Impacts

4.18.6.1 Cumulative Impacts Analysis Area

The CIAA for environmental justice is the population within Census Tracts either totally or partially inside the WRNF analysis area and is the same area as that analyzed for environmental justice impact analysis.

4.18.6.2 Reasonably Foreseeable Future Actions

No minority or low-income communities of concern were identified within the CIAA. Consequently, in the absence of any such communities of concern, there are no RFFAs that cumulatively would be expected to result in disproportionate and adverse environmental justice impacts to any communities of concern within the CIAA.

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4.19 Short-term Uses Versus Long-term Productivity

4.19.1 Introduction

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity is required to be addressed under NEPA. Short-term use considers the effect of occupying the land for production of gas for the period of years until the supply is depleted and reclamation is completed. This section discusses whether the short-term uses of environmental resources would affect the long-term productivity of the environment. Short term refers to the period of gas production, assumed to be 20 years for this analysis although wells may produce longer. Short-term uses of the environment associated with the alternatives are generally the same as the impacts, both temporary and permanent, described for each resource in this EIS. The relationship between short-term uses and long-term productivity would not be appreciably different across the range of alternatives.

4.19.2 Air Quality

There would be short-term impacts on air quality from emissions generated by development, production, and reclamation equipment and dust from vehicle traffic. At the low density of mineral development projected for the analysis area, it is unlikely that these impacts to air quality would affect long-term regional air quality.

4.19.3 Geology, Minerals, Paleontology

Short-term uses and long-term productivity are not relevant to geologic hazards and paleontological resources. Oil and gas infrastructure (roads, pads, pipelines) constitutes a relatively short-term use even though the wells may have productive lives of 20 to 30 years. But as long as the wells are active, the land occupied by the development is precluded from other uses. Once wells are abandoned and the lands reclaimed, those areas can be returned to other uses. Development of oil and gas resources within the leases would permanently remove a large fraction of the technically recoverable resource for short-term use. Short-term uses also would have an adverse impact on long-term productivity for other mineral development in the immediate location of wells. However, because the acres of mineral resources impacted by all alternatives would be low, and better availability of some resources exist outside the lease area, overall long-term impacts to the productivity of salable mineral resources would be minor.

4.19.4 Soils

Overall site productivity is primarily a matter of revegetation success. Productivity varies with vegetation community and soil type, but more importantly, with land management practices as they relate to the establishment of desirable or productive vegetation types. In contrast, soil quality is an inherent soil characteristic involving structure, permeability, texture, acidity, microbial populations, fertility, and other physical and chemical characteristics that are beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to short-term uses while mineral development infrastructure is in place. There may be some impacts to long-term soil productivity after surface disturbance occurs due to reduced microbial activity and modification of the natural soil horizons and compaction, which may extend for many years beyond successful revegetation, is achieved.

4.19.5 Water Resources

4.19.5.1 Surface Water

Regarding Alternatives 1 through 4, until the lessees pursue approval to develop the oil and gas resources, no short-term uses of water resources would occur. At that time, surface water may be affected by increased stormwater runoff and sedimentation, although those impacts would be minimized by compliance with permit requirements.

Alternative 5 would result in impacts to short-term uses of the resource during well plugging and abandonment and reclamation of disturbed areas. However, because existing facilities would be decommissioned and disturbed areas reclaimed, the short-term disturbance would be expected to increase long-term productivity once reclamation is achieved.

4.19.5.2 Groundwater

Assuming additional approvals to develop the leases under Alternatives 1 through 4, oil and gas development would consume water resources in the short-term, potentially affect the chemistry of groundwater resources, and alter the hydrogeology. In the long term, water resources may be slightly reduced due to increased consumption. Groundwater resources could be locally contaminated due to spills, leaks, and well failures, although this would be minimized by compliance with state and federal laws and permit requirements. Based on current knowledge of the hydrogeologic settings in the WRNF, oil and gas resources are often developed from geological reservoirs that do not contain significant amounts of freshwater.

Under standard procedures the USFS and BLM follow when considering specific post-leasing drilling proposals, the agencies have the ability to move a proposed oil and gas well location up to 200 meters to minimize potential environmental effects. This would include the ability to move a location to protect or minimize effects to groundwater resources and would serve to further reduce potential effects to groundwater resources. Further, during subsequent NEPA analyses that would consider effects of post-leasing project level proposals, site-specific circumstances and effects may indicate that water resource monitoring is required. Compliance with existing rules and regulations, stipulations, other COAs, modern practices, and BMPs would combine to reduce the likelihood of adverse impacts to long-term productivity.

4.19.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

Impacts from localized short-term uses on long-term vegetative resource productivity would vary slightly by alternative with greater impacts from alternatives with more development and fewer restrictions. A loss of native vegetation productivity from oil and gas development would most likely occur in areas of concentrated oil and gas development. The extent of impacts to long-term productivity would vary depending on the intensity of the local short-term use.

After disturbance, most native vegetation communities would not recover to pre-disturbance levels until decades after implementation of reclamation. Habitat and populations of federally listed plant species would be protected under all alternatives, while habitat and populations of other special status plant species would receive lesser protections, varying by alternative. Relaxed reclamation standards could promote the spread of noxious weeds and other invasive plant species. This could reduce the suitability of special status plant habitats, and habitats of their pollinators. Herbicide drift from chemical treatment of invasive species also could impact special status plants and their pollinators.

4.19.7 Terrestrial Wildlife Including Special Status Species

Under all alternatives, construction, drilling, and completion activities would result in some short-term impacts to terrestrial wildlife and special status species habitat as well as individuals. This short-term use may affect long-term productivity of terrestrial species should there be alteration or loss, modification or fragmentation of habitat, direct mortality of individuals, and increased disturbance from human activity. Wildlife habitat would be reduced due to local short-term uses until reclaimed areas return to mature vegetation communities that provide suitable habitat. Oil and gas development activities would have localized impacts on wildlife populations during development particularly during the construction drilling and completion phases, although stipulations and regulatory requirements would reduce the level of adverse impacts to terrestrial wildlife species.

4.19.8 Aquatic Resources

Construction under all alternatives would result in some short-term impacts to aquatic habitat and fish species that may affect long-term productivity due to surface disturbance and water use if sources are derived from or linked to surface water. Specific short-term impacts to aquatic habitat and species would include alteration or loss of habitat, water quality effects from sedimentation and possible contaminant spills, and potential habitat reductions due to water use. Oil and gas development activities may have localized short-term impacts on fish populations particularly during the drilling and completion phases. Stipulations and compliance with regulatory requirements would minimize the level of adverse impacts to fish species over the long-term.

4.19.9 Cultural Resources

Short-term uses that involve surface disturbance have the potential to adversely affect eligible cultural resources if they are not mitigated or avoided. Compliance with federal and state laws and regulations would minimize the potential for adverse impacts to eligible sites. Cultural resources surveys and data recovery and analyses would contribute to the long-term knowledge of cultural resources in the region.

4.19.10 Transportation

Over the 20-year development period, a more extensive road network would be in place for enhanced access and other uses, where permitted. Over the long-term, roads accessing well pads would be reclaimed, resulting in a return to the previous transportation network in the area unless the Forest Service decides to keep and maintain some of the roads.

4.19.11 Lands and Special Uses

Under Alternatives 1 through 4, lease development may preclude authorization of other potential uses in the locations of oil and gas infrastructure until those facilities are plugged, abandoned, and reclaimed. Under Alternative 5, other uses of the land would be facilitated after the 75 producing wells and associated infrastructure are reclaimed.

4.19.12 Special Designations

Naturalness and the roadless aspects of special designations could be disrupted during lease development as roads and facilities are constructed and used for the producing life of each well. However, in the long-term as areas are reclaimed, the naturalness and solitude of special designations would be restored. Restoration of naturalness and solitude would depend, in part, on successful reclamation as well as the timing of other potential projected oil and gas activities in the area.

4.19.13 Recreation

Recreational access could be disrupted during lease development as roads are constructed and used to facilitate mineral development and extraction. Hunting and dispersed recreational opportunities may be impaired in the short-term in areas with active drilling and production. In the long-term as areas are reclaimed, visual aesthetics and dispersed recreational opportunities would be restored to original conditions.

4.19.14 Livestock Grazing

Short-term impacts from the removal of forage for construction of oil and gas facilities would be returned to pre-disturbance conditions and restore long-term productivity following depletion of the mineral resource and successful reclamation. Short-term uses would apply to areas where initial surface disturbance would occur during construction. Permanent structures required for operations would have a longer term impact but these areas would eventually be returned to productive forage through

reclamation activities that may achieve better than pre-disturbance conditions within the grazing allotments.

4.19.15 Scenic Resources

Short-term impacts to scenic resources would result from the disturbance associated with the construction and development of oil and gas infrastructure. Impacts could be seen in the form of changes in the existence of wells infrastructure and roads that would exist over the producing life of each well. Long-term impacts would be visible until production of oil and gas well is complete and the area has been reclaimed. These impacts to scenic resources could include changes in landscape scenery, light pollution during nighttime hours, and the construction of buildings, well pads, and other associated infrastructure.

4.19.16 Hazardous Materials and Human Health and Safety

The maintenance and enhancement of long-term productivity of resources linked to human health and safety is not expected to be affected by short-term uses due to compliance with regulations and BMPs for protections of the transportation and use of hazardous materials and disposal of solid waste. Long-term productivity could be affected by short-term uses if spills or improper waste disposal were to impact water, soils, vegetation, or other resources.

4.19.17 Socioeconomics

Natural gas development would result in short-term use, the duration of which will be determined by rate of the extraction and quantity of the developable natural gas reserves. After surface reclamation is completed, the full productivity of the surface lands would be expected to be fully restored. Consequently, in the long-term, surface lands would continue to provide the current levels of economic activity and the future productivity would not be permanently impaired or reduced.

4.19.18 Environmental Justice

Because no minority or low-income communities of concern occur in the analysis area, there would be no impacts would result in changes to short-term uses or long-term productivity.

4.20 Irreversible or Irretrievable Impacts

4.20.1 Introduction

NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided, should the alternatives be implemented. A commitment of a resource is considered irreversible when the primary or secondary impacts from its use limit the future options for its use. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations.

Selection and approval of any of the alternatives could result in the irreversible commitment of specific resources (e.g., the loss of future options for resource development or management), especially for nonrenewable resources such as minerals or cultural resources. It also may result in the irretrievable commitment of resources due to lost production or use of resources.

4.20.2 Air Quality

There would be no irreversible or irretrievable impacts to air quality.

4.20.3 Geology, Minerals, and Paleontology

4.20.3.1 Mineral Resources

The development and production of natural gas from the resource base would be an irreversible impact. When the natural gas is consumed, that would constitute an irreversible impact because it cannot be replaced.

4.20.3.2 Paleontological Resources

Damage to paleontological resources would be irreversible and irretrievable. An irreversible impact would occur if even if valuable fossils are documented, salvaged, and curated, because once disturbed they cannot be returned to their previous in-place conditions. The impacts to paleontological resources also would be irretrievable if fossils are destroyed and not scientifically documented. If documented and preserved, they would be preserved for future study.

4.20.4 Soils

Disturbance activities associated with oil and gas development could result in the loss of soil through erosion or physical disruption of natural soil horizons during construction and reduced soil productivity. This reduction of soil productivity could extend over many years, depending on interim reclamation methods and success, as well as site-specific conditions and mitigation measures, until reclamation success is achieved and soil quality and productivity improve. With successful reclamation, adverse impacts to soils would not be irreversible.

4.20.5 Water Resources

4.20.5.1 Surface Water

Irreversible impacts to surface water would not be anticipated because the permitting agency would require practices that minimize sedimentation and disturbance to surface water. Reclamation would be performed at the end of the development, which would minimize long-term effects on water quantity and quality over time. Temporary reductions in water quality from erosion and sedimentation, should they occur, would be irretrievable, as would water used during lease development. However, consumptive use of water is not likely to be irreversible because the water uses would end after development is completed.

4.20.5.2 Groundwater

The anticipated irreversible impacts to groundwater would be removal of produced water from oil and gas development and disposal possibly into a different formation, and hydrogeologic alterations from well drilling, completion, operation, and plugging, withdrawal of oil, gas, and produced water. In addition, oil and gas development would create a slightly increased risk of potentially irreversible events due to contamination from accidental spills of hydrocarbons, fuels, or chemical additives, and from improperly cased and sealed wells.

4.20.6 Vegetation, Riparian and Wetlands, Special Status Species, and Noxious Weeds

If features associated with oil and gas facilities, such as roads, become permanent, then there would be localized irreversible or irretrievable loss of vegetation resources. These may include loss of riparian/wetland (including fen) habitat and loss of sensitive plant species habitat. The actions to protect or reclaim habitat from surface disturbance and protect from the spread of noxious weeds should adequately prevent irreversible or irretrievable impacts to special status plant species and significant plant communities.

4.20.7 Terrestrial Wildlife Including Special Status Species

Depending on the selection of alternative, 821 to 893 acres of terrestrial wildlife habitat would be incrementally lost during construction, drilling, completions, production, and maintenance of the leases. This would be considered an irretrievable commitment of the resource because it is anticipated that upon completion of mineral production or cancellation of the leases, reclamation would return affected areas to native habitats. Some vegetation communities are expected to return to a native state within in a relatively short period of time (i.e., 5 years). Other more sensitive habitats, such as sagebrush shrublands, may require up to 50 years or longer to return to native conditions. Regardless of timeframes, it is possible that wildlife habitat impacted during construction could return to pre-development conditions, thus avoiding any irreversible commitments of wildlife habitat.

4.20.8 Aquatic Resources

No irretrievable or irreversible impacts to aquatic resources are anticipated. Most of the impacts to aquatic resources would cease to be adverse after the disturbed stream or riparian areas are reclaimed or oil and gas infrastructure is stabilized.

4.20.9 Cultural Resources

There would be an irretrievable and irreversible impact on cultural resources should archaeological sites be disturbed without being identified, recorded, and a determination of eligibility to the NRHP. Compliance with federal laws and permit requirements would minimize these impacts.

4.20.10 Transportation

Oil and gas development-related road construction and traffic increases would exist over the 20-year development period, but would be reversible and would cease at the end of well production. Although development-related traffic increases would be reversible after the development period, the potential exists for these impacts to extend beyond 20 years, depending on what ultimately would be the development timeframe. Development related impacts due to development of new roads would be reversible, as roads would be reclaimed at the end of well production life; however, the timeframe for production life could be many years, resulting in an extended long-term impact, depending on the life of the field. It is anticipated that there would be no irretrievable impacts to transportation associated with lease development, assuming that road construction and maintenance follow federal and state guidelines.

4.20.11 Lands and Special Uses

There would be no irreversible or irretrievable impacts for lands and special use authorizations. Any surface disturbance and related infrastructure that might be authorized under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.12 Special Designations

There are no anticipated irreversible or irretrievable impacts to areas with special designations. Any surface disturbance and related infrastructure that might occur under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.13 Recreation

There are no anticipated irreversible or irretrievable impacts to recreation. Any surface disturbance and related infrastructure that might occur under all future development scenarios could be reversed by successful reclamation and restoration actions.

4.20.14 Livestock Grazing

Assuming successful reclamation would occur following completion of oil and gas operations, there would be no irreversible or irretrievable impacts to livestock or livestock grazing operations. The disturbed areas within the affected allotments would return to prior conditions (or better) with successful reclamation, and would provide desirable forage for livestock grazing.

4.20.15 Scenic Resources

Future oil and gas development would result in an increase in the appearance of man-made structures and equipment associated with oil and gas exploration activities. The impacts to scenic resources would be greatest in localized areas of concentrated oil and gas operations. Although the location and concentration of facilities would vary by alternative, the characteristic landscape would appear more developed and lose much of its natural scenic quality in some areas. The appearance of the equipment and operations associated with oil and gas development would be an irretrievable impact on scenic resources until production ceases and final reclamation of the site is complete.

4.20.16 Hazardous Materials and Human Health and Safety

Assuming additional approvals to develop the leases would be required, irreversible and irretrievable impacts to resources linked to human health and safety would not be anticipated because the permitting agency would require adherence to regulations and BMPs that would minimize adverse impacts to air quality, noise, fire, water resources, transportation, and other human health and safety issues. If a spill affecting public water supplies, atmospheric contamination, or fire were to occur, the affected resources would experience irretrievable impacts until cleanup or remediation is complete. There would be no irreversible or irretrievable impacts from traffic or noise.

4.20.17 Socioeconomics

As with any consumptive use of a nonrenewable resource, natural gas extraction would have an irretrievable and irreversible impact on the mineral reserves. Consequently, there would be a permanent loss of the mineral resource. While this may represent an irretrievable socioeconomic impact related to the extraction of mineral resources, future surface reclamation can be expected to allow future resumption of any permitted surface uses (such as recreational activities and livestock grazing) that could have positive socioeconomic outcomes.

4.20.18 Environmental Justice

No minority or low income communities of concern were identified within the analysis area. Consequently, no irreversible or irretrievable impacts would result in disproportionate and adverse environmental justice impacts to any communities of concern in the region.